



**Building Organizational Resilience through Strategy, Risk and
Business Continuity Planning: A System Dynamics Approach**

Master Thesis submitted in fulfilment of the requirements for the degree
of

Master of Philosophy

System Dynamics

GEO-SD351

Name: Noedine Colette Isaacs-Mpulo

Number: 285292

Supervisor: Lars-Kristian Lunde Trellevik

June 2021

Acknowledgements

The past two years have been a journey of reclaiming myself and my life after a long time. This program has been instrumental in rediscovering myself and my intellectual curiosity. For that I am grateful to the University of Bergen and the faculty of System Dynamics.

I would like to particularly thank my thesis supervisors Professor Pål Ingebrigt Davidsen and Lars-Kristian Lunde Trellevik for their guidance through this thesis process. I would like to address you each personally.

I will start with Pål who guided me at the beginning of this process. Thank you for your immense patience, enthusiasm, wisdom and incredible empathy and gentleness. Thank you for the long discussions, allowing me to formulate my thoughts as we went along and always guiding me toward an objective. I was so sorry that we could not complete the process together but my respect and admiration for you as an academic and human being is immense and will just not allow me to let go of you just yet.

Lars-Kristian, I am so grateful that you stepped in as my supervisor when needed. It has been an absolute pleasure getting to know you better. Thank you for letting me do the work but holding me accountable to do it and do it properly. I appreciate your accessibility and your constant reassurance. Thank you for seeing me across the finish line. Thank you for forcing me to keep my feet dry and my gun clean to fight another day.

My journey, in this distant land and in this program would have been unbearable without a few of friends who have become so important to me. Thank you all for your love, support and friendship and for making this adventure so worth it.

Two people who have literally been with me on this journey since day 1 and we will cross the finish line together. Willard Noyes and Besir Suleyman Oz. Thank you, guys for being there for me whenever and for whatever I needed. You are the friends who became family.

Besir, thank you for the constant encouragement and for always applying your aesthetic prowess to our models, CLD, graphics and formatting.

Will, I have told you this, but I don't know if you realise exactly how important you are to me. From our bouts of silliness, your care and assistance in everything I need, your patience and affection toward me, you have just been a godsend to me. Thank you for all your modelling help, encouragement, and belief in me. You are the purest soul I know, and your generosity of spirit knows no bounds. Even when it was incredibly hot, you never dropped it!

I finally would like to thank my family both in South Africa and Norway for the incredible support, love and encouragement which I could always count on. Thank you for bearing with me through this entire process.

Noedine

Abstract

The world has experienced and witnessed many disasters both natural and man-made in history. Such type of events have happened before and will certainly occur in the future. The implications of these events go beyond the tragic loss of human life to the devastation to infrastructure, economies, businesses and livelihoods. It is the responsibility of managers and leaders in organizations to ensure that their organizations are prepared to manage the potential threats, known and unknown, that they may face. This applies not only to commercial businesses but also to non-profit organizations to whom the burden to provide relief to society's most vulnerable often falls.

This research project has looked at how existing management tools and methodologies can be employed in unison with the scientific methodology of systems dynamics as well as simulated models to assist organizations in the non-profit sector plan, prepare for and mitigate against threats to their system.

Using theory from Strategic Management, Risk Management, Business Continuity Management and Resilience Theory a conceptual framework and predictive simulation model has been developed and used to play out scenarios testing the resilience of the system of the PBO. Further, policies have been developed and tested, proving that indeed, organizational resilience can be enhanced by the application of appropriate policy interventions.

Table of Contents

Acknowledgements	ii
Abstract	iii
Introduction	1
Research Questions.....	2
Problem Statement	3
Introduction to the Case Study	4
Dynamic Hypothesis	5
Causal Loop Diagram.....	5
Expected Shock Outcomes: System Resilience	6
Ethical Considerations	8
Theoretical Basis	10
The Use of System Dynamics in Strategy	10
Business Continuity and Risk Management	10
Resilience	11
Scenario Planning.....	12
Challenges in Non-Profit Organizations	13
Conceptual Framework	13
Scope	14
Research Design and Methodology	15
Step 1: Facilitation of Discussion on Mission and Strategic Risks	15
Step Two: A Questionnaire	16
Step 3: Workshop and Questionnaire Report.....	17
Step 4: Two Group Model Building	17
Step 5:	17
Step 6: Data.....	17
Step 7: Verification of data and initial values.....	18
Step 8: Model Validation.....	18
Model Testing	18
Sensitivity Analysis	18
Research Report.....	18
Reference Mode	19
System Archetype	20
Policy Development	23
The Predictive Simulation Model	26
Model Structure	26
Model Description.....	27

Causal Loop Diagram.....	27
Model Structure and Description.....	29
Finance Sector	29
Delivery Sector	32
Skills Sector	33
Resilience Testing.....	34
Data Collection.....	35
Sensitivity Testing and Analysis.....	35
Exogenous Variables:	36
Effect to observe and measure resilience on	37
Tests which have been conducted	37
Setting the Baseline.....	39
Base Run.....	39
Scenario 2: “Utopia” Run	40
Shocks to Turnover Rate	43
Scenario 3: Series of Shocks to Turnover Rate with All Policies Switched Off	43
Scenario 4: Shock to Turnover Rate with Dividend Pay-out Ratio Policy Switched On.....	45
Scenario 5: Shock to Turnover Rate with Max Reserves Policy Switched On	46
Scenario 6: Shock to Turnover Rate with Donor Funds Rate Percentage Policy Switched On.....	48
Scenario 7: Shock to Turnover Rate with All Policies Switched On.....	50
Summary of Shock to Turnover Rate Scenarios	52
Shocks to Administrative Costs	54
Scenario 8: Shock to Administrative Costs All Policies Switched Off	54
Scenario 9: Shock to Administrative Costs with Dividend Payout Ratio Policy On	56
Scenario 10: Shock to Administrative Costs with Reserves Usage Policy On	57
Scenario 11: Shock to Administrative Costs with Donor Funds Percentage Policy On	59
Scenario 12: Shock to Administrative Costs with All Policies Switched On (Recommended Run).....	61
Summary of Shock to Administrative Costs Scenarios	64
Shocks to Market Growth	65
Scenario 13: Shock to Market Growth All Policies Switched Off.....	65
Scenario 14: Shock to Market Growth with Dividend Payout Ratio Switched On	67
Scenario 15: Shock to Market Growth with Max Reserves Usage Policy.....	69
Scenario 16: Shock to Market Growth with Donor Funds Percentage Policy Switched On	70
Scenario 17: Shock to Market Growth with All Policies Switched On (Recommended Run).....	72
Summary of Shock to Market Growth Scenarios	75
Extreme Conditions Testing	77
FURTHER TESTING ON MARKET GROWTH TO CHECK ELASTICITY	80
Shock at Average Magnitude of 3	80

Shock to Market Growth with Average Magnitude of 2	81
Shock to Market Growth with Average Magnitude of 3	82
Summation of Testing Elasticity of Market Growth variable.	83
Key Findings	84
Limitations	84
Future Work.....	85
Conclusion.....	86
Appendix A – Sensitivity Analyses	88
Base Run	89
Scenario 3	91
Utopia Scenario.....	93
Scenario 4	95
Scenario 5	97
Scenario 6	99
Scenario 7	101
Scenario 8	103
Scenario 9	105
Scenario 10.....	107
Scenario 11.....	109
Scenario 12.....	111
Scenario 13.....	113
Scenario 14.....	115
Scenario 15.....	117
Scenario 16.....	119
Scenario 17.....	121
Scenario 18.....	123
Scenario 19.....	126
Scenario 21.....	131
Scenario 22.....	133
Scenario 23.....	135
Scenario 24.....	137
Scenario 25.....	139
Scenario 26.....	141
Scenario 27.....	143
Scenario 28.....	145
Scenario 29.....	147
Appendix - B.....	150
Model Documentation	150

BibliographyFeil! Bokmerke er ikkje definert.

Introduction

Over the last century the world has experienced many disasters, both natural and instigated by human beings. These have included earthquakes, hurricanes, tsunamis, famine, terror attacks, nuclear accidents, plagues, and pandemics leaving pandemonium, loss and suffering in their wake. In most of these disasters, the human toll in terms of lives lost have been immense. However, beyond the tragic loss of human life comes the devastation to infrastructure, economies, business, and livelihoods.

According to Fortune Media referring to small businesses in the United States, “nearly 100,000 business that temporarily shut down due to the pandemic are now out of business” (Sraders & Lambert, 2020). A World Bank blog reporting on *The Global State of Small Business during COVID-19: Gender Inequalities* (Goldstein et al., 2020) reports on the disproportional burden and suffering that the pandemic has placed on women and women-owned business, particularly in developing countries. For many, this is added to already difficult circumstances prior to COVID and as governments scramble to contain the pandemic and its repercussions, they look to non-governmental or non-profit organizational partners to assist in alleviating the suffering.

It is indisputable that events of the magnitude and nature as have been mentioned are extremely disruptive, depending on their scale, to countries, regions, cities, communities, families and businesses. They present a shock or series of shocks whose repercussions can be felt a long time after the original event. In terms of natural and other disasters, national, regional and local authorities generally have plans in place to manage the aftermath of a disaster for example focusing first on the safety and preservation of human life and then moving on to restoring services such as electricity and water supply, ensuring that the displaced have shelter, food and basic clothing and hygiene supplies. This is forms part of that authority’s disaster management plans.

In terms of businesses such shocks would be managed through Disaster Recovery and Business Continuity Plans. “Business continuity refers to the actions taken to sustain and/or resume operations impacted by crisis events...Business Continuity Management (BCM) is a holistic management program that identifies potential events that threaten an organization and provides a framework for building resilience...”(Engemann & Henderson, 2012).

“Risk Management consists of the processes of risk assessment, risk communication and risk treatment” as defined by Engemann and Henderson in their book *Business Continuity and Risk Management: Essentials of Organizational Resilience* (Engemann & Henderson, 2012). They further state that Business Continuity and Risk Management are not in competition with each other but are best used in combination, proving to be “coherent and productive.”

It is true that the risks or shocks that an organization may face may come from both inside or outside of the organization. While the nature of a shock, it’s magnitude or timing may not be known upfront, it is the duty of management to prepare the organization for the possibility of shocks and major disruptions. Those preparations would include how to minimize the impact of such a shock and how to either maintain or get back to full operational capacity as soon as possible after the shock. This process of “bouncing back” is what is called resilience. The term is often used to describe the ability of a system (human, natural, social, etc) to return to it pre-shock state as soon after the shock as possible or to withstand such a shock without change in its state.

While private sector organizations may be well-versed in the concepts and methodologies described and may have operationalised them within the organizations, the same is not widely true in the non-profit sector.

Research Questions

In this paper we will seek to answer the following questions:

1. Can an organization learn to become more resilient?
2. Are there tools already in the management and leadership toolbox that can be used to build organizational resilience in a non-profit organization?
3. How can an organization use what they already know to prepare for threats, disturbances and shocks they don't know?
4. Can simulation modelling be useful to provide greater insight than just current methodologies?
5. Is it possible to bounce back better than your starting position?
6. Can policy development aid resilience?

Problem Statement

Organizations, like all other parts of society, sometimes face events that are a shock to their system and are often ill-equipped or prepared to withstand or bounce back from such shock even after a considerable time has passed from the initial event. The events which pose a threat to the continued smooth operation can come from inside or outside the organization and are not necessarily sinister in nature. It could be the result of unintended consequences of decisions, policies, processes and the lack of understanding of inter-relatedness of different elements of the system, how they impact each other and how they may balance or reinforce each other through feedback loops.

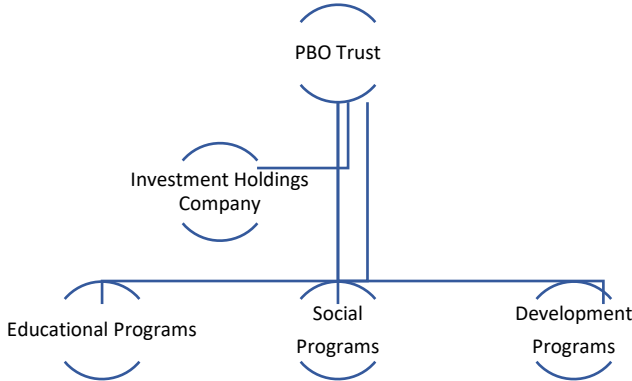
If this applies to many businesses who have a comprehensive set of leadership and management skills, tools and methodologies, in their realms then it is more so for non-profit organizations who have a different focus and therefore different capabilities at their daily disposal. Yet, for non-profit organizations the need to ensure that they can operate soon after a shock event such as a natural disaster is crucial given the role they play in society, supplementing the work of governments in service of society's most vulnerable. This is further exacerbated by the pressure that non-profit organizations find themselves under to prove relevance and impact in their competition for the diminishing sources of funding and resources needed to carry out their missions. In hard economic times the sources for funding reduce causing difficulty in a non-profit organization's drive to survive and continue the services they provide (Ibrisevic, 2020).

Introduction to the Case Study

The organization selected as a case study for purposes of this thesis is a Public Benefit Organization (PBO) in South Africa whose mission is to empower rural women to gain financial security and break the cycle of generational poverty. For purposes of confidentiality, the organization will not be named but referred to as the PBO.

The PBO carries out its mission by delivering a suite of programs to rural communities which include educational, social and development programs and projects. These are targeted at improving the dignity of indigent women, improving access to basic governmental services, improving literacy rates and improving levels of financial security.

The graphic below depicts the manner in which the organization is structured.



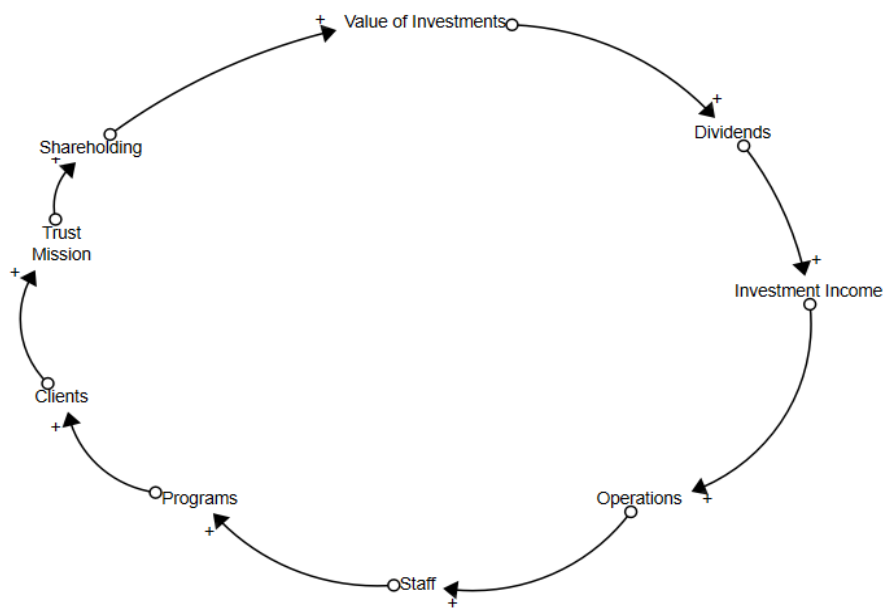
(FIGURE 1 PBO STRUCTURE)

The PBO is a Trust with specific governance and regulatory requirements. It has formed a separate investment company which holds all its investments. These investments yield dividends which are used to fund the various programs and projects which the PBO undertakes. In addition to dividend income, the PBO earns interest from its cash reserves. The dividend and interest income is currently the only sources of revenue for the PBO. All programs and projects, plus the administration and operations of the PBO are funded from this income.

Dynamic Hypothesis

Causal Loop Diagram

The following Causal Loop Diagram is a simple depiction of the system of the PBO, its core elements and how those elements relate to each other.



(FIGURE 2 DYNAMIC HYPOTHESIS CLD)

The *Trust has a mission* to empower rural women to gain financial freedom and emerge from poverty. As a way of carrying out that mission they set up an investment company which holds **shareholding** in various entities on the Trusts behalf. This shareholding will lead to a growth in the **value of their Trusts investments**. That value will yield **dividends** and be paid into the organization as **investment income**. The investment income is used to fund the operations of the organization, allowing it to hire the **staff** to deliver the various **programs (services)** of the organization to **Clients** (beneficiaries). The higher the number of Clients served, the greater the successful implementation of the **mission**.

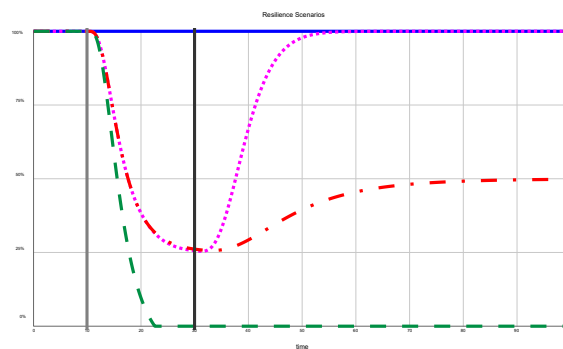
The elements in this system have a cause and effect relationship with each other. These elements reinforce each other therefore if the one elements moves in a positive direction, :

The specific effected variable that we are concerned in this system is that of **Clients** since that is a direct indicator of whether or not the organization is fulfilling its mission and strategic intent.

Expected Shock Outcomes: System Resilience

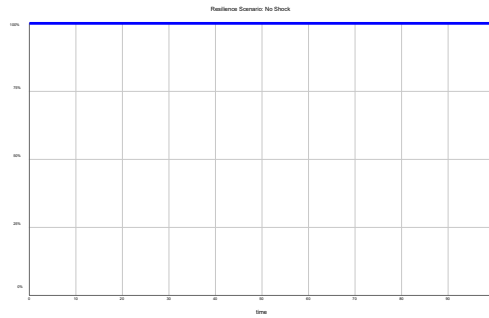
Learning from the literature on resilience theory, and specifically the work done by Hugo Herrera (2017) in the area of ecological resilience one can perhaps predict how a system in equilibrium or steady state may respond to a shock in relation to their level of resilience. The learnings can be applied to social systems, to which organizations belong, perhaps with some nuance.

Figure 1 shows a compilation of scenarios which include when no shock is applied (system is in equilibrium or steady state), the system response in the case of no resilience, the system response in a case of low resilience and the system response in a case of high resilience. The vertical lines indicate the start and end of the shock.



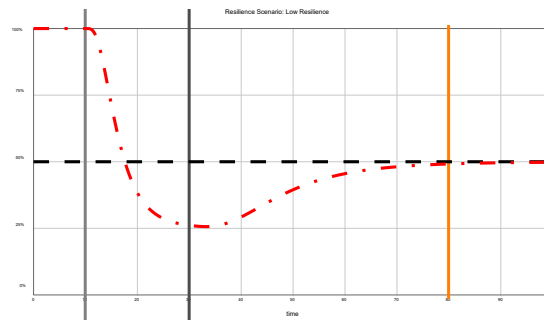
(FIGURE 1 DYNAMIC HYPOTHESIS RESILIENCE SCENARIOS)

Figure 2 below illustrates the expected behaviour of a system in equilibrium when no shock is applied. It is then assumed, that should all conditions remain equal, the system would continue as it was in steady state as there is no shock or disturbance to throw it off course.



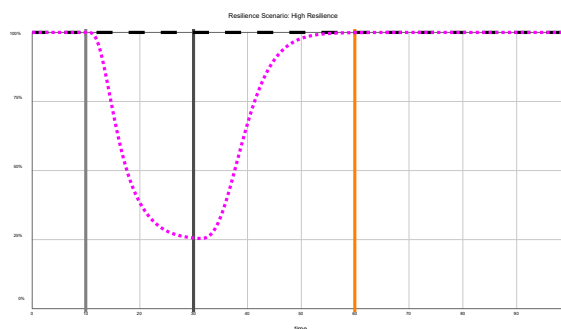
(FIGURE 2 RESILIENCE NO SHOCK)

Figure 3 depicts a system which experience a shock as has low resistance. It is expected that such a system would experience a decline from it pre-shock condition and may take a longer time to recover than a more resilient system and may also experience recover not reaching pre-shock levels, but settle into steady state at a “new normal”.



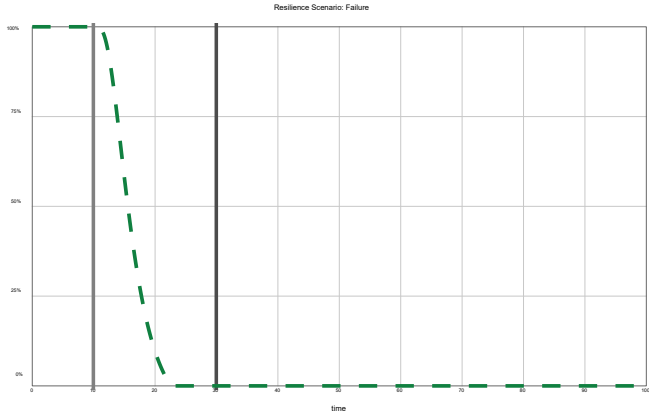
(FIGURE 3 LOW RESILIENCE)

Figure 4 illustrates the behaviour of a system with a high level of resilience which “bounces back” faster and resettles after some time to its pre-shock levels.



(FIGURE 4 HIGH RESILIENCE)

Figure 5 depicts a system demonstrating no resilience which fails after experiencing a shock and despite the passage of time, does not recover, not even to a “new normal”.



(FIGURE 5 FAILURE)

In this project we use a predictive system dynamics model to test the resilience of the system that is the PBO. The model is initialized with current data and values of the organization and replicates its current operation. Prior to embarking on the various scenario runs, the system is initialized into steady state and baseline is established against which we are able to measure demonstrated levels of resilience or lack thereof. Thus, figure 1-5 above is an assumption based on theory, however, later in the paper we will see actual results.

Ethical Considerations

In deciding about an organization to use as a case study, the PBO indicated interest as they were facing some challenges and were going through a process of organizational reflection. They were willing to commit their time and effort in assisting to make information and understanding of their environment and operation available consistently throughout the project. The understanding was that the engagement in the process was mutually beneficial. However, they had one request that the name of the organization and the identity of its patron not be disclosed. This is due to the fact that the patron is a high-profile individual. To this end a non-disclosure agreement was entered into and signed.

The above facts have been discussed and disclosed to my thesis supervisors. Further, the agreement has been honored in that nowhere in the paper or model is the organization named but is rather referred to as the PBO or the organization.

Theoretical Basis

The Use of System Dynamics in Strategy

“In other fields of human endeavour, we have reduced the risk of serious failure with two related approaches. First, we build models – at one time, physical models, more often today, software models – of things we want to try, before creating the real thing, whether that is a building, an aircraft, or a drug. Secondly, we codify how things are supposed to work, to ensure reliable delivery of whatever it is we are trying to do. Since we learn from what we do, we revise the models and update the processes we have codified to improve performance further (Warren, 2015)”. These are the words of Kim Warren in his book *Strategy Dynamics* as he explains the use of System Dynamics and simulation models in the strategic planning and management process. Warren simplifies the management of strategy into three tasks namely: choosing objectives for the organization, positioning the organization relative to other organizations and steering the organization’s progress over time (Warren, 2015). This, according to Warren, does not only apply to commercial entities but to any organization, including non-profit organizations.

Business Continuity and Risk Management

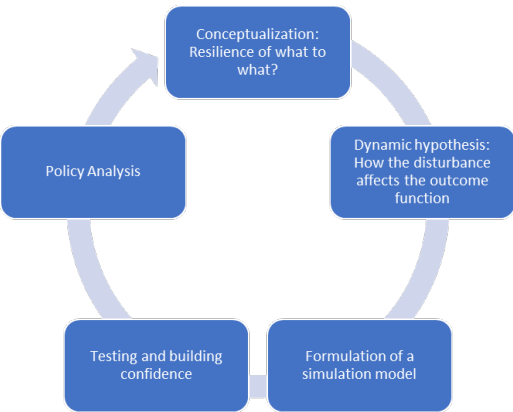
The issue of business continuity and contingency planning as well as risk management are critical components of good governance as they ensure an organization’s internalization of risks to its operation and continued existence should it face a major disturbance or shock. These measures go toward securing human life, physical assets and property but also the core operations of an organization. In their book *Business Continuity and Risk Management: Essentials of Organizational Resilience* Kurt J. Engemann and Douglas M. Henderson (2012) define business continuity as “...the actions taken to sustain and/or resume operations impacted by crisis events.” They go on to emphasize that “Business Continuity Management (BCM) is a holistic management program that identifies potential events that threaten an organization and provides a framework for building resilience with the capability for effective response that safeguards interests of its key stakeholders....Resilience is the ability of the organization to withstand the impact of a crisis event (Engemann & Henderson, 2012).”

Risk Management according to Engemann and Henderson (2012) are “processes of risk assessment, risk communication and risk treatment.” They assert that using business continuity and risk management together is “coherent and productive (Engemann & Henderson, 2012).”

Resilience

In his paper *From metaphor to practice, operationalizing the analysis of resilience using system dynamics modelling*, Hugo Herrera (2017) addresses the many challenges of the concept of resilience having different or nuanced understanding and meaning across different disciplines, no standard method for analysis or measure therefore making standardized application and operationalization of the concept difficult across disciplines. He describes the two paradigms of resilience description most widely used and accepted as being “engineering resilience and ecological resilience”(Herrera, 2017). He references (Pimm, 1984) in explaining that “ the engineering paradigm defines resilience as the rate at which a system returns to equilibrium after a disturbance.” While “ the ecological paradigm defines resilience as a measure of the amount of disturbance or stress required to transform a system while “keeping its essential function”(Folke, 2006, p. 253).

Herrera further proposes using system dynamics modelling to operationalize resilience analysis. He proposes a system dynamics modelling process (summarized) as shown in Figure 6 below.



(FIGURE 6 SYSTEM DYNAMICS MODELLING PROCESS)

Engemann and Henderson (2012) define resilience in the context of organizations as “the ability of an organization to withstand the impact of a crisis.” They propose the idea that Business Continuity and Risk Management can be used to both develop and maintain organizational resilience.

Scenario Planning

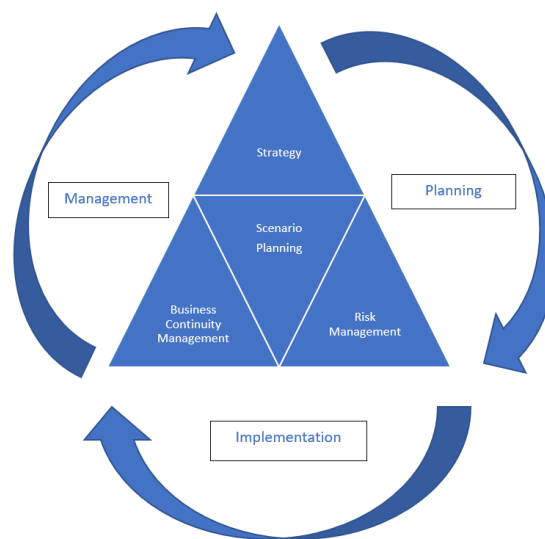
In discussing the strengths and weaknesses of various strategic planning methodologies, Kim Warren (2015) discusses the importance of scenario planning and makes the distinction between scenario planning and forecasting. He describes scenario planning as: “...plausible alternative stories of how an industry’s wider environment and competitive conditions might evolve in the future.” He further offers that it offer an opportunity for managers and leaders to “assess how demand, competitive conditions, and other factors might change under alternative versions of the future. These conclusions are then used to develop a strategy that can both exploit opportunities that may arise while at the same time being robust enough to account for any dangers that may threaten those futures” (Warren, 2015). He asserts that scenario planning is a critical part of strategic management and is as applicable to non-profit organizations as to commercial entities.

Challenges in Non-Profit Organizations

The South Africa Nonprofit Sector: Struggling to Survive, Needing to Thrive is an article which highlights the challenges facing the NPOs in South Africa. The author describes a landscape where the legacy of apartheid has left many South Africans without basic social services made worse by huge inequality and a government spending less and less on social services. This has meant that the need for NPOs is increasing, however, many are struggling to survive due to decreasing funding by government brought about by economic decline. This forces NPOs to explore alternate funding models and as they compete for limited resources, reporting demands from funders shifts focus to activity-reporting rather than impact (Stuart, 2013).

Conceptual Framework

The Problem Statement, Dynamic Hypothesis and Theoretical Basis for this project can perhaps best be depicted in the Figure 7 below.



(FIGURE 7 CONCEPTUAL FRAMEWORK)

In order to strengthen and maintain organizational resilience it is important that the strategy, risk management and business continuity management are integrated into a continuous improvement cycle. All three elements are strengthened by the use of scenario planning as a tool to envision alternate realities to the status quo and adapting strategies to take advantage of opportunities and mitigate potential threats that those scenarios present.

System dynamics modelling provides a useful tool in ensuring that the cycle above is virtuous in that it provides an opportunity to take note of and understand the system behaviour of the past, while also being able to simulate scenarios of the future, providing learning and insights to inform strategy and policy development. This ability is invaluable in a world of growing complexity.

Scope

The scope of this paper is limited to the level of planning depicted in the conceptual framework presented above as it relates to organizational resilience. The project will:

1. Review the strategic plans of the case study organization
2. Gain an understanding of the organization's strategic risks, threats, operational processes and inter-relationships
3. Develop a predictive systems dynamics model to enable scenario plan related to the strategic risk identified above
4. Replicate the status quo system of the organization in the simulation model and initialize it in equilibrium or steady state
5. Run numerous scenarios by introducing shocks to the system
6. Analyse the resilience of the system in terms of the patterns of behaviour (trends and trajectories) and assessing the system's ability to return to its pre-shock levels
7. Introduce policies
8. Rerun scenarios to assess whether or not the policies enhanced resilience
9. Report on the findings

Research Design and Methodology

John Sterman (2000) in describing the modelling process states that: “Modeling does not take place in splendid isolation. It is embedded in an organization and social context. Even before the modeling process begins per se. the modeler must gain access to the organization and identify the client .” Taking from this philosophy the research design and methodology placed strong emphasis of extensive primary research as well as an approach that engaged the organization standing in as our case study from the beginning and throughout the process. Table 1 below summarizes the research steps and methodology used for the project. The approach was inspired by several considerations namely:

1. Since the case study is a South African non-profit organization, there is an appreciation for the fact that the culture of South Africa is very consultative in nature. Generally, organizations behave in a democratic fashion. This is evidenced by the labour laws of the country.
2. In a paper on group model building, Herrera and Kopainsky (2017) discuss the importance of inclusive process in research especially when dealing with diverse interests, backgrounds, perspectives etc.
3. Given the research objectives, a combination of methodologies were employed including facilitate workshop, questionnaire and group model building.

The process of engagement with the PBO has been iterative and included a number of steps and outcomes. These included:

(TABLE 1 RESEARCH METHODOLOGY)

Research Activity	Purpose	Theory and Sources
Step 1: Facilitation of Discussion on Mission and Strategic Risks	The purpose of this step was to position the identification of strategic risks in the context of the Strategy Development process and linked directly to what the mission of the organization is. This is important to ensure that the business continuity plans are linked to the strategic risks and those risks are directly linked to the mission of the organization.	Sterman (2000) states that: “The client context and real world problems determine the nature of the model, and the modeling process must be consistent with the clients’ skills, capabilities and goals.”

	<p>The process with the PBO took place in the form of a four hour long online facilitated workshop with 8 participants from a cross section of the organization, from the highest to lowest level. The workshop was held on the Microsoft Teams platform and using Mirro as a collaboration tool where each participant could add their discussion points. Given the mix of participants, it was necessary to call on individuals to share their point of view as the more junior employees tended to keep quiet except when called upon to speak. From the process the following outcomes were achieved:</p> <p>Confirmation of the organization’s mission; its reason for existence; Identification of the top strategic risks facing the organization and categorization of those risks according to: Governance Capacity or Skills Performance Monitoring and Evaluation Identification of the Mission-critical functions, resources and systems of the organization. These would be the focus of business continuity plans going forward.</p>	<p>Information gained from the workshop was from the PBO management and employees.¹</p>
<p>Step Two: A Questionnaire</p>	<p>A questionnaire was developed to be completed by all the people who participated in the preceding workshop. The questionnaire sought to achieve the following outcomes: Confirmation of the Mission once again with the added aspect of confirming whether this resonated with the stated mission of the organization; Confirmation of the mission-critical functions, resources and systems of the organization; Identification and likelihood of potential threats to those mission-critical function, resources and systems identified;</p>	<p>“Questionnaire surveys offer Human Resource Development (HRD) researchers an efficient tool for the collection of data on the same topic from a large number of respondents. As a general term, questionnaire refers to all data collection instruments in which each respondent is asked to answer the same set of questions in a predetermined order (Vaus & Vaus, 2013). It therefore includes structured interviews and telephone questionnaires, as well as those completed without an interviewer being present (Saunders, 2015).”</p>

¹ (PBO, 2021) – Notes from workshop held with PBO

	<p>Differentiation of those threats or risks according to the categorization of:</p> <ul style="list-style-type: none"> Disturbance (minor disruption) Shocks (could cause major disruption) Seismic shocks (big enough to threaten continued existence of the organization) <p>Solicit an understanding of whether current strategies existed to manage shocks to the system and whether or not the organization could withstand a major shock;</p> <p>Finally, an opportunity for the organization to think about possible strategies to allow the organization to “bounce back” from a major shock</p>	
Step 3: Workshop and Questionnaire Report	<p>A brief report was produced to all the participants summarizing the process and outcomes of the workshop and questionnaire. This report then formed the basis for the forthcoming work (Sterman, 2000).</p>	
Step 4: Two Group Model Building	<p>Two Group Model Building sessions of 3 hours each were held with the management of the PBO. The purpose of these sessions was to map out the inter-relationships between different parts of the system and set the boundaries of the model to be built. This would contribute significantly to the CLD that would be developed which in turn would enable the design of the model to be built.</p>	<p>“Group model building is a powerful tool for extracting and eliciting stakeholder mental models and combining them in a system dynamics model. On the other hand, the model building of system dynamics helps participants in group model building to define, clarify, and organize their ideas into a shared view (Château et al., 2012) (Haji Gholam Saryazdi et al., 2021).</p>
Step 5:	<p>Commencement with iterative model building process</p>	<p>“Modeling is a feedback process, not a linear sequence of steps. Models go through constant iteration, continual questioning, testing and refinement. (Sterman, 2000)”</p>
Step 6: Data Exchange	<p>Data was received from the PBO in the form of Annual Reports and Financial Reports in order to set initial values in the model. Since the model developed is one which is predictive and due to the fact that the organization has undergone several iteration and reporting standards, it was</p>	

	decided that the only data required was the latest financial data in order to set a baseline for the model. There was no need for historical data since the model is predictive and historic data is not relevant and would not be reliable due to the fact that it would not be reliably comparable from one year to the next due to multiple changes in the PBOs structure, mission, reporting standards. ²	
Step 7: Verification of data and initial values.	Once the model was populated was developed and populated with initial values gleaned from the financial report provided, two x 1.5 hour long discussions were held with the CEO and CFO to confirm assumptions, initial values and relationships between variables.	³
Step 8: Model Validation	The model was demonstrated with the PBO as a way of confirming that the logic was correct and the system elements were accurate	⁴
Model Testing	Follows in later section of this report	
Sensitivity Analysis	Follows in later section of this report	
Research Report		

² (PBO, 2021) – Financial Reports and Information from PBO

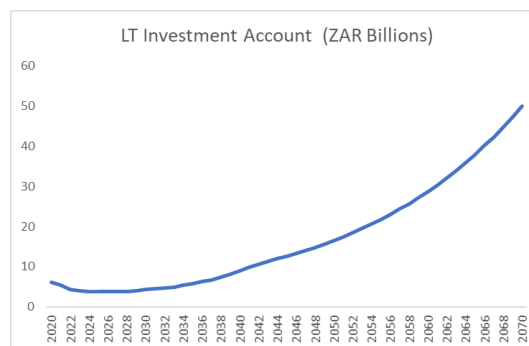
³ (PBO, 2021) – Information from PBO

⁴ (PBO, 2021) – Verification discussions with PBO

Reference Mode

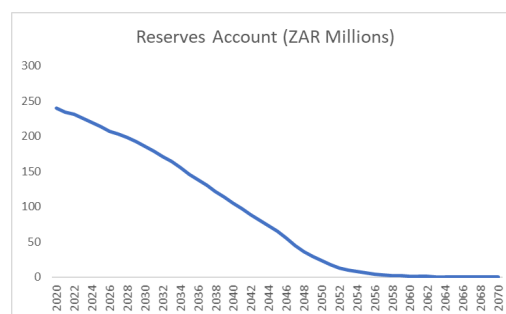
When looking at the situation at the PBO regarding their identified risks, understanding their policies and processes currently in operation as well as starting values of some key variables the following reference mode is assumed.

1. The LT Investment Account: from the start time to the end of the time of the horizon, the long term investment account will experience exponential growth assuming that market growth is stable and positive. This is due to the fact that the current policy does not dictate consistent dividend payouts.



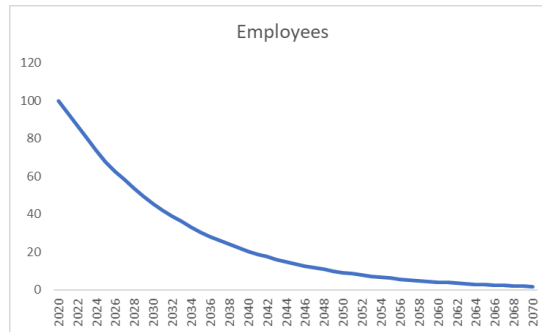
(FIGURE 3 REFERENCE MODE: LT INVESTMENT)

2. The Reserves Account: will experience exponential decline over the time horizon. This is due to the fact that the organization has only two sources of income namely, dividends and interest earned from the Reserves Account. However, as this is not sufficient to support their programs, annual draw-downs from the Reserves Account occur to meet the short-fall between the income and the expenses. This will lead to an exponential decline in the balance of the Reserves Account over time as well as the interest earned from that account.



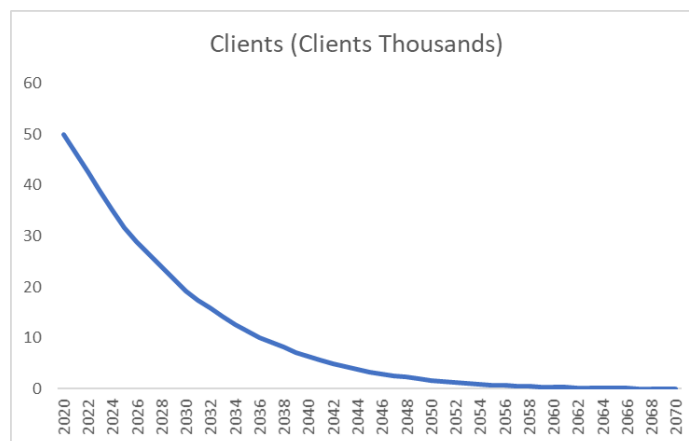
(FIGURE 4 REFERENCE MODE: RESERVES)

3. Employees: will also experience exponential decline over the time horizon due to the decline in the Reserves Account and the inability to cover expenses, of which employee salaries is significant due to the nature of work carried out by the organization.



(FIGURE 5 REFERENCE MODE: EMPLOYEES)

4. Clients: will also experience exponential decline over the time horizon due to the decline in the number of employees as well as the added inability to cover operational expenses.



(FIGURE 6 REFERENCE MODE: CLIENTS)

System Archetype

In a paper called *Systems Archetypes: Diagnosing System Issues and Designing High-Level Interventions*, Daniel H. Kim describes the eight system archetypes and offers guidelines on how to overcome the challenges each present (Kim, 2016).

The archetypes described are listed below with a brief discussion on the three which could be applicable to our case study:

- Escalation:
- Growth and Underinvestment
- Limits to Success
- Shifting the Burden / Addiction
- Tragedy of the Commons
- Drifting Goals: “In a “Drifting Goals” archetype, a gap between the goal and current reality can be resolved by taking corrective action” (Kim, 2016). In discussions with the PBO the term “mission drift” was used often to express the concern that their focus often moves away from what was originally intended. As a result, they have often deviated from their mission into services that shifted their goals. They have changed business models and objectives frequently in order to try to address this concern. At face value one maybe inclined to consider that the organization fits the “Drifting Goals” archetype. However, further dispels this inclination.
- Fixes that Fail: “A solution is quickly implemented that alleviates the symptom, ...but the unintended consequences of the “fix” exacerbate the problem. Over time the problem symptom returns to its previous level or becomes worse” (Kim, 2016). In order to keep their operations and programs going, the PBO when faced with income shortfalls has resorted to drawing down from savings, namely their Reserves Account. This does “fix” the cashflow symptom in the short-term, however it will eventually cause a larger problem of diminished cash reserves as well as evaporating earnings from interest on those reserves. However, even though this may seem like the architecture at play, further investigation is required to understand the root cause of the problem.
- Success to the Successful: “...if one person or group is given more resources, it has a higher likelihood of succeeding...assuming they are equally capable...” (Kim, 2016). On understanding the structure, policies and performance of the PBO, it becomes evident that one part of the system enjoys almost unbridled success with it seeing exponential growth over the time horizon. This refers to the Long Term Investment Account. Should market growth remain positive and relative stable, there would be no reason to believe that this behaviour would not continue ad infinitum. However, without policies to bring about balance of resources to the system as a whole, this exponential

growth would be at the expense of the rest of the system. This would ultimately mean that the organization has, while achieving enormous success in one area, failed to deliver on its core mandate and mission and may even cease to exist in its current form. This is a governance issue which can be rectified with policy. This point is later demonstrated in the model resilience testing discussed later in this paper.

Policy Development

In terms of the issues which the organization has identified and confirmed as their top strategic threats in need of mitigation are⁵:

1. Governance: the PBO has found itself over the years experiencing mission drift where they have moved, sometimes, significantly from they intended purpose. There are various reasons for this and include:
 - From time to time there have been leadership changes and new leadership have a different vision or approach
 - Some past decisions have led to a situation where a subsidiary has the power to over-ride decisions of the parent organization. This has led to a situation where the investment income via dividend payments have not been flowing with the consistency they should, putting the PBO's programs in jeopardy
 - Dependence on a key individual in the form of the patron to form the glue that keeps the organization together and the oil that keeps the machinery moving smoothly. This in and of itself is a major risk.
2. Skills: the PBO operates in a sector where there is tough competition for the relevant skills. As such they are challenged in that:
 - it is not always easy to find the correct people, with the correct skills for the work they do
 - turnover in the sector is generally high
 - they often lose their skilled staff to government
3. Financial resources are sometimes constrained putting the continuation of certain programs at risk. These constraints include:
 - Only two income streams namely: dividends and interest earned from cash reserves
 - An inconsistent flow of dividend payments due to a governance issue

The result of these top three challenges is that it has created a situation of a start and stop organization, managing from crisis to crisis. This is in part due to a need for proper governance structures and policies, along with a "Success to Successful" archetype at work. This has lead

⁵ (PBO, 2021) – Information from PBO Workshop and Risk Questionnaire

to the shifts in focus and resultant mission drift as the organization at a program level are forced into survival mode and therefore start or take on programs outside of their core mandate. All this while, in fact, the organization has the financial resources to have a much higher impact than they currently have. This comprises the mission and mandate of the organization, threatens its sustainability and erodes its resilience.

Given the above challenges, three policies have been identified to address and mitigate these risks, allowing for the organization to build its resilience and ensure its continuity. The identified policies are:

1. Dividend Payout Ratio Policy

This policy sets a ratio which is a percentage of the value of the LT Investment Account to be paid out annually as Investment Income into the Operating Account. This would allow for the sustainable inflow of finances allowing the organization to plan, operationalise and implement their strategies and programs. It also returns the original intention for setting up its investment company; which was to ensure that their investment are able to financial sustain its poverty alleviation work.

2. Max Reserves Usage Policy

The PBO has a significant cash reserve which is held in call accounts. This is the organization's savings. However, what currently happens is that when dividend are not paid or are not paid in full, the shortfall for current operations are drawn down from the Reserves Account. This has two serious implications in that it reduces the savings, and as a result, the interest income which is earned off the Reserves Account. The proposed policy limits the amount which can be drawn from the Reserves Account annually. As much as it slows down the decline and depletion of the Reserves Account, the policy does not go far enough. Although not included in this project, a supplementary policy would see a percentage of investment income go into savings in the Reserves Account. However, one had to consider the boundaries of this project and this addition could be included in future work.

3. Donor Funds Percentage Policy

This policy explores alternate additional income sources as there are many organizations and governments worldwide that provide grants and funding for the

type of work which the PBO does. They could be tapping into these sources. This is especially true in that they have been operation for more than 30 years and have a track record which would enable them to acquire such funding. The policy sets a percentage of expenses which should be externally sourced.

All three policies have been canvassed with the PBO and are believed to be acceptable and workable. The Dividend Payout Ratio Policy is the most powerful of the three as will be seen in the testing and analysis that follows. However, it is important to realise that the starting point was how to ensure that we build organisational resilience through business continuity planning and risk management. Understand that business continuity planning is a way of mitigating strategic risks and ensuring contingency in the face of crises or unexpected disturbances. Therefore, in keeping with the theme of this thesis, it is important that the three policies are treated as a package that addresses the identified risk and puts policies in place to manage and mitigate them in a dynamic fashion, made possible by the tool of a system dynamics model.

The Predictive Simulation Model

Model Structure

The model developed and presented is a predictive model which replicates the current operations of the PBO and then with the addition of shocks / disturbances demonstrates how resilient the system is to those shocks. As a predictive model it does not seek to replicate past behaviour, but rather uses one year of history to set initial values for certain variables and stocks. In their paper titled *Tests for Building Confidence in System Dynamic Models* (Forrester, 1978) Jay W. Forrester and Peter M. Senge make the point that: “System dynamics model-builders have often stressed that their models do not strive for prediction of future values of system variables—that is, for “point prediction”...However system dynamics models should tell certain things about behaviour in the future.” Taking guidance from this statement, it is this authors belief, while there are always lessons to be learned from the past that can assist us in crafting a better future, sometimes circumstances necessitate that we predict what the future may entail without having the benefit of historical data. In our most recent experience we have seen the role that predictive models have been used in trying to combat the global COVID-19 pandemic. One may argue that the many models used on various global, national and local staged have helped communicate a brief understanding of the “history” of the development of the pandemic, but perhaps more importantly predict the future development of the virus and the need and urgency required in adopting certain policies and strategies. Globally, ordinary citizens gained an understanding of the term “flatten the curve”. This assisted scientists in communicating the seriousness of the situation to politicians and assisted politicians in communicating the need and justification for certain political decisions and policies. Further, just as in the case of the models used regarding the pandemic, what this model seeks to do is not communicate specific, detailed point values, but rather to project behaviour patterns that will allow an understanding of trends and trajectories. The policies recommended are intended to shift those behaviour patterns and trends in a direction which is more desirable to an organization.

The model is built in Stella Architect Version 2.1.1 and Euler Integration Method. The model start time is the year 2020 and stop time is the year 2070 giving a time horizon of 50 years. The reason for the start time selected is that the 2020 data from the PBO sets the base conditions for the model and allows a steady state before any test conditions are applied. It is also important to note that the model is predictive and therefore it is unnecessary for a historic perspective except a baseline which 2020 provides. Further it is believed that 50 years is sufficient time to observe patterns of model behaviour and trends.

The model is comprised of 6 stocks and 12 flows organised in 4 main sectors as depicted in the graphics below. In the model graphics depicted in following sections, the colour-coding of the variables are as follows:

(TABLE 1 MODEL KEY)

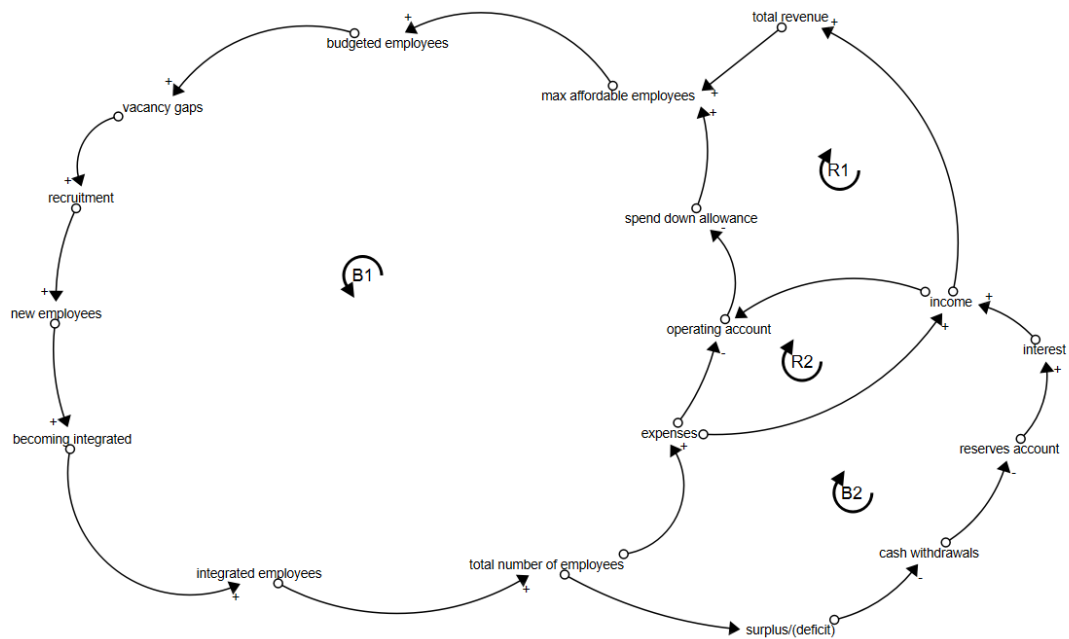
Green	starting values are verified or validated from information from the PBO
Red	policy switches
White	model equations or calculations
Gold	budget management

All equations, initial values and assumptions included in the model can be found in the Model Documentation attached as an Appendix.

Model Description

Causal Loop Diagram

The model has a total of 21 loops: 14 balancing and 7 reinforcing loops, however not all are strong or dominant. The major loops driving the model behaviour are illustrated in Figure 8 below.



(FIGURE 8 MODEL CAUSAL LOOP DIAGRAM)

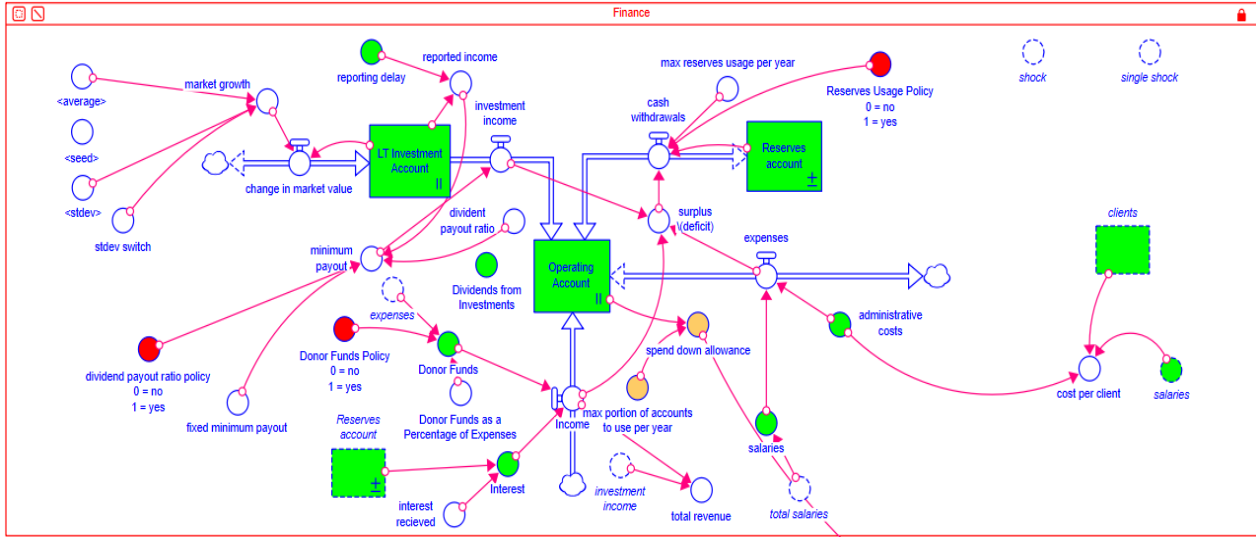
(TABLE 2 MAJOR LOOPS)

Loop Label	Description
B1	<p>This loop is a balancing loop dealing with the employment processes, elements and inter-relationships of the system. Stemming from outside of this loop is the variable of total revenue which dictates the number of employees that the organization can afford through the max affordable employees variable. This is then translated into the number of planned employees through the variable budgeted employees. If the planned number of employees is greater than the actual number of employees, this creates vacancy gaps which trigger a recruitment process for new employees who, once employed go through a process of orientation and becoming integrated into the workforce. Once new employees have gone through the integration process they then become part of the pool of experienced and fully integrated employees and part of the total number of employees in the organization. All the employees of the organization make up the salary bill which is a major part of the expenses that drain the operating account. A limitation is set on how much of the operating account can be used to fund expenses through the spend down allowance which influences the budget which in turn sets the max affordable employees closing the loop.</p> <p>When we get to the scenario testing, it will become evident that this loops is drives the number of Clients that the organization can serve. The direction of the variable of total number of employees determines the direction of clients.</p>
B2	<p>This loop is another balancing loop starting with the total number of employees which influences the surplus / (deficit) variable through salaries which is added to expenses. If salaries are high, expenses will be high which increase the chances of being in a deficit the investment income does not cover them. This scenario would trigger cash withdrawals</p>

	from the reserves account , driving that balance down and leading to lower interest earned which negatively effects income reducing inflow into the operating account .
R1	This loop links with B1 from expenses which link to income as discussed in R2 and income links into total revenue which closes the loop back into the larger loop of B1 through max affordable employees .
R2	The link between expenses and income is through the donor funds as the donor funding procured would be a percentage of expenses. For example the organization may seek to raise 15% of expenses from donors. Therefore the higher the expenses the higher the amount sought from donor funding. That would the lead to a higher value being contributed to the operating account thus all the elements of this loop reinforcing each other.

Model Structure and Description

Finance Sector



(FIGURE 7 MODEL: FINANCE SECTOR)

The Finance sector shown covers the financial operations of the organization. It accounts for the sources of income of the organization, its main expense categories, its investments and savings. The sector also captures the financial flows as well as exogenous variables influencing the value of the stocks.

As the diagram above shows, this sector has 3 stocks, 4 flows and 25 variables. The stocks are:

- a. *LT Investment Account* which has an initial value and then is grown by an in-flow called *Change in Market Value* which calculates the change to the value of the investment account based on *Market Growth*. The stock of *LT Investment Account* is drained by

the flow of *Investment Income* which becomes an inflow into another stock, namely *Operating Account*. Key variables linked to this stock include:

- *Market Growth*: averages out the growth in the market on an annual basis
- *Reported Income*: indicates the income earned from investments over the reporting delay
- *Minimum Payout*: indicates the minimum dividend from the investments which will be paid annually
- *Dividend Payout Ratio*: indicates the ratio (or percentage of the value of the LT Investment Account) to calculate the dividend payout

b. *Reserves Account* is a stock which initial value is from data from the PBO. It is the long-term savings account which attracts interest. The stock has one outflow which is *Cash withdrawals*, which becomes the inflow into another stock, namely *Operating Account*. Key variables linked to this stock are:

- *Surplus\{(Deficit)*: determines the need for cash withdrawals from the Reserves Account based on the difference between *Income plus Investment Income* and *Expenses*. In the case of a deficit, the balance is drawn down from the *Reserves Account*.

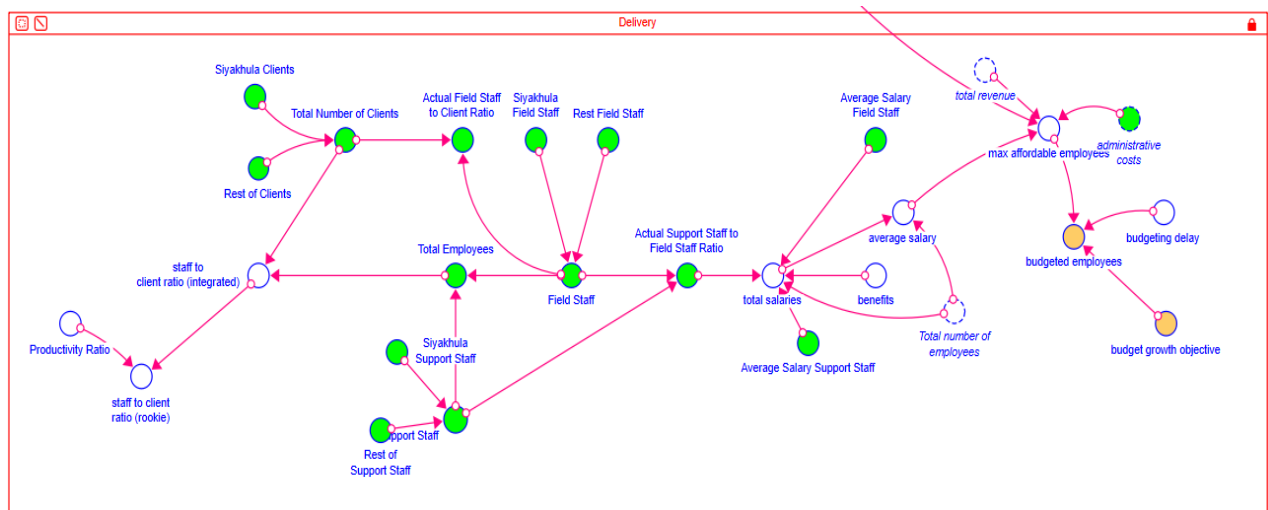
c. *Operating Account* is a stock the three inflows of: *Investment Income*, *Cash Withdrawals*, and *Income*. There is one outflow from the stock which is *Expenses*. Key variables linked to this stock are:

- *Interest*: calculates the amount of interest earned to be added to the *Operating Account* stock through the flow of *Income*.
- *Donor Funds*: calculates the amount of funding coming from donors to be added to the *Operating Account* stock through the flow of *Income*.
- *Total Revenue*: is the sum of *Investment Income* plus *Investment Income*
- *Salaries, Administrative Cost and New Programs* are all expenses which add to the *Expenses* flow which in turn drains the *Operating Account* stock.

d. The model also includes four policies which can be switched on and off. They are all off when initializing the model and setting a base line. The effect of the policies can be tested individually, in different combinations or all at once. More detail analysis of the effect of the policies on the model behaviour will be dealt with later in the chapter on Analysis. The four policies included in the model are:

- *Reserves Usage Policy* which when on sets limits on how much of the *Reserves Account* may flow into *Cash Withdrawals*. The purpose of this policy is to impose a level of saving.
- *Dividend Payout Ratio* while not labelled as a policy, is in fact a policy which is brought into effect by changing the value of the ratio. At zero the policy is effectively off and any value above zero means that the policy is on. This policy, when switched on allows for the flow of dividends or *Investment Income* into the *Operating Account* at a value that is a percentage of the total value of the *Investment Account*, for example at a value of 0.05 it allows for a total value of 5% of the *Investment Account* to be paid as a dividend in two tranches each year. The purpose of this policy is to ensure a consistent inflow of cash to allow the PBO to operate according to its mission.
- *Fixed Minimum Payout Policy*: when switched on allows for the payout of a minimum dividend each year.
- *Donor Funds Policy* when switched on allows for the receipt of donor funds as an additional source of income for the PBO. The purpose of this policy is to diversify the income streams of the PBO to allow it to achieve greater sustainability.

Delivery Sector



(FIGURE 8 MODEL: DELIVERY SECTOR)

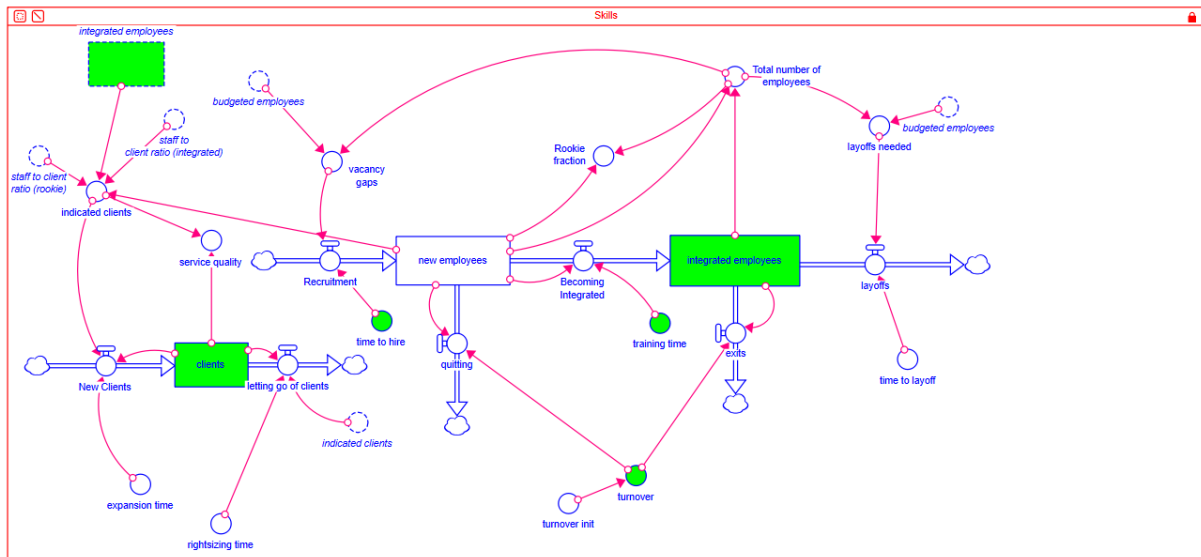
The Delivery sector captures the relationship between the number of staff in the organization and the number of clients that the organization serves.

The key variables in this sector are:

- **Total Employees:** sums up all the employees in the organization, both support staff and field staff (those interacting directing with clients).
- **Total Number of Clients:** sums up all the clients across the programs that are served by the organization
- **Staff to Client Ratio (Integrated):** this is the ratio that indicates how many clients a fully integrate (experienced) staff member serves
- **Staff to Client Ratio (Rookie):** this is the ratio that indicates how many clients a new or “rookie” staff member serves. It is calculated by multiplying the *Staff to Client Ratio (Integrated)* by the *Productivity Ratio* and assumes that the productivity of a rookie is a fraction of that of an integrated employee
- **Productivity Ratio:** the percentage of productivity achieved by a rookie versus an integrated employee
- **Total Salaries:** the sum of all the salaries of all employees
- **Average Salary:** this is used to determine what the maximum number of employees the organization can afford by dividing the Total Salaries by the Total Number of Employees to get to an Average Salary.

- *Max Affordable Employees*: determines the maximum number of employees that the organization can carry by subtracting *New Programs* and *Administrative Costs* from *Total Revenue* and dividing the result by the *Average Salary*.

Skills Sector



(FIGURE 9 MODEL: SKILLS SECTOR)

The Skills sector has 3 stocks and 5 flows. It deals with the employment and client life-cycles respectively.

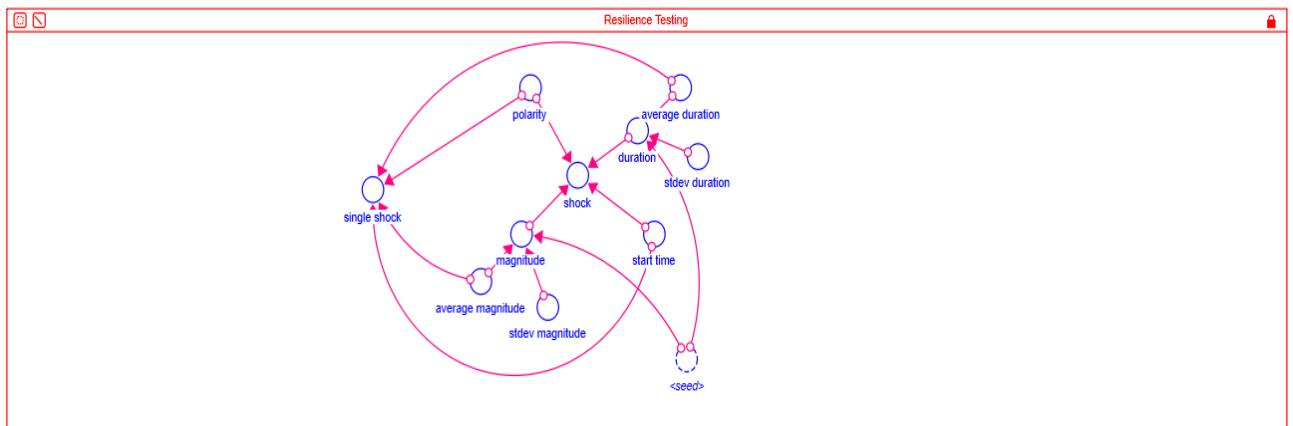
1. The employment life-cycle has:
 - a. A stock called *New Employees* accumulated through the *Recruitment* inflow and drained through two outflows namely *Quitting* (deals with employees who exit employment prior to becoming integrated) and *Becoming Integrated* which is the inflow into the *Integrated Employees* stock over a delay time called *Training Time*.
 - b. Another stock called *Integrated Employees*, which accumulates through the inflow of *Becoming Integrated* over a *Training Time* delay. The stock is drained through two outflows namely *Exits* (refers to the normal exits such as resignation, retirement, dismissal and death) and *Layoffs* (deals with exits due to budgetary or financial constraints.)
2. The client life-cycle has one stock and two flows. The stock of *Clients* is accumulated from the inflow called *New Clients* which takes on new clients to be served over an

Expansion Time delay. The stock is drained by the outflow of *Letting Go of Clients* over the *Rightsizing Time* delay.

The key variables in the sector are:

- *Vacancy Gap*: calculates the difference between the *Budgeted Employees* and *Total Employees* which is then the number of people to recruit.
- *Turnover*: this is the percentage of employees who leave the organization each year through various methods.
- *Rookie Fraction*: is the percentage of new employees to the overall organization
- *Layoffs Needed*: indicates the number of headcount to reduce based on affordability
- *Indicated Clients*: is the number of clients that the organization can serve based on the number of employees it has.

Resilience Testing



(FIGURE 10 MODEL: RESILIENCE TESTING SECTOR)

This sector sets up the shocks that can be applied in order to test the resilience of the system.

The key variables in the sector are:

- *Single shock*: when applied will introduce a single shock to the system
- *Shock*: when applied will introduce a series of shocks to the system
- *Polarity*: used to set the polarity of the shock
- *Magnitude*: sets the magnitude of the shock
- *Duration*: sets the duration of time that the shock lasts

- *Start time*: sets the time that the shock to the system starts
- *Seed*: introduces stochasticity when a series of shocks are introduced

Data Collection

As stated previously in earlier sections, the model presented is predictive and therefore does not rely on nor study past system behaviour. Further, it uses data from the case study as initial values for certain stocks and variables and allow for the system to be initialised in steady state. To this end information and data was received from the PBO⁶ in the form of:

- One on-line workshop
- A questionnaire
- Two on-line Group Model Building sessions
- Annual Reports from the PBO
- 2 Data verification and clarification sessions
- 1 Model presentation session

Sensitivity Testing and Analysis

This project is focused on the testing and building an organization's resilience, as such extensive testing, introduction of shocks to the system and the introduction of policy are all vital. In this regard Hugo Herrera's paper: *From metaphor to practice, operationalising the analysis of resilience using system dynamics modelling* (Herrera, 2017) Herrera states: "The measures of resilience are calculated using the behaviour (produced) by a previously calibrated and validated SD Model. The model allows simulating the system response to different disturbances."⁷

In discussing *Quantifying and measuring resilience from the simulated behaviour* Herrera discusses the challenges with trying to measure resilience and concludes by citing Bennett et that "because resilience itself is hard to measure, the alternative is to measure attributes

⁶ (PBO, 2021) – Data and Information received from various interactions with PBO

⁷ (Herrera, 2017)

“attributes of systems that are related to the resilience of the system and are measurable” (Herrera, 2017).

In our case, we have identified that the mission of the organization is to empower poor women to break the bonds of poverty. This is the core reason for the organization’s existence. All other resources and processes, however important, are in the service of this primary objective. This is achieved through a suite of services, programs and projects delivered through a workforce of employees which the organization employs. Therefore, it would stand to reason that the indicator of the organization’s success would be the number of clients they served. This is therefore the *measurable attribute* (Herrera, 2017) by which we will measure the organization’s resilience. We can further decide that the outcome we will measure is the actual number of clients at the end of the time horizon in each scenario and that the desired outcome is that that number will be equal to or greater than the base case.

Further in determining the resilience of the organization we would determine the system to be resilient if at the end of the time horizon the system generates behaviour which meets one of the following conditions:

1. The number of Clients is equal to the Base Run
2. The number of Clients is better than the Base Run
3. The number of Clients is no worse than 5% lower than the Base Run.

In testing for resilience, it was important to identify the exogenous variables to which shocks could be applied and then observe the effect that would be an indication of the presence or absence of resilience in the system. In this model it was determined that the following variables and justifications applied.

Exogenous Variables:

1. **Turnover Rate:** the turnover rate is one of the variables out of the control of the system. In the environment in which the PBO operates staff turnover rates are high as there is a scarcity of the skills required and therefore on-going competition for those skills, including from the government sector. Further, the turnover rate has a direct

impact on the quality of service delivered to clients as well as the number of clients that the organization is able to take on or service. If employee numbers decrease, this leads to a corresponding decrease in the number of clients.

2. **Administrative Expenses:** in discussing some of the potential risks which the PBO faces, the issue of potential spike in administrative expensive due technical governance issue arose. These would come from outside of the system and would not be in the control of the PBO. By applying shocks to this variable, we are able to see what such an event would do to the system as a whole.
3. **Market Growth:** this variable is exogenous. By its nature it already presents a level of uncertainty as it is subject to fluctuation outside of the influence of the system of the PBO. In the model we build in a level stochasticity for this variable in the model and the values taken on is the average growth over a year. However, it is also a variable which lends itself to being tested by shocks as its effect on the entire system is significant.

Effect to observe and measure resilience on

The mission of the PBO is to empower rural women to gain financial independence and uplift themselves and their families out of poverty. This is achieved though providing a suite of social, educational and development services. These services are delivered through frontline employees of the PBO to the clients of the PBO. It would stand to reason therefore that a measure of success of the organization would be the number of clients it can serve and does serve over a period of time. Everything in the organization is geared toward ensuring that increasing numbers of clients are served each year. Therefore, the effect selected for testing resilience is that of *Clients*.

Tests which have been conducted

The model and developed policies have undergone extensive testing. The model is on its 7th version and underwent testing while each version was developed. Once the model was at the level considered suitable for testing the following testing occurred.

- 1 base run with all policies switched off in order to establish a baseline
- 1 run with all the policies switched on in order to see the effect of all the policies, working in unison, on the system
- 15 scenarios of 250 runs each, applying a **series of shocks** to each of three exogenous variables (namely: Turnover Rate, Administrative Expenses and Market Value) in order to test the effect on Clients.
- 12 scenarios of 1 run each applying a **single shock** of extreme conditions

The result of the testing produced in excess of 1.4 GB (>200 million lines) of data, too large for Excel to handle which resulted in other tools such as Microsoft Power BI being used.

- Following this extensive testing, the analysis of the results of the different scenarios began. At some point during the analysis, it became clear that something was amiss with the model. It was not behaving the way it was expected to behave in that the Total Number of Employees and the Clients were running to zero while the two stocks of Reserves Account and Operating Account were not draining as they were expected to. It took some time of going through the entire model to establish where the problem was. The problem was identified as creating a circular self-reinforcing behaviour. This was corrected by adding a budget element to the model. Following this an entire new round of testing was done. This included:
 - 1 Base run with no shocks and no policies turned on
 - 1 Utopia Run with no shocks and all three policies turned on
 - 15 Scenarios applying shocks to the 3 exogenous variables with 250 runs per scenario (3x5x250 or 3750 runs)
 - 12 Scenarios of extreme testing with 1 run each.

In order to reflect the sensitivity range of each scenario, the graphs reflect the confidence levels. However, for the purposes on analysis, the last run of each scenario is used. Further, to calculate the resilience of a scenario, the move away from the base run is calculated. However,

it must be reiterated that the calculation is just to understand the scale and direction away from the starting point. Our interest remains in the trends and trajectory of the move rather than specific data points. Detail test results and analysis follows.

Setting the Baseline

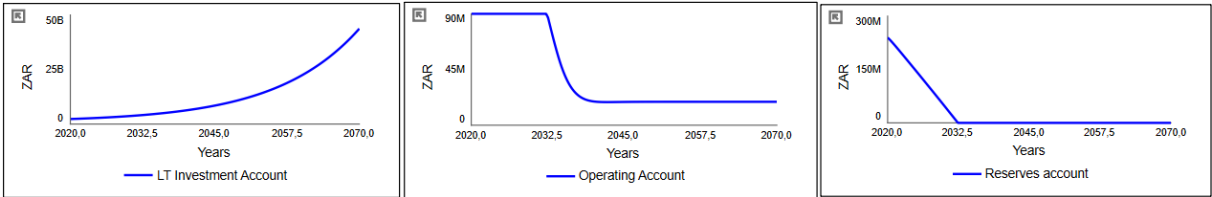
Base Run

In this base run the system is initialised. The Figure 11 below indicates the values of key stocks and variables for the first 5 years and the last 5 years of the time horizon.

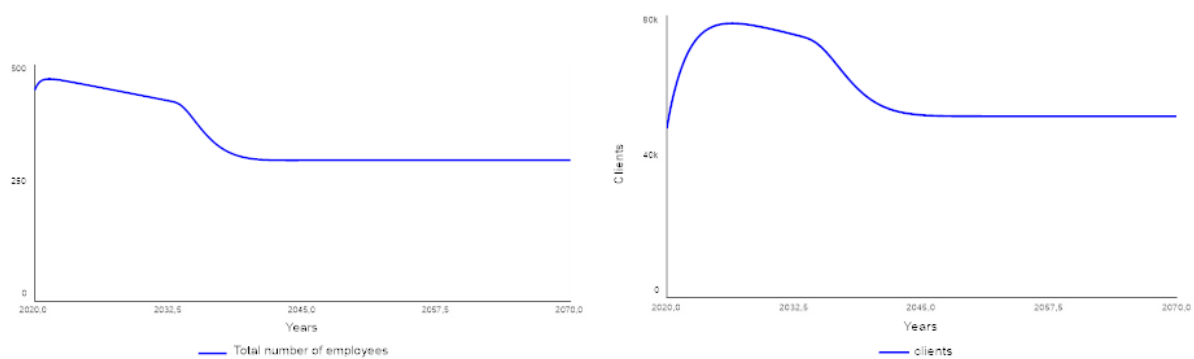
Base Run

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2066	51,4k	298	18,9M	0	33,3B
2067	51,4k	298	18,9M	0	35,6B
2068	51,4k	298	18,9M	0	38,2B
2069	51,4k	298	18,9M	0	40,8B
Final	51,4k	298	18,9M	0	43,7B

(FIGURE 11 BASE RUN BALANCES)



(FIGURE 12 BASE RUN: FINANCIAL STOCKS)



(FIGURE 13 BASE RUN: EMPLOYEES & CLIENTS)

Key observations in this run are:

- **Reserves Account:** starts at ZAR240million and decreases each year until it is depleted in 2033.
- **LT Investment Account:** starts at a value of ZAR2,3billion, shows exponential growth each year and reaches a value of ZAR43,7billion at the end of the time horizon. (Graph...)
- **Operating Account:** starts at a value of ZAR90million decreases until it settles at a value of ZAR18,9m until the end of the time horizon.
- **Total number of Employees:** start at 446 employees and increases slightly in the first 2 years and then declines until 2043 where it settles into a steady state at 298 employees for the rest of the time horizon.
- **Clients:** start at 48,000 and grows to a peak of 77,800 in 2026 before it begins to decrease again. Around 2048 it settles at 51,400 and remains in that steady state until the end of the time horizon.

Scenario 2: "Utopia" Run

The reason for naming this the Utopia Run is because the system is balanced in that all areas are thriving. In this scenario we can observe that all the indicators being tracked are in a steady state of growth, except for the Reserves Account which is almost constant.

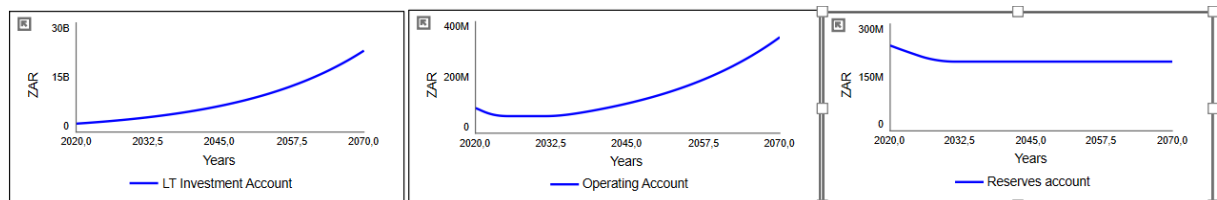
In this run all the policies are turned on. And the key policy variables are set at these levels:

- **Max Portion of Accounts to be used a year:** 0,30 (30 percent)
- **Dividend Payout Ratio:** 0,025 (2.5 percent)
- **Donor Funds Percentage:** 0,15 (15 percent)
- **Max Reserves Usage:** 0,025 (2.5 percent)

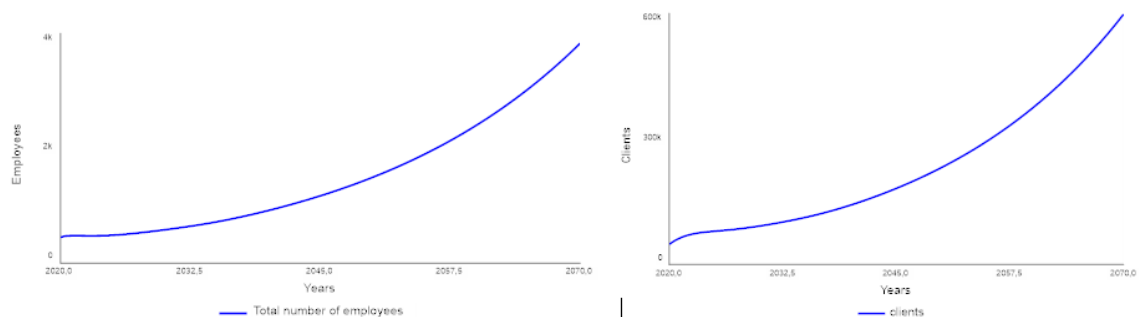
Utopia Scenario

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2066	496k	3,18k	286M	194M	18,6B
2067	520k	3,33k	300M	194M	19,5B
2068	544k	3,49k	314M	194M	20,4B
2069	570k	3,65k	329M	194M	21,4B
Final	598k	3,83k	344M	194M	22,4B

(FIGURE 14 UTOPIA SCENARIO: BALANCES)



(FIGURE 15: UTOPIA SCENARIO: FINANCIAL STOCKS)



(FIGURE 16 UTOPIA SCENARIO: EMPLOYEES AND CLIENTS)

Key observations in this run are:

- **Reserves Account:** starts at ZAR240million, decreases to ZAR194million around 2032, where it settles into steady state for the rest of the time horizon. (Figure 15)
- **LT Investment Account:** starts at a value of ZAR2,3billion, shows exponential growth each year and reaches a value of ZAR22.4billion by the end of the time horizon. (Figure 15)
- **Operating Account:** starts at a value of ZAR91million and grows to a value of ZAR344million at the end of the time horizon. (Figure 15)
- **Total number of employees:** starts at 446 employees and grow steadily each year to a total of 3 830 employees by the end of the time horizon. (Figure 16)
- **Clients:** start at 48,000 clients and grows steadily to 598,000 for the rest of the time horizon. (Figure 16)

This scenario allows for the possibility of addressing several of the strategic risks facing the organization:

- a. It allows for the number of employees to grow year on year, which means that there is an increased level of service given.
- b. The clients grow which means total alignment with the organization's mission and strategic intent, helping more women annually in their fight against poverty. This also contributes to the United Nations Sustainable Development Goals of ending poverty.
- c. By paying out a dividend ratio each year, this allows the organization to have consistent in-flows of cash and build up the operational account balance which allows for smoother operations as well as a level of stability and sustainability. The organization will not find itself in constant crisis management mode.
- d. Although the Reserves Account declines and then stabilizes, which will reduce the amount of interest earned from that account, the building up of the Operational Account has all the benefits listed in the previous point, but also will see that account remain in a positive balance and earn interest which will offset the loss of interest in the Reserves account.
- e. From the base run to this run, we can observe that the exponential growth in the LT Investment account is not as aggressive. However, the previous run showed growth that was at the expense of the rest of the organization and its mission (Success to the successful architecture described previously).

Shocks to Turnover Rate

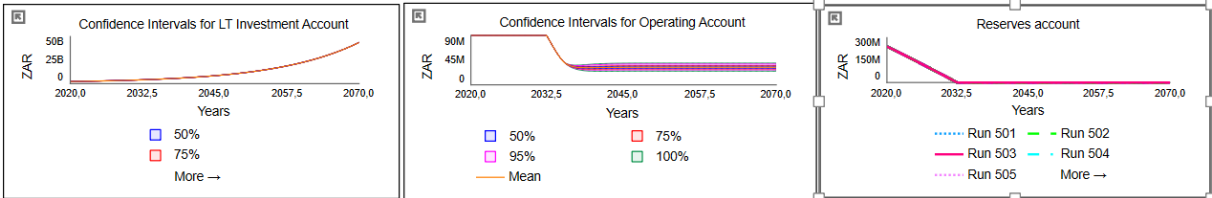
Scenario 3: Series of Shocks to Turnover Rate with All Policies Switched Off

In this scenario we apply a series of shocks to the Turnover Rate in order to assess the effect on the Total Number of Employees and the Clients. Key variable values in this scenario are set at:

(TABLE 2 SCENARIO 3: SHOCK TO TURNOVER RATE – NO POLICIES)

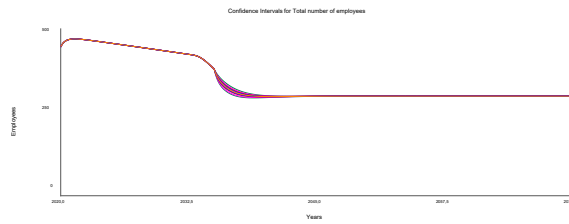
Scenario 3: Policy Being Tested: Shock to Turnover Rate		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio	0,025	Off
Donor Funds Percentage	0,15	Off
Shock to Exogenous Variable		
Variable Being Shocked	Value	Single / Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

3 Financial Stocks: In this scenario we observe that although the Investment Account grows, the Operating Accounts drops significantly and the Reserves Account displays total decline because the Operational Account will drain it until it is depleted and then the adjustments in Total Number of Employees is affected negatively, which in turn the number of Clients that the organization can service. The exponential growth displayed by the LT Investment Account is unhampered due to the fact that the only investment income is derived from the Fixed Minimum Payout which is a fixed amount.



(FIGURE 17 SCENARIO 3: FINANCIAL STOCKS)

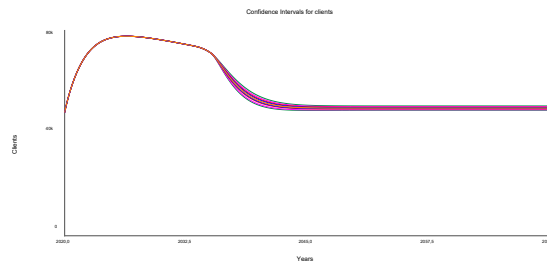
Effect on Total Number of Employees



(FIGURE 18 SCENARIO 3: EMPLOYEES)

The total number of employees start at 446 in 2020. This number rises slightly to 469 and then declines and settles at 298 from 2041 for the rest of the time horizon. The effect of the shock causes the decrease, however in this scenario the system does show resilience in that although the numbers decrease, they do settle at a “new normal” and don’t decline completely.

Effect on Clients



(FIGURE 19 SCENARIO 3: CLIENTS)

The pattern of behaviour of the Clients follows that of the Total Number of Employees and one can observe that there is a slight delay between the two. Clients start out at a Figure of 48,000 and rise to around 77,800 before they start to decline. The decline in Clients follows the decline in Employees and settles at 54,000, where it remains until the end of the time horizon.

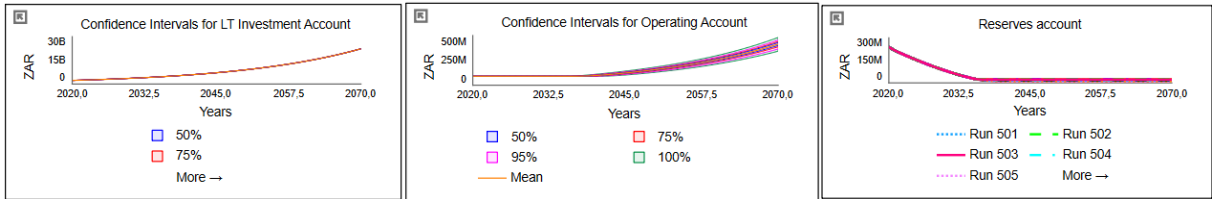
Scenario 4: Shock to Turnover Rate with Dividend Pay-out Ratio Policy Switched On

In this scenario we apply a series of shocks to the Turnover Rate in order to assess the effect on the Total Number of Employees and the Clients. The Dividend Ratio Policy is turned on. Key variable values in this scenario are set at:

(TABLE 3 SCENARIO 4: SHOCK TO TURNOVER RATE – DIVIDEND POLICY)

Scenario 4: Policy Being Tested: Shock to Turnover Rate		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	On
Donor Funds Percentage	0,15	Off
Fixed Minimum Payout Policy		Off
Shock to Exogenous Variable	Value	Single / Series
Variable Being Shocked	Turnover Rate	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

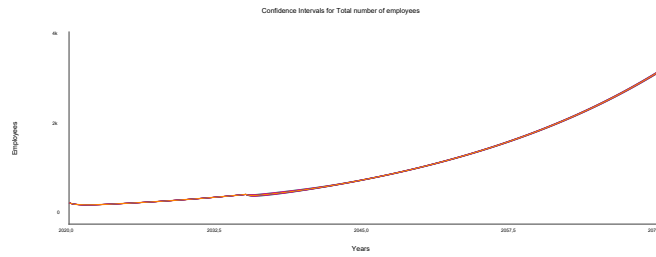
3 Financial Stocks: In this scenario the Dividend Payout Ratio Policy drives growth in the Operating Account. The same is not true for the Reserves Account as we have not turned on the policy which restricts how much can be drawn down from that account. The graphic below shows the effect of the policy on the 3 financial stocks. The detailed balances for the three stock and two variables can be found in Appendix....



(FIGURE 20 SCENARIO 4: FINANCIAL STOCKS)

Effect on Total Number of Employees

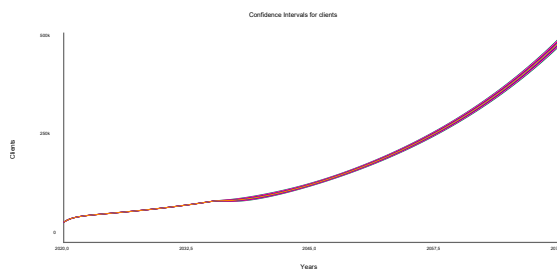
Figure 21 below shows that due to the growth instigated by the Dividend Ratio policy, there is concomitant growth in the Total number of Employees. The number starts at 446, drops slightly to 403 and then begins a climb toward the final number of 3,170.



(FIGURE 21 SCENARIO 4: EMPLOYEES)

Effect on Clients

As shown in the following Figure 22, the growth in Total Number of Employees discussed above drives the growth in the number of Clients which starts at 48,00 and then climbs to reach a value of between 480,000 at the end of the time horizon.



(FIGURE 22 SCENARIO 4: CLIENTS)

The only difference in conditions between Scenario 3 and Scenario 4 is the fact the Dividend Payout Ratio is brought into play by switching the policy on. What is observed is that despite the shock applied to the Turnover Rate, the organization not only shows resilience but grows despite the shock. One could argue that perhaps the shock is not great enough. We will test and observe the effects of more extreme conditions later in the paper.

Scenario 5: Shock to Turnover Rate with Max Reserves Policy Switched On

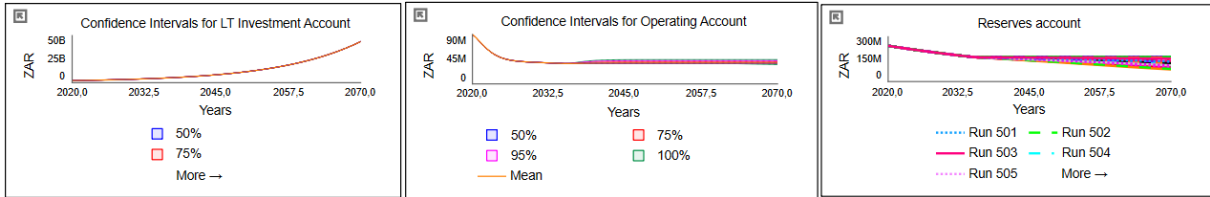
This scenario applies the shock to the Turnover Rate with the Max Reserves Policy switched. The values set for all the applicable variables are as follows:

(TABLE 4 SCENARIO 5: SHOCK TO TURNOVER RATE – RESERVES POLICY)

Scenario 5:		Policy Being Tested: Shock to Turnover Rate	
Variable	Value	Policy On / Off	
Max Reserves Usage	0,025	On	
Max Portion of Account to be used every year	0,30	N/A	
Dividend Payout Ratio Policy	0,025	Off	

Donor Funds Percentage	0,15	Off
Fixed Minimum Payout Policy		Off
Shock to Exogenous Variable		
Value		Single / Series
Variable Being Shocked	Turnover Rate	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

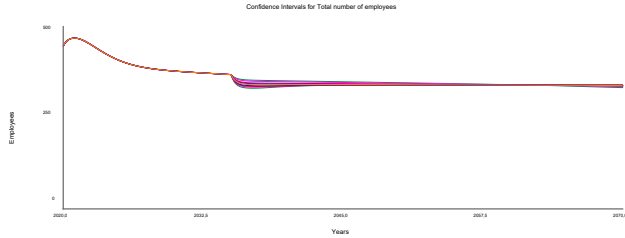
3 Financial Stocks: The impact of this scenario on the three financial stocks are shown in the Figure 23 below. We can observe that by switching the Max Reserves Usage policy on, the LT Investment Account is unaffected, however the Reserves Account slowly declines, essentially by 2.5% each year but does not completely deplete in within the time horizon. The Operating Account decreases decreasingly it settles into steady state. It is constrained by the flat amount of income i.e Fixed Minimum Payout and a declining interest payment from the Reserves Account.



(FIGURE 23 SCENARIO 5: FINANCIAL STOCKS)

Effect on Total Number of Employees

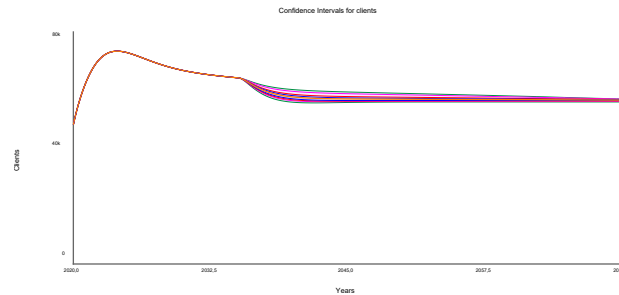
The Total Number of Employees start at 446, have a slight increase to 468 and then decrease to 339 where it settles until the end of the time horizon, constrained by the constrained Operating Account.



(FIGURE 24 SCENARIO 5: EMPLOYEES)

Effect on Clients

The Clients start at a value of 48,000 and increase to a maximum of 73,400. They then decrease and settle at 56,600 where it remains until the end of the time horizon.



(FIGURE 25 SCENARIO 5: CLIENTS)

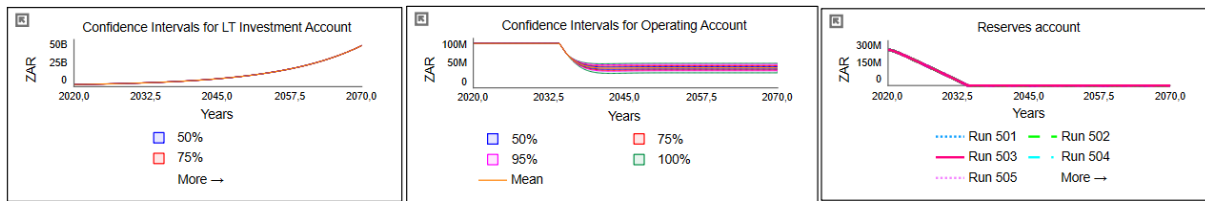
Scenario 6: Shock to Turnover Rate with Donor Funds Rate Percentage Policy Switched On

This scenario applies the shock to the Turnover Rate with the Donor Funds Rate Percentage Policy switched on. The settings for the key variables are as follows:

(TABLE 5 SCENARIO 6: SHOCK TO TURNOVER RATE – DONOR POLICY)

Scenario 6: Policy Being Tested: Shock to Turnover Rate		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	Off
Donor Funds Percentage Policy	0,15	On
Fixed Minimum Payout Policy		Off
Shock to Exogenous Variable	Value	Single / Series
Variable Being Shocked	Turnover Rate	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

3 Financial Stocks

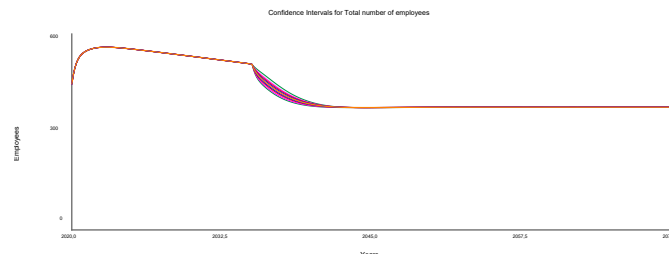


(FIGURE 26 SCENARIO 6: FINANCIAL STOCKS)

The LT Investment account starts at ZAR2,3B and grows to ZAR43,7B by the end of the time horizon. The Reserves account which starts at ZAR240m and depletes by 2035. The Operating Account starts at ZAR90m and begins to decline in 2035 after the depletion of the Reserves Account. Around 2049 it settles at a value of ZAR35.8m where it remains in steady state until the end of the time horizon. What enables the Operating Account to remain at its opening value until the depletion of the Reserves Account is income enabled by the Donor Fund Percentage Policy and the draw downs from the Reserves Account.

Effect on Total Number of Employees

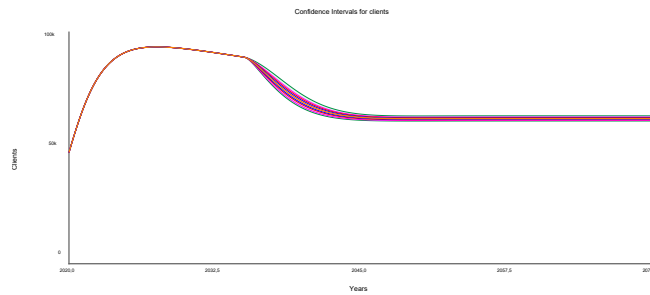
Employees start at 446, increase to 560 and the slowly decrease to 376 where it settles until the end of the time horizon. This new steady state of the Total Number of Employees is enabled by the steady state of the Operating Account.



(FIGURE 27 SCENARIO 6: EMPLOYEES)

Effect on Clients

Clients start at 48,000, increase to 93,600 and then begin to decline. They settle at 63,200 into a new steady state in 2048 and remain at that level until the end of the end of the time horizon. This is driven by the Total Number of Employees.



(FIGURE 28 SCENARIO 6: CLIENTS)

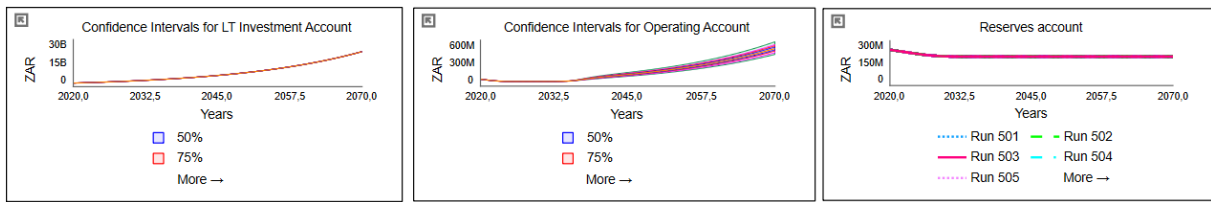
Scenario 7: Shock to Turnover Rate with All Policies Switched On

This scenario is similar to the “Utopia” Run except for the shock that it applied to the Turnover Rate. In this scenario all the policies are switched on and all values of key variables as listed in the scenario table below are set at optimal levels. The same values have been kept consistently through the various scenario testing of the shock to Turnover Rate to ensure comparability between the scenarios.

(TABLE 6 SCENARIO 7: SHOCK TO TURNOVER RATE – ALL POLICIES)

Scenario 7: Recommended Scenario		Policy Being Tested: Shock to Turnover Rate	
Variable	Value	Policy On / Off	
Max Reserves Usage	0,025	On	
Max Portion of Account to be used every year	0,30	N/A	
Dividend Payout Ratio Policy	0,025	On	
Donor Funds Percentage Policy	0,15	On	
Shock to Exogenous Variable	Value	Single / Series	
Variable Being Shocked	Turnover Rate	Series	
Average Magnitude	0,5		
Standard Deviation Magnitude	0,1		
Average Duration	1		
Standard Deviation Duration	0,1		
Polarity	Positive		
Start Time	2035		

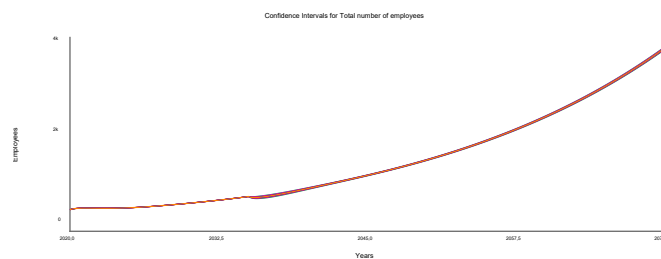
3 Financial Stocks: Figure 29 below indicates the movement in the 3 financial stocks. We can observe that the LT Investment Account and the Operating Account show a trend of growth over the time horizon, despite the shock. The Reserves Account shows a slight decline and the settles into a new steady state until the end of the time horizon.



(FIGURE 29 SCENARIO 7: FINANCIAL STOCKS)

Effect on Total Number of Employees

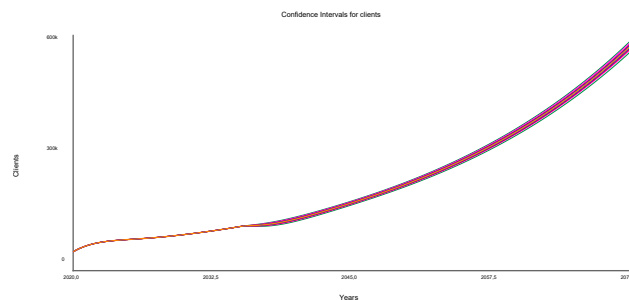
Total Number of Employees begin at 446 and increase steadily to a total of 3,770 by the end of the time horizon. This follows the curve of the Operating Account.



(FIGURE 30 SCENARIO 7: EMPLOYEES)

Effect on Clients

The Clients start at 48,000 and increase, following the curve of the Total Employees to a total of 567,000 by the end of the time horizon. All things being equal, there is no reason why this curve would not continue beyond the chosen time horizon with these settings.



(FIGURE 31 SCENARIO 7: CLIENTS)

Figure 32 below indicates the values of the first 5 and last 5 years of the time horizon for the 3 financial stocks and two key variables which we observe the effect of the applied shock.

Scenario 7

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2066	470k	3,13k	432M	194M	18,6B
2067	493k	3,28k	453M	194M	19,5B
2068	516k	3,43k	474M	194M	20,4B
2069	541k	3,6k	497M	194M	21,4B
Final	567k	3,77k	520M	194M	22,4B

(FIGURE 32 SCENARIO 7: BALANCES)

(TABLE 7 COMPARISON: UTOPIA VS SCENARIO 7)

Comparison between Utopia and Shock to Turnover Rate Recommended Run					
Utopia Run			Scenario 7: Recommended Run		
<i>Reserves Account</i>	Start	ZAR240m	<i>Reserves Account</i>	Start	ZAR240m
	Final	ZAR194m		Final	ZAR194m
<i>LT Investment Account</i>	Start	ZAR2,3B	<i>LT Investment Account</i>	Start	ZAR2,3B
	Final	ZAR22,4B		Final	ZAR22,4B
<i>Operating Account</i>	Start	ZAR90m	<i>Operating Account</i>	Start	ZAR90m
	Final	ZAR344m		Final	ZAR520m
<i>Total Employees</i>	Start	446	<i>Total Employees</i>	Start	446
	Final	3,830		Final	3,770
<i>Clients</i>	Start	48,000	<i>Clients</i>	Start	48,000
	Final	598,000		Final	567,000

Summary of Shock to Turnover Rate Scenarios

The following table 8 summarises the start and final values of the three financial stocks and the two key variables of Total Number of Employees and Clients along with both the Base and Utopia Runs.

(TABLE 8 SHOCK TO TURNOVER RATE COMPARISON)

Shock to Turnover Rate	Base	Utopia	Scenario3	Scenario4	Scenario5	Scenario6	Scenario7
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	Dividend Policy	Reserves Policy	Donor Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR43,7B	ZAR22,4B

Reserves							
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR22,2m	ZAR154m	0	ZAR194m
Operating							
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR26,5m	ZAR402m	ZAR37,1m	ZAR35,8m	ZAR520m
Employees							
Start	446	446	446	446	446	446	446
Final	298	3,830	298	3,170	339	376	3,770
Clients							
Start	48,000	48,000	48,000	48,000	48,000	48,000	48,000
Final	51,400	598,000	50,400	480,000	56,500	63,200	567,000
Resilience (Percentage move of <i>Clients</i> from the Base Run)		1,163.42%	-1.95%	933.85%	9.92%	22.96%	1,103.11%

As previously stated, the variable on which we are measuring the effect (Herrera, 2017) of the shock is *Clients* as the number of clients served is the strongest indicator of the organization fulfilling its mission. Therefore, it is this variable that we use as an indicator of the organization's resilience. For purpose of this study we will consider an outcome above the baseline or within a negative 5% of the baseline to indicate resilience. Were our focus to be on another indicator, for example a financial one, we might have a different view of the organization's resilience.

We can see from the table above that the Utopia Scenario presents a positive growth in *Clients* by 1,163.42%. This is without the shock applied.

With the introduction of the shock, Scenario 7 produces the best outcome with a positive growth in *Clients* of 1,103.11% from the Base Run. In this scenario, all the policies are switched on.

We also observe that the single strongest policy outcome is that of Scenario 4 where the Dividend Payout Ratio Policy is switched on. This produces positive growth in *Clients* of 933.85% despite the shock.

The scenario producing the worst outcome is Scenario 3 which is comparable to the Base Run except for the shock introduced. The result is a negative 1.95% move from the baseline. However, given our threshold of 5%, the system would still be considered resilient.

Shocks to Administrative Costs

Scenario 8: Shock to Administrative Costs All Policies Switched Off

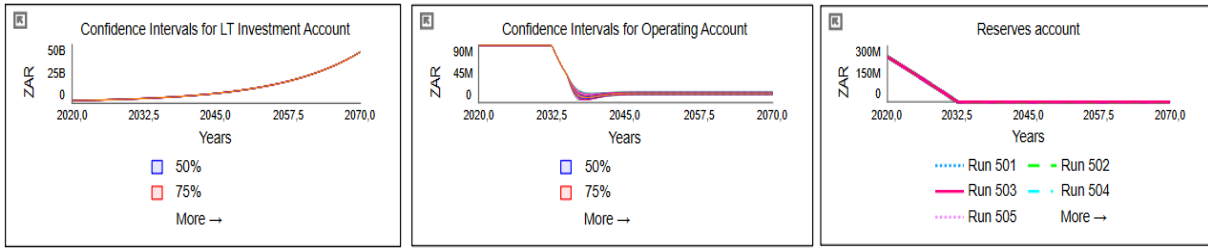
This scenario introduces a shock to the Administrative Costs with all of the policies switched off. The key variables are set at the following values:

(TABLE 9 SCENARIO 8: SHOCK TO ADMINISTRATIVE COSTS – NO POLICY)

Scenario 8: Shock to Administrative Costs		Policy Being Tested: All Policies Off	
Variable	Value	Policy On / Off	
Max Reserves Usage	0,025	Off	
Max Portion of Account to be used every year	0,30	N/A	
Dividend Payout Ratio Policy	0,025	Off	
Donor Funds Percentage Policy	0,15	Off	
Shock to Exogenous Variable	Value	Single / Series	
Variable Being Shocked	Administrative Costs	Series	
Average Magnitude	0,5		
Standard Deviation Magnitude	0,1		
Average Duration	1		
Standard Deviation Duration	0,1		
Polarity	Positive		
Start Time	2035		

3 Financial Stocks

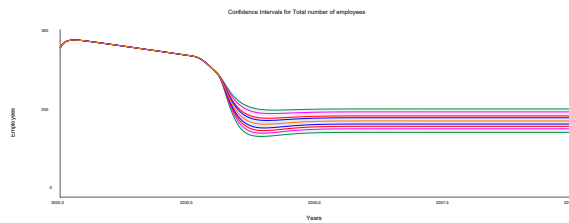
In this scenario the LT Account is unaffected by the shock and grows steadily to ZAR43,7B from a start of ZAR2,3B. The Operating and Reserves Accounts are heavily affected showing almost no resilience. The Reserves Account starts at ZAR240m and falls to zero in 2033, 2 years before the shock. This means that without being able to draw down from the Reserves Account, the Operating Account starts to decline also 2 years ahead of the shock and a year after the shock it is half the value of the previous year. This has major implications for affordability and therefore and the Total Number of Employees and ultimately, Clients.



(FIGURE 33 SCENARIO 8: FINANCIAL STOCKS)

Effect on Total Number of Employees

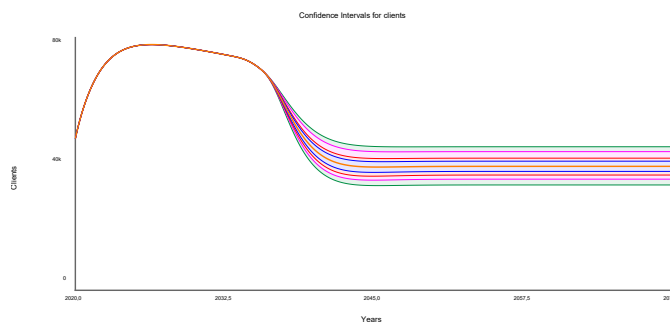
The Total Number of Employees start at 446 and climbs slightly to 469. After the shock and due to the drastic drop in the Operating Account, the Total Number of Employees drops to 251 where it settles into a steady state from 2047 until the end of the time horizon.



(FIGURE 34 SCENARIO 8: EMPLOYEES)

Effect on Clients

The total for Clients starts at 48,000 and before the shock climbs to 77,800. After the shock and the drop in Total Employees, the number of Clients falls and then settles at 43,200 to the end of the time horizon.



(FIGURE 35 SCENARIO 8: CLIENTS)

Scenario 9: Shock to Administrative Costs with Dividend Payout Ratio Policy On

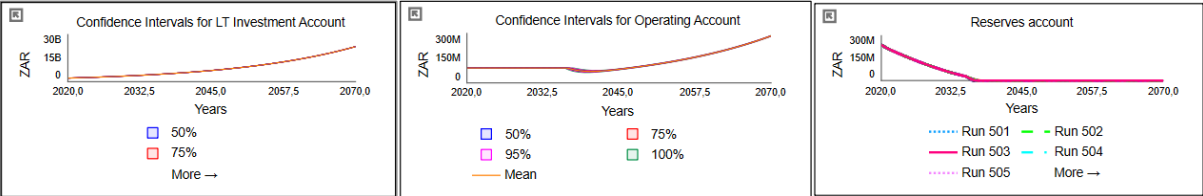
This scenario applies the shock to Administrative Cost with the Dividend Ratio Policy switched on. The key variables are set at the following values:

(TABLE 10 SCENARIO 9: SHOCK TO ADMINISTRATIVE COSTS – DIVIDEND POLICY)

Scenario 9: Shock to Administrative Costs		Policy Being Tested: Dividend Payout Ratio Policy	
Variable	Value	Policy On / Off	
Max Reserves Usage	0,025	Off	
Max Portion of Account to be used every year	0,30	N/A	
Dividend Payout Ratio Policy	0,025	On	
Donor Funds Percentage Policy	0,15	Off	
Shock to Exogenous Variable	Value	Single / Series	
Variable Being Shocked	Administrative Costs	Series	
Average Magnitude	0,5		
Standard Deviation Magnitude	0,1		
Average Duration	1		
Standard Deviation Duration	0,1		
Polarity	Positive		
Start Time	2035		

3 Financial Stocks

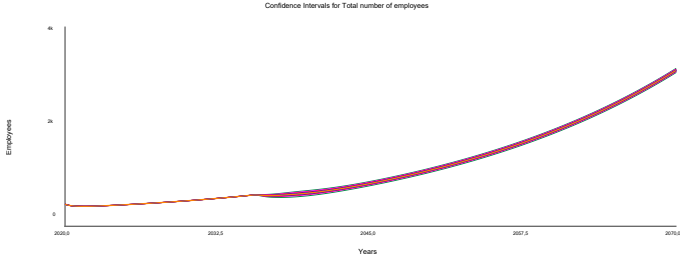
The LT Investment Account starts at a value of ZAR2,3B and steadily increases year on year to a value of ZAR22,4B at the end of the time horizon. Due to the Dividend Ratio Payout policy, the Operating Account, which starts at ZAR90m, begins to increase from the year 2042 and reaches a value of ZAR287m by the end of the time horizon, after a slight decline in from 2038 to a low of ZAR72.8m. The Reserves Account, which starts off at a value of ZAR240m experiences consistent decline and is completely depleted by 2038. There is no mechanism in place for its recovery.



(FIGURE 36 SCENARIO 9: FINANCIAL STOCKS)

Effect on Total Number of Employees

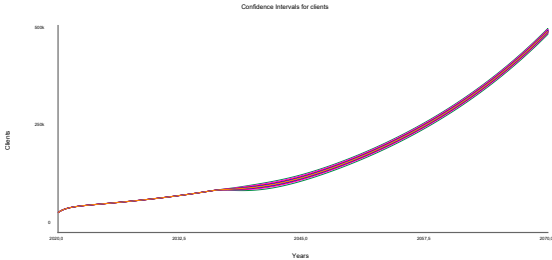
The Total Number of Employees starts at a value of 446 and rises steadily to a value of 3,150 at the end of the time horizon.



(FIGURE 37 SCENARIO 9: EMPLOYEES)

Effect on Clients

Clients start out at a value of 48,000 and steadily increases to a value of 490,000 at the end of the time horizon.



(FIGURE 38 SCENARIO 9: CLIENTS)

Scenario 10: Shock to Administrative Costs with Reserves Usage Policy On

In this scenario the shock is to Administrative Costs and the Max Reserves Usage policy is switched on. The key variables have the following settings:

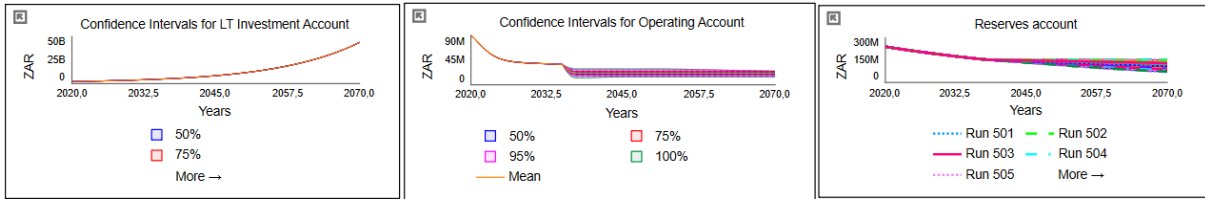
(TABLE 11 SCENARIO 10: SHOCK TO ADMINSTRATIVE COSTS – RESERVES POLICY)

Scenario 10: Shock to Administrative Costs		Policy Being Tested: Max Reserves Usage Policy	
Variable	Value	Policy On / Off	
Max Reserves Usage	0,025	On	
Max Portion of Account to be used every year	0,30	N/A	
Dividend Payout Ratio Policy	0,025	Off	
Donor Funds Percentage Policy	0,15	Off	
Shock to Exogenous Variable	Value	Single / Series	

Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

3 Financial Stocks

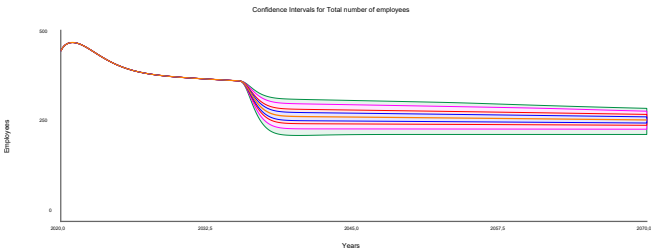
The LT Investment Account grows unhindered from a starting value of ZAR2,3B to a value of ZAR43,7B by the end of the time horizon. The Reserves Account starts at ZAR240m and declines by the 2.5% allowed every year. This has an added impact on the Operating Account which is not only restricted by limited drawing from the Reserves Account, but also has declining Interest Income. The Operating Account starts at a value of ZAR90m and begins its decline from 2021 until it settles at ZAR22.5 in 2038. It remains at this value until the end of the time horizon.



(FIGURE 39 SCENARIO 10: FINANCIAL STOCKS)

Effect on Employees

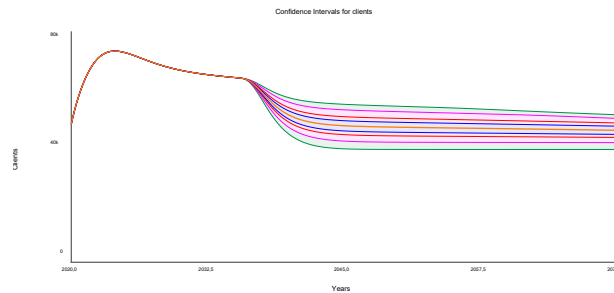
The Total Number of Employees start at 446 and rise in 2021 slightly to 468 whereafter it declines year on year to 271 at the end of the time horizon. This decline drives down the number of Clients in return.



(FIGURE 40 SCENARIO 10: EMPLOYEES)

Effect on Clients

The value of Clients once initialised is then driven by the Employee-Client Ratio. As a result, we observe the value of Clients, which starts at 48,000 climbs to 73,400 in 2024. Thereafter it settles into the Employee-Client Ratio and thereafter tracks the value of Total Number of Employees to a value of 46,900 at the end of the time horizon.



(FIGURE 41 SCENARIO 10: CLIENTS)

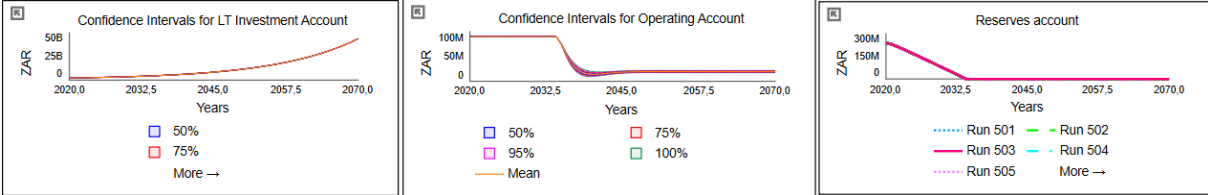
Scenario 11: Shock to Administrative Costs with Donor Funds Percentage Policy On

This scenario has a shock to Administrative Costs with the Donor Funds Percentage policy on. The key variables settings are as follows:

(TABLE 12 SCENARIO 11: SHOCK TO ADMINISTRATIVE COSTS – DONOR POLICY)

Scenario 11: Shock to Administrative Costs Policy Being Tested: Donor Funds Percentage Policy		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	Off
Donor Funds Percentage Policy	0,15	On
Shock to Exogenous Variable		
Variable Being Shocked	Value	Single / Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

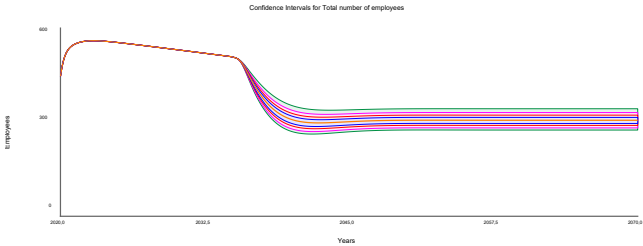
3 Financial Stocks: The LT Investment account starts at ZAR2,3B and grows to ZAR4,7B over the time horizon. The Reserves Account starts at a value of ZAR240m and decline to 0 by 2035. The Operating Account starts at ZAR90m and then declines until it settles at ZAR20,6m for the rest of the time horizon.



(FIGURE 42 SCENARIO 11: FINANCIAL STOCKS)

Effect on Total Number of Employees

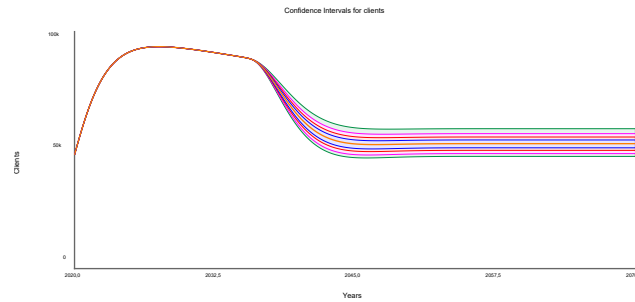
The Total Number of Employees start at 446 and rise to 560 by 2023, whereafter it starts to decline to 326 where settles there to the end of the time horizon.



(FIGURE 43 SCENARIO 11: EMPLOYEES)

Effect on Clients

The Clients start out at 48,000 and rises to 93,600 by 2028 as it catches up with the Employee-Client Ratio and the rise in Total Number of Employees after the applicable time delays. It then begins to decline, tracking the decline in Total Number of Employees, until it reaches a value of 49,600 in 2053 where it settles until the end of the time horizon.



(FIGURE 44 SCENARIO 11: CLIENTS)

Scenario 12: Shock to Administrative Costs with All Policies Switched On (Recommended Run)

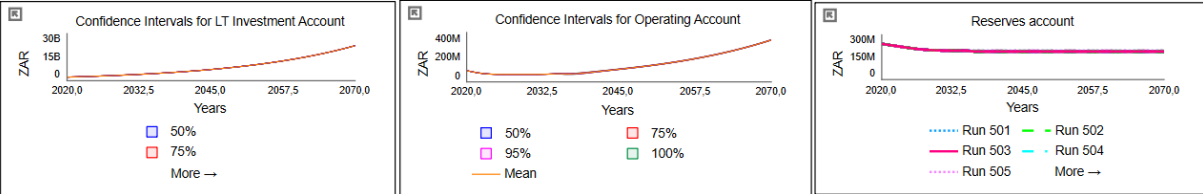
This scenario is similar to the Utopia Run Except for the shock applied to the Administrative Costs. All policies are switched on. The settings for the key variables are as follows:

(TABLE 13 SCENARIO 12: SHOCK TO ADMINISTRATIVE COSTS: ALL POLICIES)

Scenario 12: Shock to Administrative Costs Policy Being Tested: All Policies Switched On		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	On
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	On
Donor Funds Percentage Policy	0,15	On
Shock to Exogenous Variable	Value	Single / Series
Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Positive	
Start Time	2035	

3 Financial Stocks

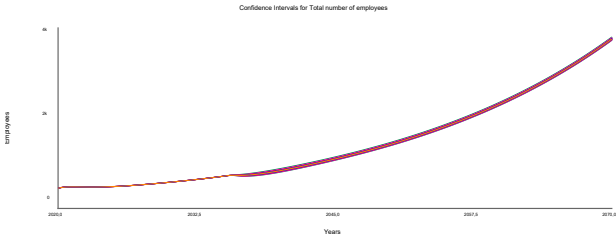
The LT Investment Account starts at ZAR2,3B and continuously rises year on year to a final value of ZAR22,4B. The Reserves Account which starts at ZAR240m decreases until 2037 when it reaches a value of ZAR189m. It settles into a steady state at that value until the end of the time horizon. The Operating Account starts at ZAR90m and experiences decline until 2031, whereafter it begins to grow again. Its final value at the end of the time horizon is ZAR340m.



(FIGURE 45 SCENARIO 12: FINANCIAL STOCKS)

Effect on Total Number of Employees

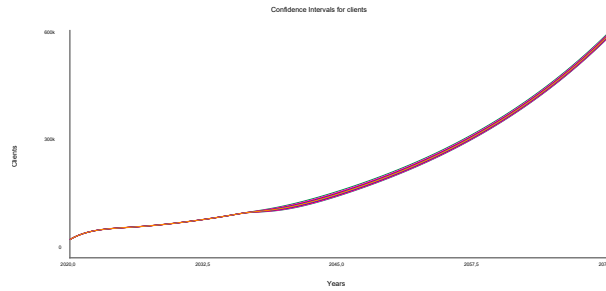
The Total Number of Employees start out at 446 in continuously grow to a final value of 3,770 at the end of the time horizon.



(FIGURE 46 SCENARIO 12: EMPLOYEES)

Effect on Clients

The Clients begin with a value of 48,000 and grow in line with the growth in Total Number of Employees to a final value of 587,000 by the end of the time horizon.



(FIGURE 47 SCENARIO 12: CLIENTS)

The table below shows the annual values of the three financial stocks and 2 key variables of Total Number of Employees as well as Clients for the first 5 and last 5 years of the time horizon. The complete table for this run can be found in the appendices.

Scenario 12

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2066	485k	3,11k	282M	189M	18,6B
2067	509k	3,27k	296M	189M	19,5B
2068	534k	3,43k	310M	189M	20,4B
2069	560k	3,59k	325M	189M	21,4B
Final	587k	3,77k	340M	189M	22,4B

(FIGURE 48 SCENARIO 12: BALANCES)

Below is a table with a comparison between the Utopia Run and Scenario 12. The conditional difference between the two is the presence of the shock which accounts for the difference in values.

(TABLE 14 COMPARISON: UTOPIA VS SCENARIO 12)

Comparison between Utopia and Shock to Administrative Costs Recommended Run					
Utopia Run			Scenario 12: Recommended Run		
<i>Reserves Account</i>	Start	ZAR240m	<i>Reserves Account</i>	Start	ZAR240m
	Final	ZAR194m		Final	ZAR189m
<i>LT Investment Account</i>	Start	ZAR2,3B	<i>LT Investment Account</i>	Start	ZAR2,3B
	Final	ZAR22,4B		Final	ZAR22,4B
<i>Operating Account</i>	Start	ZAR90m	<i>Operating Account</i>	Start	ZAR90m

	Final	ZAR344m		Final	ZAR340m
Total Employees	Start	446	Total Employees	Start	446
	Final	3,830		Final	3,770
Clients	Start	48,000	Clients	Start	48,000
	Final	598,000		Final	587,000

Summary of Shock to Administrative Costs Scenarios

The following table summarises the start and final values of the three financial stocks and the two key variables of Total Number of Employees and Clients along with both the Base and Utopia Runs.

(TABLE 15 SHOCK TO ADMINISTRATIVE COSTS COMPARISON)

Shock to Administrative Costs	Base	Utopia	Scenario8	Scenario9	Scenario10	Scenario11	Scenario12
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	Dividend Policy	Reserves Policy	Donor Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR43,7B	ZAR22,4B
Reserves							
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	0	ZAR102m	0	ZAR189m
Operating							
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR15,9m	ZAR287m	ZAR22,5m	ZAR20,6m	ZAR340m
Employees							
Start	446	446	446	446	446	446	446
Final	298	3,830	251	3,150	271	326	3,770
Clients							
Start	48,000	48,000	48,000	48,000	48,000	48,000	48,000
Final	51,400	598,000	43,200	490,000	46,900	56,100	587,000
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-15,95%	953.31%	-8,75%	9,14%	1,142%

With the shock to Administrative Costs, the Scenario producing the best result is Scenario 12 where all the policies are switched on. This results in a 1,142% growth in Clients from the baseline.

The single most influential policy is the Dividend Ratio policy which is switched on in Scenario 9 and produces a result 953.31% higher than the baseline.

Scenario 11 indicates resilience with just the Donor Funds Percentage policy being switched on.

Scenarios 8 and 10, at -15.95% and -8.75% indicate a lack of resilience in that they both fall below the negative 5% threshold which was set.

Shocks to Market Growth

Scenario 13: Shock to Market Growth All Policies Switched Off

Scenario 13 introduces a shock to Market Growth. All policies are switched off and polarity is negative. The key variable setting are as follows:

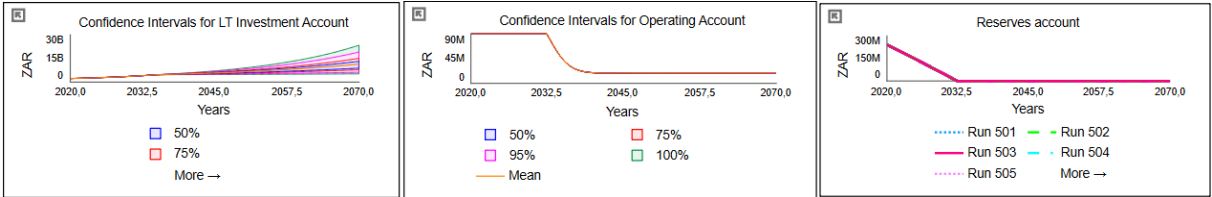
(TABLE 16 SCENARIO 13: SHOCK TO MARKET GROWTH – NO POLICY)

Scenario 13: Shock to Market Growth Policy Being Tested: None		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	Off
Donor Funds Percentage Policy	0,15	Off
Shock to Exogenous Variable	Value	Single / Series
Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Negative	
Start Time	2035	

3 Financial Stocks: Looking at Figure 50 below for the Confidence intervals for the LT Investment Account, we observe a graph that can be described as fanned out. This is the wide variance of confidence intervals caused by two variables, both with built in stochasticity being

multiplied by each other. In this case the variables *Market Growth and Shock*, both have stochasticity as part of their equations.

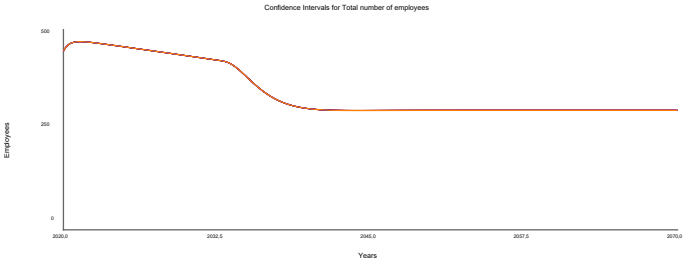
The LT Investment Account starts at a value of ZAR2,3B and, despite the shock, grows to a final value of ZAR11,6B . The Reserves Account starts at ZAR240m and is depleted by 2033 (2 years prior to the shock). The Operating Account which opens at ZAR90begins to decline in 2033, following the depletion of the Reserves Account. The Operating Account settles at a value of ZAR18.9m in 2047 and remains there in steady state for the remainder of the time horizon.



(FIGURE 49 SCENARIO 13: FINANCIAL STOCKS)

Effect on Total Number of Employees

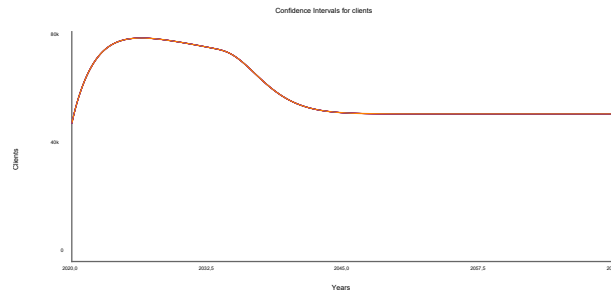
The opening value of Total Number of Employees is 446 and after a small increase, the value declines until it settles at 298 in 2043 and remains steady until the end of the period.



(FIGURE 50 SCENARIO 13: EMPLOYEES)

Effect on Clients

The Clients open at a value of 48,000 and for a few years to 77,800 before it begins a decline. It finally settles as 51,400 for the remainder of the time horizon.



(FIGURE 51 SCENARIO 13: CLIENTS)

Scenario 14: Shock to Market Growth with Dividend Payout Ratio Switched On

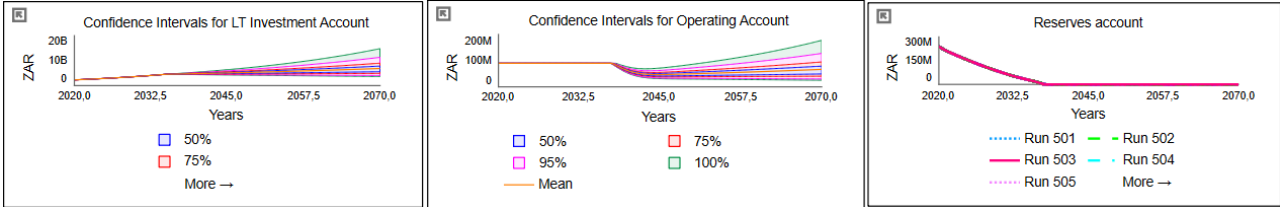
Scenario 14 applies a shock to Market Growth with the Dividend Payout Ratio Policy switched on. The key variable settings are as follows:

(TABLE 17 SCENARIO 14: SHOCK TO MARKET GROWTH – DIVIDEND POLICY)

Scenario 14: Shock to Market Growth Policy Being Tested: Dividend Payout Ratio Policy		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	On
Donor Funds Percentage Policy	0,15	Off
Shock to Exogenous Variable		
Variable Being Shocked	Value	Single / Series
Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Negative	
Start Time	2035	

3 Financial Stocks: The LT Investment Accounts begins are ZAR2,3B and gradually grows to ZAR8,28B. This slower growth is caused by the shock to Market Growth as well as the Dividend Pay-out Ratio policy passing Investment earnings to the Operating Account. The Reserves Account opens at ZAR240m and is depleted by 2039. The Operating Account which starts at a value of ZAR90m begins to decline in 2038 after the Reserves Account is depleted. It decreases

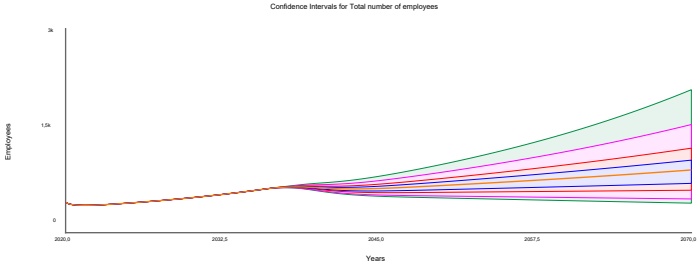
to ZAR52,6m in 2044 and then begins to increase again, closing at a final value of ZAR85,3m at the end of the time horizon. The fanning we observe in the graph of the Operating Account is as a result of the fanning we see in the Investment Account graph, as in this scenario, the Operating Account grows in tandem with the value of the Investment Account due to Dividend Payouts.



(FIGURE 52 SCENARIO 14: FINANCIAL EMPLOYEES)

Effect on Total Number of Employees

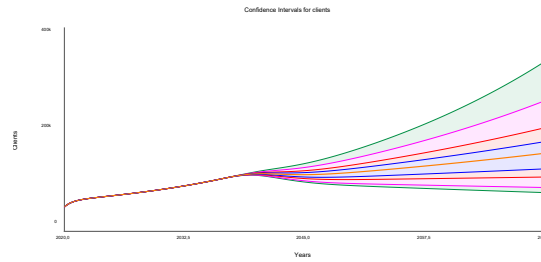
The Total Number of Employees starts out at 446, decline slightly and then begin to increase. It ends at a final value of 1,140. Again, we observe a fan Confidence Intervals graphs and this is coming from the LT Investment Account through the Operating Account which drives the Total Number of Employees.



(FIGURE 53 SCENARIO 14: EMPLOYEES)

Effect on Clients

The Total Number of Employees determines the number of Clients through the Employee-Client Ratio. In this scenario the Clients which begin at 48,000 grows to a final value of 188,000 at the end of the time horizon.



(FIGURE 54 SCENARIO 14: CLIENTS)

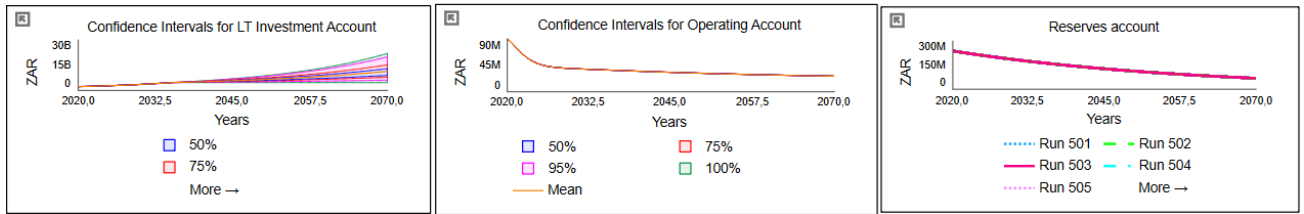
Scenario 15: Shock to Market Growth with Max Reserves Usage Policy

This scenario applies the shock to the Market Growth with the Max Reserves Usage Policy switched on. The key variable settings are as follows:

(TABLE 18 SCENARIO 15: SHOCK TO MARKET GROWTH – RESERVES POLICY)

Scenario 15: Shock to Market Growth Policy Being Tested: Max Reserves Usage Policy		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	On
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	Off
Donor Funds Percentage Policy	0,15	Off
Shock to Exogenous Variable	Value	Single / Series
Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Negative	
Start Time	2035	

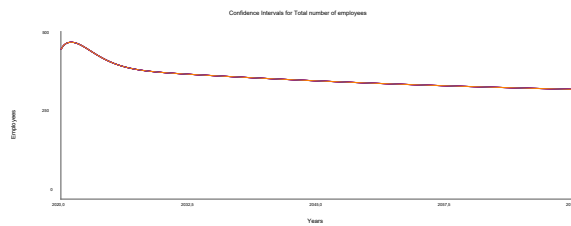
3 Financial Stocks: The LT Investment Account has an opening balance of ZAR2,3B at the beginning of the time horizon and grows to a final value of ZAR8,01B. The Reserves Account starts out at ZAR240m and slowly declines by 2.5% per annum (due to the Max Reserves Usage Policy in effect) until it reaches a final value of R68,6m at the end of the time horizon. The Operating Account has an opening value of ZAR90m and slowly declines over the period to a final value of ZAR26,5m.



(FIGURE 55 SCENARIO 15: FINANCIAL STOCKS)

Effect on Total Number of Employees

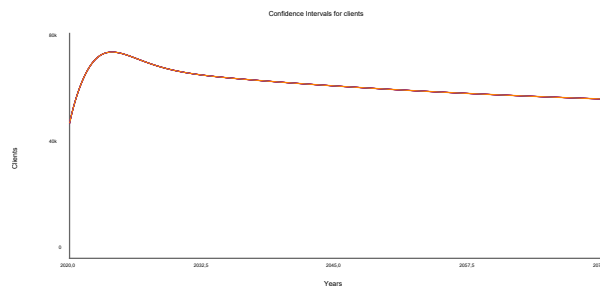
The Total Number of Employees which is determined by the movement of the Operating Account, starts at a value of 446 and slowly decreases over time to a final value of 328.



(FIGURE 56 SCENARIO 15: EMPLOYEES)

Effect on Clients

The Clients have an opening balance of 48,000 which initially grows for a period and reaches a high of 73,400 before it declines, finally reaching a value of 56,700 at the end of the time horizon.



(FIGURE 57 SCENARIO 15: CLIENTS)

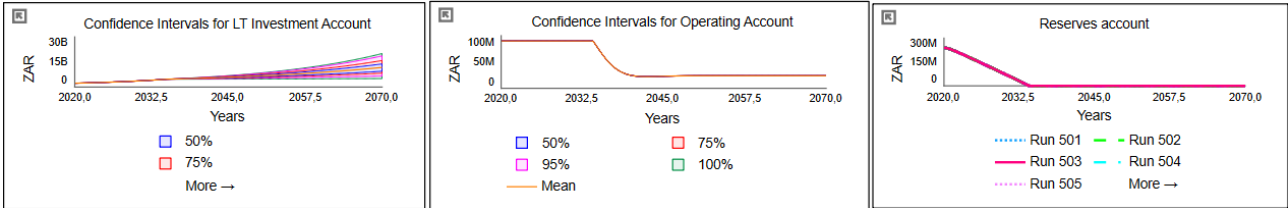
Scenario 16: Shock to Market Growth with Donor Funds Percentage Policy Switched On

In this scenario the shock is applied to the Market Growth while the Donor Funds Percentage policy is switched on. The key variables settings are as follows:

(TABLE 19 SCENARIO 16: SHOCK TO MARKET GROWTH – DONOR POLICY)

Scenario 16: Shock to Market Growth Policy Being Tested: Donor Funds Percentage Policy		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	Off
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	Off
Donor Funds Percentage Policy	0,15	On
Shock to Exogenous Variable		
Variable Being Shocked	Value	Single / Series
Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Negative	
Start Time	2035	

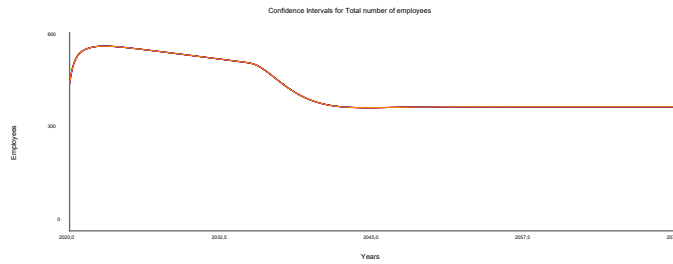
3 Financial Stocks: The LT Investment Account opens with a balance of ZAR 2,3B which steadily grows to a final value of ZAR 11,6B. Meanwhile, the Reserves Account which started at ZAR 240m is depleted by 2035. The Operating Account opens at ZAR 90m, a value it holds until 2034, whereafter, it begins to decline due to the Reserves Account being drained. It reaches a value of ZAR 23,8m in 2050 and maintains that value until the end of the time horizon.



(FIGURE 9 SCENARIO 16: FINANCIAL STOCKS)

Effect on Total Number of Employees

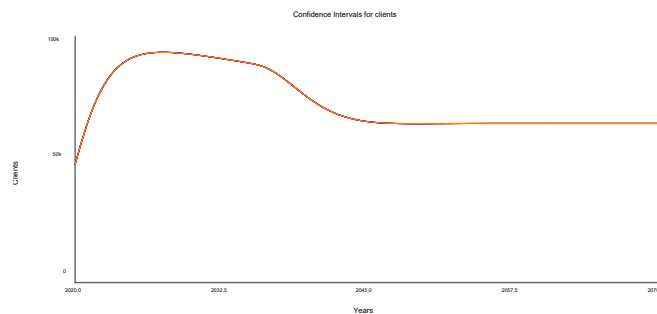
The Total Number of Employees starts at 446 and increases to a high of 560 in 2023 whereafter it begins to decline to 376 where it settles into steady state until the end of the time horizon.



(FIGURE 58 SCENARIO 16: EMPLOYEES)

Effects on Clients

Clients starts at a value of 48,000 and grows to a high of 93,600 by 2027 whereafter it begins to decline, tracking the decline in the Total Number of Employees. By 2048 it reaches a value of 64,700 and settles there until the end of the time horizon.



(FIGURE 59 SCENARIO 16: CLIENTS)

Scenario 17: Shock to Market Growth with All Policies Switched On (Recommended Run)

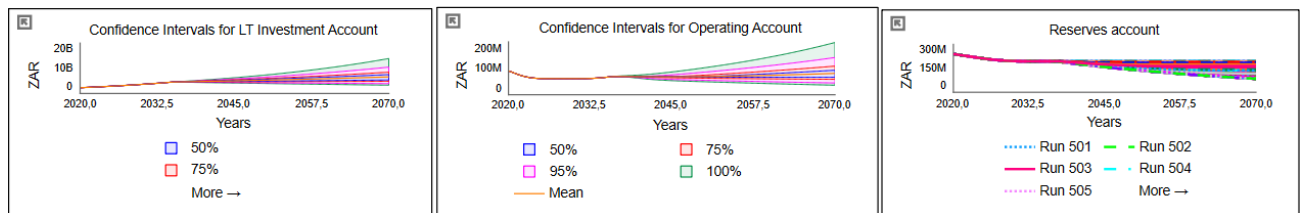
This scenario applies the shock to Market Growth with all the policies switched on. This scenario is similar to the Utopia Run except for the application of the shock. The key variable settings are as follows:

(TABLE 20 SCENARIO 17: SHOCK TO MARKET GROWTH – ALL POLICIES)

Scenario 17: Shock to Market Growth Policy Being Tested: All Policies		
Variable	Value	Policy On / Off
Max Reserves Usage	0,025	On
Max Portion of Account to be used every year	0,30	N/A
Dividend Payout Ratio Policy	0,025	On
Donor Funds Percentage Policy	0,15	On
Shock to Exogenous Variable	Value	Single / Series

Variable Being Shocked	Administrative Costs	Series
Average Magnitude	0,5	
Standard Deviation Magnitude	0,1	
Average Duration	1	
Standard Deviation Duration	0,1	
Polarity	Negative	
Start Time	2035	

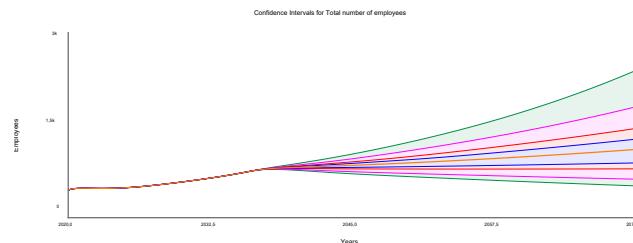
3 Financial Stocks: The LT Investment Account starts at a balance of ZAR2,3B and slowly grows to a final value of ZAR6,29B. This slowed growth is due to the fact that the Dividend Ratio is being paid out every year. The Reserves Account, which starts at ZAR240m gradually declines (2.5% per annum) as a result of the Max Reserves Usage policy which limits annual drawings from the account. It has a final value of ZAR143m. The Operating Account has an opening balance of ZAR90m which gradually decreases to its final value of ZAR73,1m at the end of the time horizon. It is sustained by inflows from the Investment Income, draw downs from the Reserves Account and income from Donor Funds.



(FIGURE 60 SCENARIO 17: FINANCIAL STOCKS)

Effects on Total Number of Employees

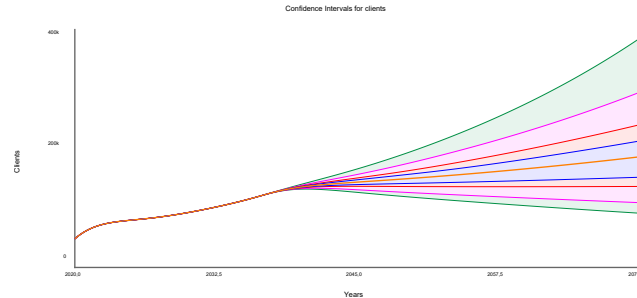
The Total Number of Employees start at 446 and gradually increases, driven by the Operating Account, to a final balance of 1,050 at the end of the time horizon.



(FIGURE 61 SCENARIO 17: EMPLOYEES)

Effects on Clients

Clients open at a balance of 48,000 and tracks the growth in the Total Number of Employees to end the period at 177,000.



(FIGURE 62 SCENARIO 17: CLIENTS)

The following table includes the balances for the 3 financial stocks and 2 key variables which we are analysing for the first and last 5 years of the time horizon. The table covering the entire period of the time horizon is included as an Appendix.

Scenario 17

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2066	170k	1,01k	70,3M	143M	6,06B
2067	172k	1,02k	70,9M	143M	6,12B
2068	174k	1,03k	71,6M	143M	6,18B
2069	175k	1,04k	72,4M	143M	6,23B
Final	177k	1,05k	73,1M	143M	6,29B

(FIGURE 63 SCENARIO 17: BALANCES)

The follow table provides a comparison between the Utopia Scenario and Scenario 17.

(TABLE 21 COMPARISON: UTOPIA VS SCENARIO 17)

Comparison between Utopia and Shock to Market Growth Recommended Run					
Utopia Run			Scenario 17: Recommended Run		
<i>Reserves Account</i>	Start	ZAR240m	<i>Reserves Account</i>	Start	ZAR240m
	Final	ZAR194m		Final	ZAR143m
<i>LT Investment Account</i>	Start	ZAR2,3B	<i>LT Investment Account</i>	Start	ZAR2,3B

	Final	ZAR22,4B		Final	ZAR6,29B
<i>Operating Account</i>	Start	ZAR90m	<i>Operating Account</i>	Start	ZAR90m
	Final	ZAR344m		Final	ZAR73,1m
<i>Total Employees</i>	Start	446	<i>Total Employees</i>	Start	446
	Final	3,830		Final	1,050
<i>Clients</i>	Start	48,000	<i>Clients</i>	Start	48,000
	Final	598,000		Final	177,000

Summary of Shock to Market Growth Scenarios

The following table summarises the start and final values of the three financial stocks and the two key variables of Total Number of Employees and Clients along with both the Base and Utopia Runs.

(TABLE 22 SHOCK TO MARKET GROWTH COMPARISON)

Shock to Market Growth	Base	Utopia	Scenario13	Scenario14	Scenario15	Scenario16	Scenario17
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	Dividend Policy	Reserves Policy	Donor Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR11,6B	ZAR8,28B	ZAR8,01B	ZAR11,6B	ZAR6,29B
Reserves							
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	0	ZAR68,6m	0	ZAR143m
Operating							
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR18,9m	ZAR85,3m	ZAR26,5m	ZAR23,8m	ZAR73,1m
Employees							
Start	446	446	446	446	446	446	446
Final	298	3,830	298	1,140	328	376	1,050
Clients							
Start	48,000	48,000	48,000	48,000	48,000	48,000	48,000
Final	51,400	598,000	51,400	188,000	56,700	64,700	177,000
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	0	365,76%	10,31%	25,15%	344,36%

With the shock to Market Growth scenarios the system has proven to be resilient to this particular shock. All the scenarios produced result better than those of the base case in terms of the “effect” variable except for Scenario 13 which was equal to the baseline.

Scenario 14 yields the best result against this shock. This would be because the Dividend Payout Ratio policy is the strongest policy and provide a strong income stream for the Operating Account. Further, in this scenario, the only policy at play is the Dividend Payout Ratio policy and therefore the flow from the Reserves Account into the Operating Account has no limit on it until that account is depleted, which is demonstrated by the final balance of zero at the end of the time horizon.

Scenario 17 produces the second best result at 344,36% better than the baseline.

It is perhaps remarkable that the system proved to resilient against this shock to Market Growth as the dominant driver of the system’s success is strong flows of Investment income which are pressured by this shock.

Further, as discussed earlier, this shock introduces a multiplication of stochasticity which perhaps would not materialize in reality. This multiplication of stochasticity occurs due to the following equations:

1. The equation for the LT Investment Account:

$$LT_Investment_Account(t - dt) + (change_in_market_value - investment_income) * dt$$

where

Change in Market Value is calculated as:

$$market_growth * LT_Investment_Account$$

and

Investment Income is calculated as:

$$MAX(0; minimum_payout)$$

2. The equation for Market Growth:

$$NORMAL("<average>"; "<stdev>" * stdev_switch)$$

3. The calculation for Market Growth with the Shock Applied

$$NORMAL("<average>"; "<stdev>"*stdev_switch)*shock$$

where

The calculation for the Shock is:

$$1+STEP(magnitude*polarity; start_time)+STEP(magnitude*-polarity; start_time+duration)*0$$

Extreme Conditions Testing

Given the fact that the system generally proved resilient in the 17 previous scenarios under which it was tested, further tests were conducted intensifying the magnitude of the shocks applied to test the point at which the system would fail.

The following tests were conducted applying a single shock of a **magnitude of 4** to the three exogenous variables:

1. Shock to Turnover Rate
 - a. Scenario 18: Shock to Turnover Rate with all policies switched OFF
 - b. Scenario 19: Shock to Turnover Rate with all policies switched ON

(TABLE 23 EXTREME TESTING: TURNOVER RATE)

Shock to Turnover Rate	Base	Utopia	Scenario18 Av. Magnitude=4	Scenario19 Av. Magnitude=4
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR22,4B
Reserves				
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR194m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR125m	ZAR1,42B
Employees				
Start	446	446	446	446
Final	298	3,830	298	3,460
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	42,600	449,000

Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-17,12%	873,54%
--	--	------------	---------	---------

In the above two scenarios, the system, without the policies switched on, fails the resilience test. At this point we know that the dominant policy is the Dividend Payout Policy and that would be contributing the greatest to the resilience of the System under Scenario 19.

2. Shock to Administrative Costs

- a. Scenario 20: Shock to Administrative Costs with all policies switched OFF
- b. Scenario 21: Shock to Administrative Costs with all policies switched ON

(TABLE 24: EXTREME TESTING: ADMINISTRATIVE COSTS)

Shock to Administrative Costs	Base	Utopia	Scenario20 Av. Magnitude =4	Scenario21 Av. Magnitude = 4
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR43,7B	ZAR24,4B
Reserves				
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR188m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR4,38m	ZAR309m
Employees				
Start	446	446	446	446
Final	298	3,830	0	3,270
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	0	501,000
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-100%	974,71%

In the above two scenarios, the system, without the policies switched on, bottoms out and fails the resilience test. At this point we know that the dominant policy is the Dividend Payout Policy and that would be contributing the greatest to the resilience of the System under Scenario 21.

3. Shock to Market Growth

- a. Scenario 22: Shock to Market Growth with all policies switched OFF
- b. Scenario 23: Shock to Market Growth with all polices switched ON

(TABLE 25 EXTREME TESTING: MARKET GROWTH 1)

Shock to Market Growth	Base	Utopia	Scenario22 Av. Magnitude =4	Scenario23 Av. Magnitude = 4
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	0	ZAR1,02m
Reserves				
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR82,3m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	0	ZAR396k
Employees				
Start	446	446	446	446
Final	298	3,830	0	0
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	0	0
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-100%	-100%

In the above two scenarios, the system completely fails. With the LT Investment Account being almost completely depleted, the Operating Account lacks its main source of income and therefore collapses resulting in 0 Total Number of Employees and 0 Clients. This is evident that the other two policies were no sufficient to sustain the system.

FURTHER TESTING ON MARKET GROWTH TO CHECK ELASTICITY

Hugo Herrera (2017) in his paper: *From metaphor to practice, operationalising the Analysis of Resilience Using System Dynamics Modelling*, discusses the concept of using elasticity as a measure of resilience used in ecology. He referenced a definition of the term Elasticity as: “the ability of the system to withstand a disturbance without changing to a different steady state”(Holling, 1996).

Although this concept and definition of Elasticity in Herrera’s work refers to ecological resilience, it has been used in this paper in trying to ascertain the Elasticity of this organization or social system (Gunderson & Holling, 2003).

Given the total collapse of the system with the shock at an Average Magnitude of 4, further tests were conducted to check up to what point the system could be stressed before collapsing. Further, as indicated in the previous scenarios, the most dominant policy is the Dividend Ratio Policy and the most vulnerable of the exogenous variables is the Market Growth. Therefore, the tests below are only performed on the Market Growth and it is assumed that whatever stress the Market Growth variable can withstand, the rest of the system will withstand.

Shock at Average Magnitude of 3

- a. Scenario 24: Shock to Market Growth with Average Magnitude of 3 and all policies switched OFF
- b. Scenario 25: Shock to Market Growth with Average Magnitude of 3 and all policies switched ON

(TABLE 26 EXTREME TESTING: MARKET GROWTH 2)

Shock to Market Growth	Base	Utopia	Scenario24 Av. Magnitude =3	Scenario25 Av. Magnitude =3
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	0	ZAR12,7m
Reserves				

Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR82,5m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	0	ZAR421k
Employees				
Start	446	446	446	446
Final	298	3,830	0	0
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	13*	0
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-99,97%	-100%

Shock to Market Growth with Average Magnitude of 2

- a. Scenario 26: Shock to Market Growth with Average Magnitude of 2 and all policies switched OFF
- b. Scenario 27: Shock to Market Growth with Average Magnitude of 2 and all policies switched ON

(TABLE 27 EXTREME TESTING: MARKET GROWTH 3)

Shock to Market Growth	Base	Utopia	Scenario26 Av. Magnitude =2	Scenario27 Av. Magnitude =2
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	0	ZAR155m
Reserves				
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR82,7m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	0	ZAR698k
Employees				

Start	446	446	446	446
Final	298	3,830	0	0
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	793*	19*
Resilience (Percentage move of Clients from the Base Run)		1,1163.42%	-98,46%	-99,6%

Shock to Market Growth with Average Magnitude of 3

- c. Scenario 28: Shock to Market Growth with Average Magnitude of 1 and all policies switched OFF
- d. Scenario 29: Shock to Market Growth with Average Magnitude of 1 and all policies switched ON

(TABLE 28 EXTREME TESTING: MARKET GROWTH 4)

Shock to Market Growth	Base	Utopia	Scenario28 Av. Magnitude =1	Scenario29 Av. Magnitude =1
LT Investment	No Policies No Shock	All Policies No Shock	No Policy	All Policies
Start	ZAR2,3B	ZAR2,3B	ZAR2,3B	ZAR2,3B
Final	ZAR43,7B	ZAR22,4B	ZAR2,23B	ZAR1,87B
Reserves				
Start	ZAR240m	ZAR240m	ZAR240m	ZAR240m
Final	0	ZAR194m	0	ZAR83,6m
Operating				
Start	ZAR90m	ZAR90m	ZAR90m	ZAR90m
Final	ZAR18,9m	ZAR344m	ZAR18,9m	ZAR16,9m
Employees				
Start	446	446	446	446
Final	298	3,830	298	255
Clients				
Start	48,000	48,000	48,000	48,000
Final	51,400	598,000	51,400	47,800
Resilience		1,1163.42%	0	-7%

(Percentage move of Clients from the Base Run)				
--	--	--	--	--

Summation of Testing Elasticity of Market Growth variable.

Scenarios 22 to 29 have shown that the variable Market Growth cannot withstand a shock with an Average Magnitude of 1 or above, however it can withstand an Average Magnitude of 0,5.

The threshold set for Resilience was a negative 5% move of the number of Clients from the Base Run. That would mean that a scenario which yielded a final value of 48,830 Clients and above would pass the Resilience test and any scenario which yielded a final value of less than 48,830 Clients would fail.

An average magnitude of 1 is 100% higher than the 0,5 Average Magnitude under which the Market Value maintained resilience. Further Scenario 29 produced a result that was just outside of the Resilience threshold as it yielded a result of negative 7%. It is assumed therefore that Market Growth could probably withstand an Average Magnitude of 0,95, meaning that an Average Magnitude of 0,95 is the extent of the elasticity of the system.

Key Findings

The extensive testing has led to a few key insights as listed hereafter.

1. The Base Run confirms an archetype of Success to the Successful in that the LT Account displays exponential growth while the rest of the indicators either remain stagnant or experience decline.
2. The Dividend Payout Ratio Policy is the most powerful of the three policies and has the ability to effect not just stability but growth in our selected outcome of Clients in all scenarios where the shocks were of an average magnitude of 0,5
3. In the majority of scenarios where all three policies were on, this produced a better result, even where the average magnitude of the shock was increased to 4.
4. The exception to the above point was when the shock at a higher magnitude was applied to the Market Growth. In these cases the system proved to not show resilience.
5. This leads to the conclusion that the most vulnerable of the variables to shocks of a greater magnitude is the Market Growth. Although as previously stated, this could have to do with the multiplication of stochasticity in the model.
6. The further extreme testing of elasticity to Market Growth indicates that the system could probably withstand a shock of up to an average magnitude of 0,95. A higher magnitude leads to resilience failure.
7. The displayed vulnerability of Market Growth would indicate a need to diversify risk as well as income sources.

Limitations

The subject of Business Continuity and Risk Management is extensive and extremely important and this project, given the time, there remains much which can still be explored. Therefore, as much as some policies have been introduced that improve the resilience of the organization, one could argue and accept that there are other policies and policy combinations which may yield better results.

Further, this project used the mission as a starting point and that would dictate that the purpose is not to pursue unfettered investment growth while not seeing the same growth in other objectives. Some may argue that policies which slow growth in the value of the investment account is not ideal. However, sustainability of this organization depends on a balance of objectives as they are inter-dependent.

The simulation model itself presents a dilemma in that it is too specific for general application. This is due to the fact that the design and logic is based on the mission, identified risks and

business processes of the PBO and therefore would require additional work in order to find general applicability.

The flip side of the above dilemma is that the model is also too generic and therefore does not drill down to any level of detail of the PBO itself. This could mean that further investigation into the details of the different sections or programs of the PBO could possibly change the dynamics of the model. An example of this is the self-funding model that the PBO has through its investment company. This characteristic would make the model incapable of general application even to other non-profit organizations without some modification.

As much as the model is, and was intended to be, predictive in nature, the inclusion of some historic data would perhaps have provided greater insight into the cycles that the organization has gone through which could be useful in understanding what tacit knowledge has enabled their longevity, even if they have changed business models or focus from time.

Another limitation was the vast amount of data to try to mine and analyse, given time constraints as well as technical ability of the researcher with the available tools.

Future Work

The project was an exciting one which yielded vast learning. As discussed previously the short amount of time did not allow the level of depth that one would have like to delve in. This means that there is much room for further and future work including:

1. The model itself can be expanded to included all functions in an organization in greater detail.
2. Inclusion of more sophisticated financial tools and models.
3. Exploration of the measurement of impact rather than just the numbers of Clients to assess return on investment.
4. The model can be modularised making each sector a model of its own that can be used individually or collectively and with broader application.
5. There are many more iterations and refinement of testing that can be done looking at the various measurement approaches to resilience

Conclusion

At the end of the Introduction section of this report we posed several research questions. We now revisit those questions to examine whether the project has answered them.

Research Question	Discussion
<p>1. Can an organization learn to become more resilient?</p>	<p>The literature which we explored in the early chapters of this report suggest that resilience can be developed or enhanced. In terms of the scope of this research, the sensitivity test and analysis indicates that where appropriate policies were implemented, the system proved to be more resilient and recovered to pre-shock levels or, in some cases better. This would then imply that organizations can in-fact learn to become more resilient through a process of simulating scenarios and adjusting policies to mitigate potential threats and weaknesses.</p>
<p>2. Are there tools already in the management and leadership toolbox that can be used to build organizational resilience in a non-profit organization?</p>	<p>The tools and methodologies commonly used in commercial organizations were put together into an integrated and collaborative framework (Conceptual Framework) which was used in this project. They included the use of strategy, risk management planning, business continuity planning and scenario planning. We further used management simulation through a system dynamics simulation model to test for resilience. Therefore, the tools used in this process are tools already used in context of a non-profit organization are the tools used in businesses.</p>
<p>3. How can an organization use what they already know to prepare for threats, disturbances and shocks they don't know?</p>	<p>While not all organizations may be familiar with simulation models, most do know how to plan and how to develop policy. With their ability to access the tools used in this project, especially the scientific methodology and modelling tools used in system dynamics, they can get better at anticipating the future and planning or adjusting for it. It is important to realise that the intrinsic knowledge coded into a model, actually comes from clients who know their organizational dynamics, and their environment. It is on this knowledge that the</p>

	modeler leans to get the information needed to develop useful models.
4. Can simulation modelling be useful to provide greater insight than just current methodologies?	The scenario testing and analysis provided great insight into the resilience levels of the PBO under different conditions. It also provided insight into the magnitude of shock which the organisation could withstand. These are insight which managers don't readily have available to them in the dynamic manner in which a simulation model provides. The answer is not necessarily one over the other but using complimentary tools and methodologies in combination where it makes sense.
5. Is it possible to bounce back better than your starting position?	The results of the scenario simulation points to this being possible by implementing policies that will enhance resilience.
6. Can policy development aid resilience?	The results of the testing and analysis undertaken in this project imply that appropriate policy can aid resilience.

In summary, the world has experienced and witnessed many disasters both natural and man-made in history. Such type of events have happened before and will certainly occur in the future. The implications of these events go beyond the tragic loss of human life to the devastation to infrastructure, economies, businesses and livelihoods. It is the responsibility of managers and leaders in organizations to ensure that their organizations are prepared to manage the potential threats, known and unknown, that they may face. This applies not only to commercial businesses but also to non-profit organizations to whom the burden to provide relief to society's most vulnerable often falls.

This research project has looked at how existing management tools and methodologies can be employed in unison with the scientific methodology of systems dynamics as well as simulated models to assist organizations in the non-profit sector plan, prepare for and mitigate against threats to their system.

Using theory from Strategic Management, Risk Management, Business Continuity Management and Resilience Theory a conceptual framework and predictive simulation model has been developed and used to play out scenarios testing the resilience of the system of the PBO. Further, policies have been developed and tested, proving that indeed, organizational resilience can be enhanced by the application of appropriate policy interventions.

Appendix A – Sensitivity Analyses

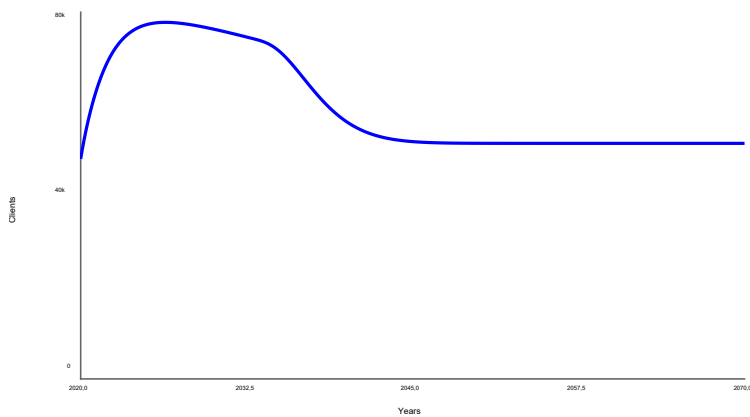
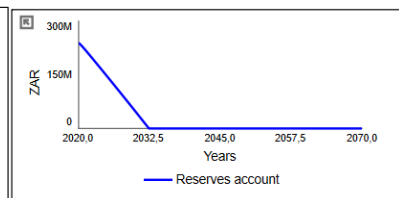
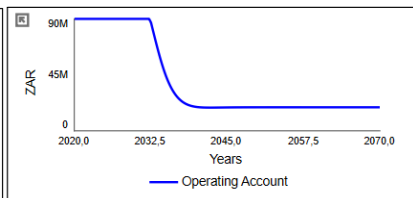
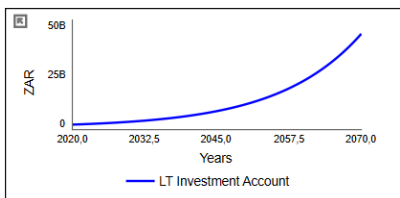
Table of Contents : Testing Results

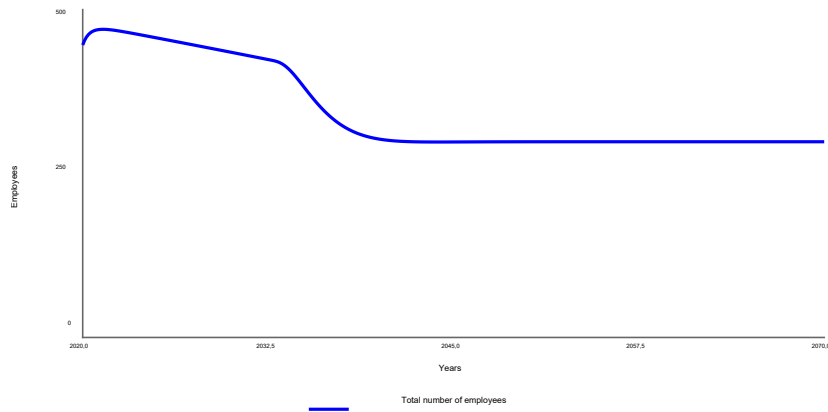
- Base Run 89**
- Scenario 3 91**
- Utopia Scenario..... 93**
- Scenario 4 95**
- Scenario 5 97**
- Scenario 6 99**
- Scenario 7 101**
- Scenario 8 103**
- Scenario 9 105**
- Scenario 10..... 107**
- Scenario 11..... 109**
- Scenario 12..... 111**
- Scenario 13..... 113**
- Scenario 14..... 115**
- Scenario 15..... 117**
- Scenario 16..... 119**
- Scenario 17..... 121**
- Scenario 18..... 123**
- Scenario 19..... 126**
- Scenario 21..... 131**
- Scenario 22..... 133**
- Scenario 23..... 135**
- Scenario 24..... 137**
- Scenario 25..... 139**
- Scenario 26..... 141**
- Scenario 27..... 143**
- Scenario 28..... 145**
- Scenario 29..... 147**

Base Run

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	4,97B
2037	64,8k	331	26,4M	0	5,26B
2038	61,4k	317	22,4M	0	5,57B
2039	58,5k	308	20,2M	0	5,9B
2040	56,2k	302	19,2M	0	6,26B
2041	54,5k	300	18,8M	0	6,64B
2042	53,3k	299	18,7M	0	7,04B
2043	52,6k	298	18,7M	0	7,48B
2044	52,1k	298	18,7M	0	7,95B
2045	51,8k	298	18,8M	0	8,45B

2046	51,6k	298	18,8M	0	8,99B
2047	51,5k	298	18,9M	0	9,57B
2048	51,4k	298	18,9M	0	10,2B
2049	51,4k	298	18,9M	0	10,9B
2050	51,4k	298	18,9M	0	11,6B
2051	51,4k	298	18,9M	0	12,3B
2052	51,4k	298	18,9M	0	13,2B
2053	51,4k	298	18,9M	0	14B
2054	51,4k	298	18,9M	0	15B
2055	51,4k	298	18,9M	0	16B
2056	51,4k	298	18,9M	0	17,1B
2057	51,4k	298	18,9M	0	18,2B
2058	51,4k	298	18,9M	0	19,5B
2059	51,4k	298	18,9M	0	20,8B
2060	51,4k	298	18,9M	0	22,2B
2061	51,4k	298	18,9M	0	23,8B
2062	51,4k	298	18,9M	0	25,4B
2063	51,4k	298	18,9M	0	27,2B
2064	51,4k	298	18,9M	0	29,1B
2065	51,4k	298	18,9M	0	31,1B
2066	51,4k	298	18,9M	0	33,3B
2067	51,4k	298	18,9M	0	35,6B
2068	51,4k	298	18,9M	0	38,2B
2069	51,4k	298	18,9M	0	40,8B
Final	51,4k	298	18,9M	0	43,7B

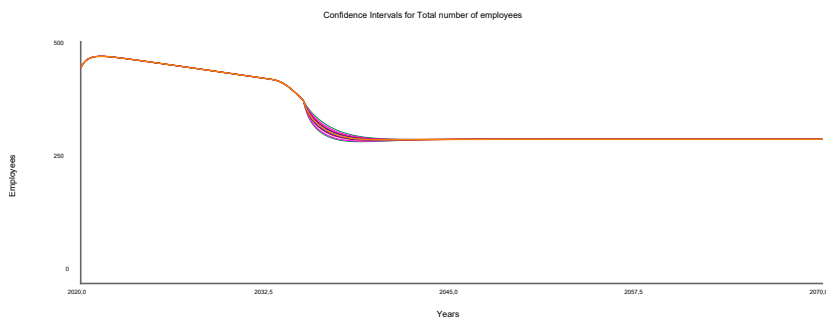
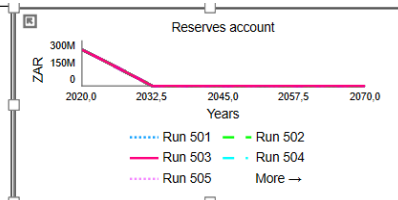
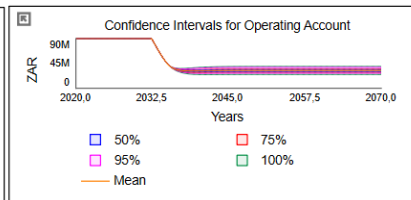
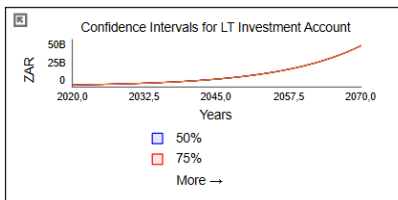


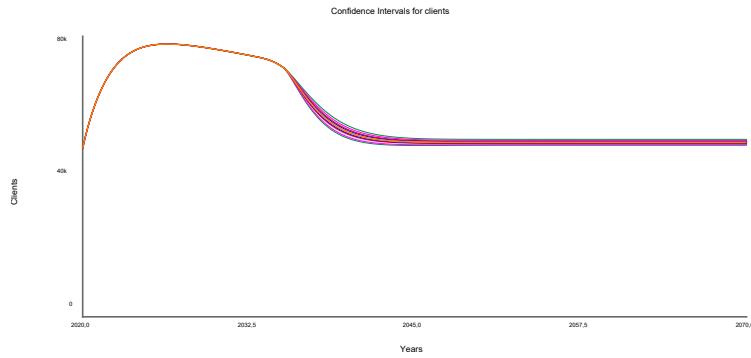


Scenario 3

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	67,5k	339	34,8M	0	4,97B
2037	63k	319	30M	0	5,26B
2038	59,1k	308	27,7M	0	5,57B
2039	56,2k	302	26,6M	0	5,9B
2040	54,1k	300	26,3M	0	6,26B
2041	52,7k	298	26,2M	0	6,64B
2042	51,8k	298	26,2M	0	7,04B
2043	51,2k	298	26,3M	0	7,48B
2044	50,9k	298	26,3M	0	7,95B
2045	50,7k	298	26,4M	0	8,45B

2046	50,6k	298	26,4M	0	8,99B
2047	50,5k	298	26,4M	0	9,57B
2048	50,5k	298	26,4M	0	10,2B
2049	50,4k	298	26,5M	0	10,9B
2050	50,4k	298	26,5M	0	11,6B
2051	50,4k	298	26,5M	0	12,3B
2052	50,4k	298	26,5M	0	13,2B
2053	50,4k	298	26,5M	0	14B
2054	50,4k	298	26,5M	0	15B
2055	50,4k	298	26,5M	0	16B
2056	50,4k	298	26,5M	0	17,1B
2057	50,4k	298	26,5M	0	18,2B
2058	50,4k	298	26,5M	0	19,5B
2059	50,4k	298	26,5M	0	20,8B
2060	50,4k	298	26,5M	0	22,2B
2061	50,4k	298	26,5M	0	23,8B
2062	50,4k	298	26,5M	0	25,4B
2063	50,4k	298	26,5M	0	27,2B
2064	50,4k	298	26,5M	0	29,1B
2065	50,4k	298	26,5M	0	31,1B
2066	50,4k	298	26,5M	0	33,3B
2067	50,4k	298	26,5M	0	35,6B
2068	50,4k	298	26,5M	0	38,2B
2069	50,4k	298	26,5M	0	40,8B
Final	50,4k	298	26,5M	0	43,7B

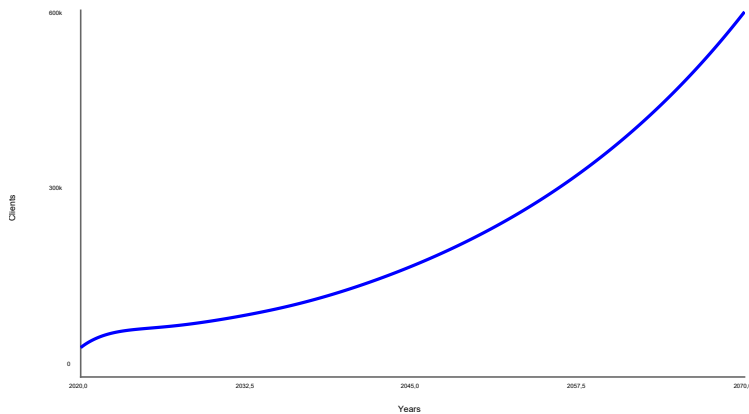
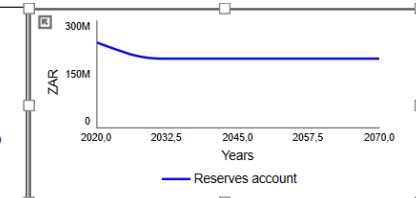
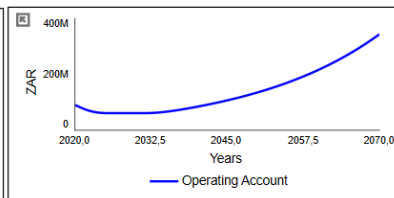
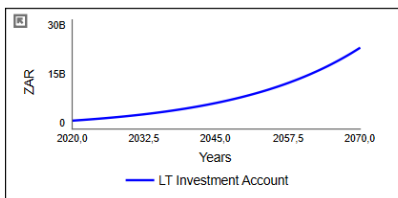


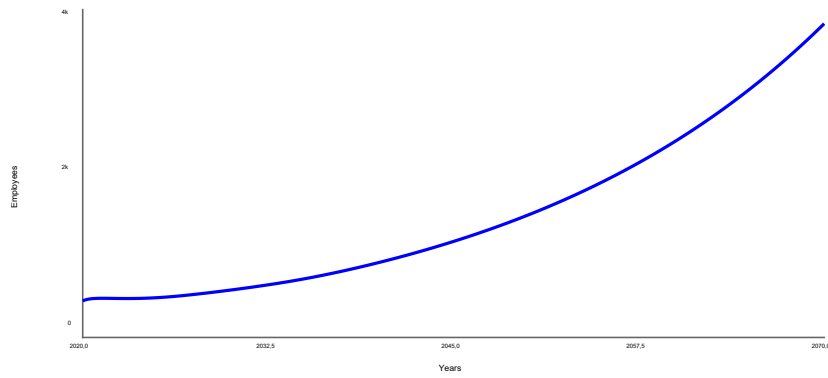


Utopia Scenario

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	752	69,1M	194M	4,76B
2037	123k	789	72,4M	194M	4,98B
2038	129k	829	76M	194M	5,22B
2039	135k	871	79,8M	194M	5,46B
2040	142k	916	83,9M	194M	5,71B
2041	149k	962	88,1M	194M	5,98B
2042	157k	1,01k	92,5M	194M	6,26B
2043	165k	1,06k	97,1M	194M	6,55B
2044	173k	1,12k	102M	194M	6,85B
2045	182k	1,17k	107M	194M	7,17B

2046	191k	1,23k	112M	194M	7,51B
2047	201k	1,29k	118M	194M	7,85B
2048	211k	1,35k	123M	194M	8,22B
2049	221k	1,42k	129M	194M	8,6B
2050	232k	1,49k	135M	194M	9B
2051	244k	1,56k	142M	194M	9,42B
2052	256k	1,64k	149M	194M	9,86B
2053	268k	1,72k	156M	194M	10,3B
2054	281k	1,81k	164M	194M	10,8B
2055	295k	1,89k	171M	194M	11,3B
2056	309k	1,99k	180M	194M	11,8B
2057	324k	2,08k	188M	194M	12,4B
2058	340k	2,18k	197M	194M	13B
2059	357k	2,29k	207M	194M	13,6B
2060	374k	2,4k	217M	194M	14,2B
2061	392k	2,51k	227M	194M	14,9B
2062	411k	2,64k	238M	194M	15,5B
2063	431k	2,76k	249M	194M	16,3B
2064	451k	2,89k	261M	194M	17B
2065	473k	3,03k	273M	194M	17,8B
2066	496k	3,18k	286M	194M	18,6B
2067	520k	3,33k	300M	194M	19,5B
2068	544k	3,49k	314M	194M	20,4B
2069	570k	3,65k	329M	194M	21,4B
Final	598k	3,83k	344M	194M	22,4B

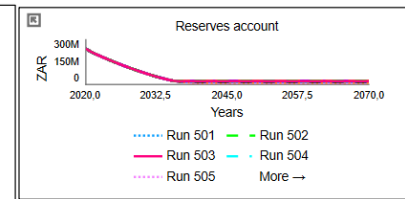
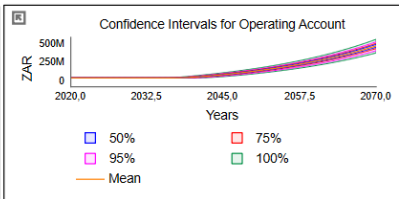
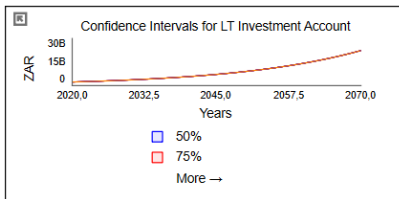




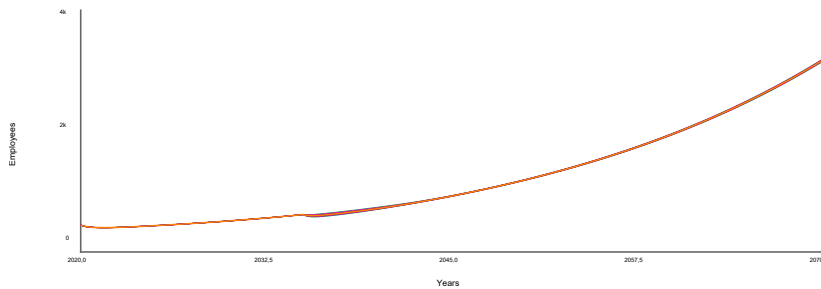
Scenario 4

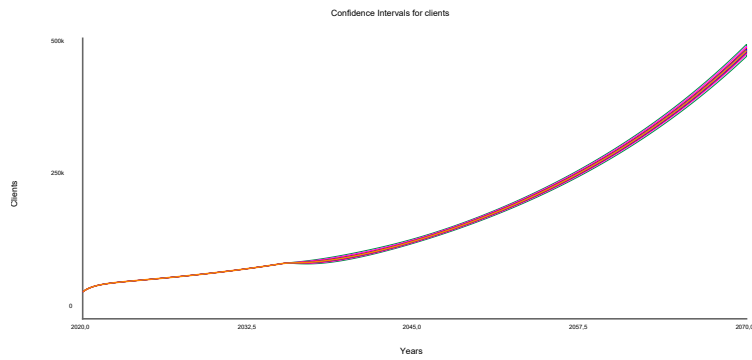
	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	58,8k	405	90M	217M	2,41B
2022	63,2k	403	90M	199M	2,52B
2023	65,9k	411	90M	182M	2,64B
2024	68,1k	422	90M	167M	2,76B
2025	70,2k	435	90M	151M	2,89B
2026	72,4k	449	90M	136M	3,02B
2027	74,7k	463	90M	122M	3,16B
2028	77k	479	90M	108M	3,31B
2029	79,6k	496	90M	94,2M	3,46B
2030	82,3k	513	90M	81,4M	3,62B
2031	85,1k	532	90M	69,3M	3,79B
2032	88,1k	552	90M	57,8M	3,97B
2033	91,3k	573	90M	47M	4,15B
2034	94,7k	595	90M	36,9M	4,35B
2035	98,3k	619	90M	27,6M	4,55B
2036	99,9k	606	90M	23,2M	4,76B
2037	101k	629	90M	22,2M	4,98B
2038	103k	657	90,5M	22,2M	5,22B
2039	107k	686	92,2M	22,2M	5,46B
2040	111k	719	95,1M	22,2M	5,71B
2041	115k	755	98,9M	22,2M	5,98B
2042	120k	794	103M	22,2M	6,26B
2043	126k	835	108M	22,2M	6,55B
2044	133k	879	114M	22,2M	6,85B
2045	139k	926	120M	22,2M	7,17B

2046	147k	975	126M	22,2M	7,51B
2047	154k	1,03k	132M	22,2M	7,85B
2048	162k	1,08k	139M	22,2M	8,22B
2049	171k	1,14k	146M	22,2M	8,6B
2050	180k	1,2k	154M	22,2M	9B
2051	189k	1,26k	161M	22,2M	9,42B
2052	199k	1,32k	169M	22,2M	9,86B
2053	209k	1,39k	178M	22,2M	10,3B
2054	220k	1,46k	187M	22,2M	10,8B
2055	231k	1,54k	196M	22,2M	11,3B
2056	243k	1,61k	206M	22,2M	11,8B
2057	256k	1,7k	216M	22,2M	12,4B
2058	269k	1,78k	227M	22,2M	13B
2059	282k	1,87k	238M	22,2M	13,6B
2060	296k	1,96k	250M	22,2M	14,2B
2061	311k	2,06k	262M	22,2M	14,9B
2062	327k	2,16k	275M	22,2M	15,5B
2063	343k	2,27k	289M	22,2M	16,3B
2064	360k	2,38k	303M	22,2M	17B
2065	378k	2,5k	317M	22,2M	17,8B
2066	396k	2,62k	333M	22,2M	18,6B
2067	416k	2,75k	349M	22,2M	19,5B
2068	436k	2,88k	366M	22,2M	20,4B
2069	458k	3,02k	384M	22,2M	21,4B
Final	480k	3,17k	402M	22,2M	22,4B



Confidence Intervals for Total number of employees

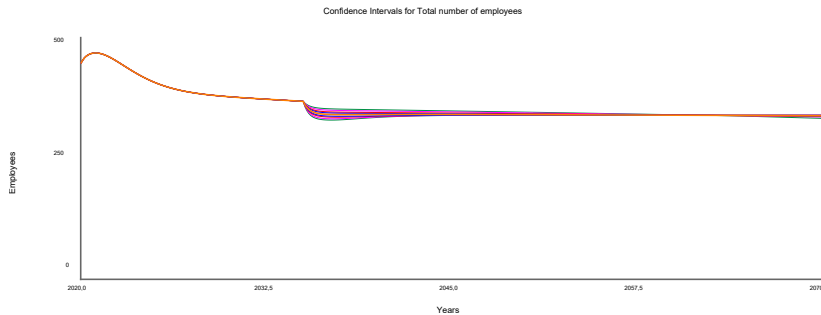
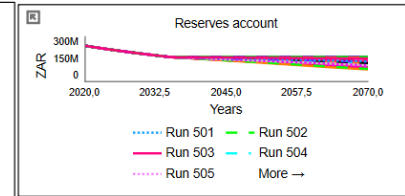
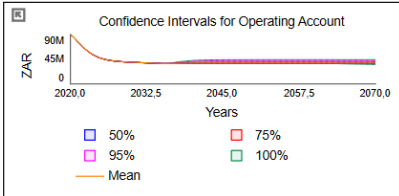
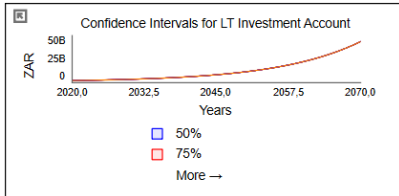


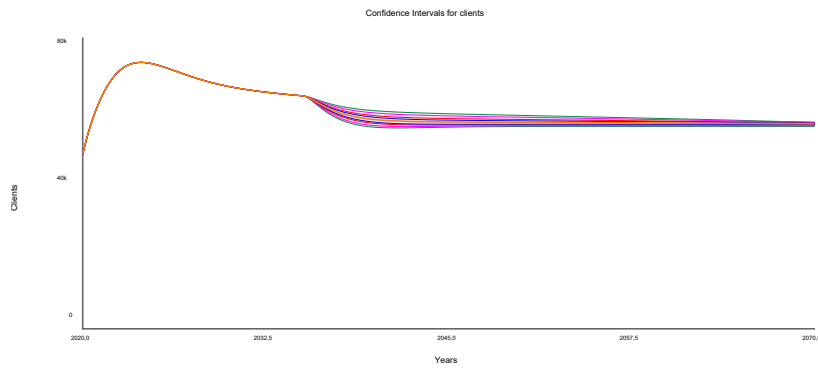


Scenario 5

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	468	79,4M	234M	2,39B
2022	68,8k	459	67,8M	228M	2,49B
2023	72,4k	440	58,2M	222M	2,6B
2024	73,4k	422	51,3M	217M	2,72B
2025	72,8k	407	46,6M	211M	2,84B
2026	71,5k	397	43,7M	206M	2,98B
2027	70k	389	41,9M	201M	3,12B
2028	68,7k	384	40,7M	196M	3,27B
2029	67,6k	380	40M	191M	3,44B
2030	66,7k	378	39,4M	187M	3,61B
2031	66k	376	38,9M	182M	3,8B
2032	65,4k	374	38,4M	177M	4,01B
2033	65k	372	38M	173M	4,22B
2034	64,5k	370	37,5M	169M	4,46B
2035	64,2k	368	37,1M	165M	4,71B
2036	62,4k	343	37,1M	163M	4,97B
2037	60,3k	341	37,1M	162M	5,26B
2038	59k	340	37,1M	162M	5,57B
2039	58,1k	340	37,1M	162M	5,9B
2040	57,6k	340	37,1M	162M	6,26B
2041	57,3k	340	37,1M	161M	6,64B
2042	57,1k	340	37,1M	161M	7,04B
2043	56,9k	340	37,1M	161M	7,48B
2044	56,9k	340	37,1M	161M	7,95B
2045	56,8k	340	37,1M	160M	8,45B

2046	56,8k	340	37,1M	160M	8,99B
2047	56,8k	340	37,1M	160M	9,57B
2048	56,7k	340	37,1M	160M	10,2B
2049	56,7k	340	37,1M	160M	10,9B
2050	56,7k	340	37,1M	159M	11,6B
2051	56,7k	340	37,1M	159M	12,3B
2052	56,7k	340	37,1M	159M	13,2B
2053	56,7k	340	37,1M	159M	14B
2054	56,7k	340	37,1M	158M	15B
2055	56,7k	340	37,1M	158M	16B
2056	56,7k	340	37,1M	158M	17,1B
2057	56,7k	340	37,1M	158M	18,2B
2058	56,6k	339	37,1M	157M	19,5B
2059	56,6k	339	37,1M	157M	20,8B
2060	56,6k	339	37,1M	157M	22,2B
2061	56,6k	339	37,1M	157M	23,8B
2062	56,6k	339	37,1M	156M	25,4B
2063	56,6k	339	37,1M	156M	27,2B
2064	56,6k	339	37,1M	156M	29,1B
2065	56,6k	339	37,1M	156M	31,1B
2066	56,6k	339	37,1M	155M	33,3B
2067	56,6k	339	37,1M	155M	35,6B
2068	56,6k	339	37,1M	155M	38,2B
2069	56,5k	339	37,1M	154M	40,8B
Final	56,5k	339	37,1M	154M	43,7B

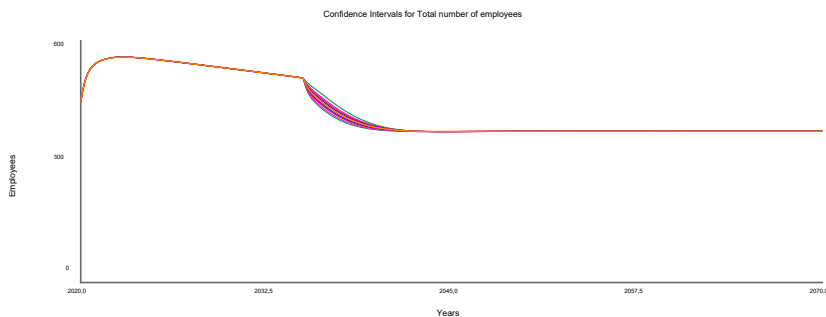
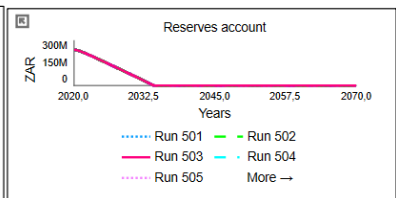
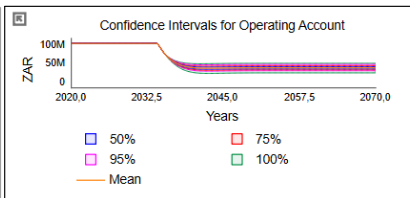
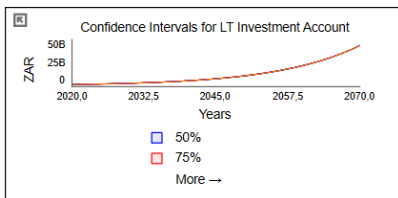


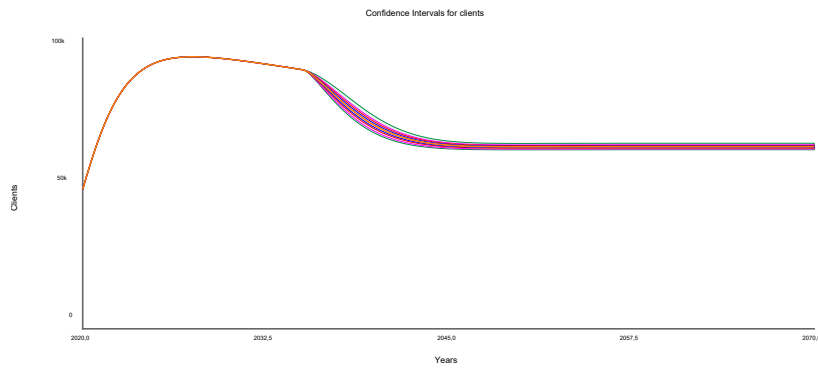


Scenario 6

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	64k	543	90M	231M	2,39B
2022	76k	557	90M	216M	2,49B
2023	84k	560	90M	200M	2,6B
2024	88,9k	558	90M	182M	2,72B
2025	91,6k	554	90M	165M	2,84B
2026	93k	550	90M	147M	2,98B
2027	93,6k	545	90M	130M	3,12B
2028	93,6k	541	90M	112M	3,27B
2029	93,3k	536	90M	93,8M	3,44B
2030	92,8k	531	90M	75,7M	3,61B
2031	92,2k	527	90M	57,6M	3,8B
2032	91,5k	522	90M	39,4M	4,01B
2033	90,8k	517	90M	21,1M	4,22B
2034	90k	513	90M	2,65M	4,46B
2035	89,2k	507	74,4M	0	4,71B
2036	86,6k	465	59,8M	0	4,97B
2037	82,7k	437	49,5M	0	5,26B
2038	78,5k	414	42,8M	0	5,57B
2039	74,6k	398	38,7M	0	5,9B
2040	71,3k	387	36,5M	0	6,26B
2041	68,7k	381	35,4M	0	6,64B
2042	66,7k	377	35M	0	7,04B
2043	65,4k	375	35M	0	7,48B
2044	64,4k	375	35,1M	0	7,95B
2045	63,9k	375	35,3M	0	8,45B

2046	63,5k	375	35,5M	0	8,99B
2047	63,3k	375	35,6M	0	9,57B
2048	63,2k	375	35,7M	0	10,2B
2049	63,2k	375	35,8M	0	10,9B
2050	63,2k	376	35,8M	0	11,6B
2051	63,2k	376	35,8M	0	12,3B
2052	63,2k	376	35,8M	0	13,2B
2053	63,2k	376	35,8M	0	14B
2054	63,2k	376	35,8M	0	15B
2055	63,2k	376	35,8M	0	16B
2056	63,2k	376	35,8M	0	17,1B
2057	63,2k	376	35,8M	0	18,2B
2058	63,2k	376	35,8M	0	19,5B
2059	63,2k	376	35,8M	0	20,8B
2060	63,2k	376	35,8M	0	22,2B
2061	63,2k	376	35,8M	0	23,8B
2062	63,2k	376	35,8M	0	25,4B
2063	63,2k	376	35,8M	0	27,2B
2064	63,2k	376	35,8M	0	29,1B
2065	63,2k	376	35,8M	0	31,1B
2066	63,2k	376	35,8M	0	33,3B
2067	63,2k	376	35,8M	0	35,6B
2068	63,2k	376	35,8M	0	38,2B
2069	63,2k	376	35,8M	0	40,8B
Final	63,2k	376	35,8M	0	43,7B

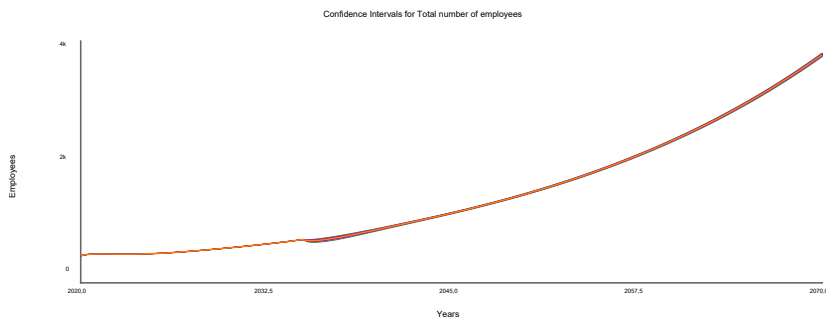
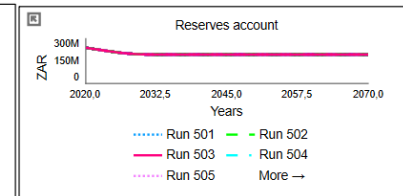
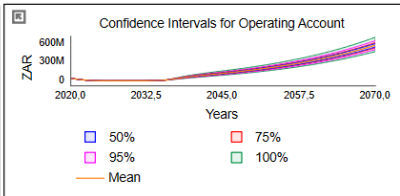
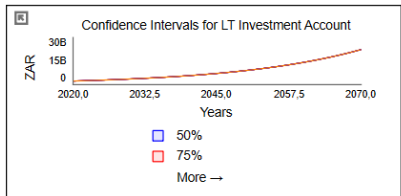


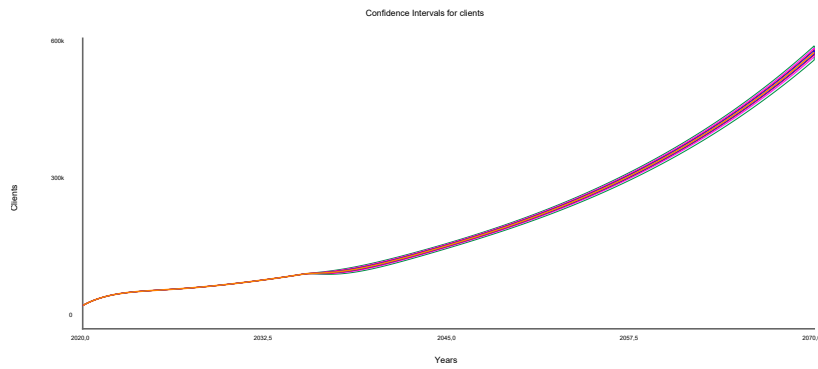


Scenario 7

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	114k	694	74,3M	194M	4,76B
2037	115k	726	85,9M	194M	4,98B
2038	118k	771	97,8M	194M	5,22B
2039	123k	823	109M	194M	5,46B
2040	130k	876	119M	194M	5,71B
2041	137k	930	128M	194M	5,98B
2042	145k	984	137M	194M	6,26B
2043	153k	1,04k	145M	194M	6,55B
2044	162k	1,09k	152M	194M	6,85B
2045	171k	1,15k	160M	194M	7,17B

2046	180k	1,21k	168M	194M	7,51B
2047	189k	1,27k	177M	194M	7,85B
2048	199k	1,33k	185M	194M	8,22B
2049	209k	1,4k	194M	194M	8,6B
2050	220k	1,47k	204M	194M	9B
2051	231k	1,54k	214M	194M	9,42B
2052	242k	1,62k	224M	194M	9,86B
2053	254k	1,69k	235M	194M	10,3B
2054	267k	1,78k	246M	194M	10,8B
2055	280k	1,86k	258M	194M	11,3B
2056	293k	1,95k	271M	194M	11,8B
2057	307k	2,05k	284M	194M	12,4B
2058	322k	2,15k	297M	194M	13B
2059	338k	2,25k	312M	194M	13,6B
2060	354k	2,36k	327M	194M	14,2B
2061	372k	2,47k	342M	194M	14,9B
2062	390k	2,59k	359M	194M	15,5B
2063	408k	2,72k	376M	194M	16,3B
2064	428k	2,85k	394M	194M	17B
2065	448k	2,98k	413M	194M	17,8B
2066	470k	3,13k	432M	194M	18,6B
2067	493k	3,28k	453M	194M	19,5B
2068	516k	3,43k	474M	194M	20,4B
2069	541k	3,6k	497M	194M	21,4B
Final	567k	3,77k	520M	194M	22,4B

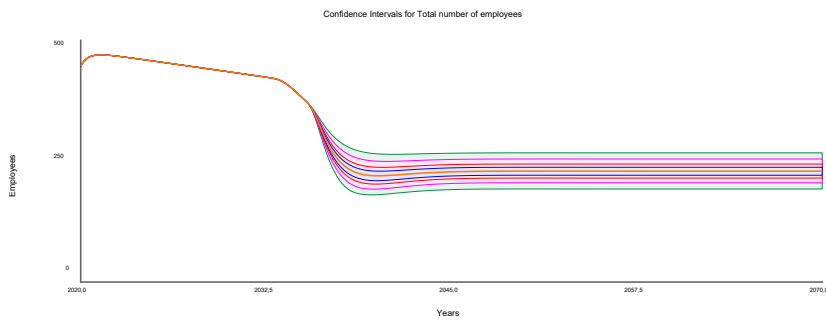
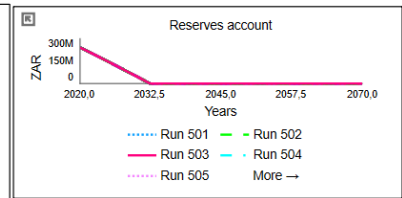
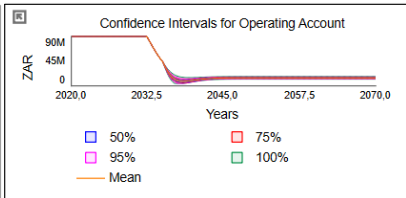
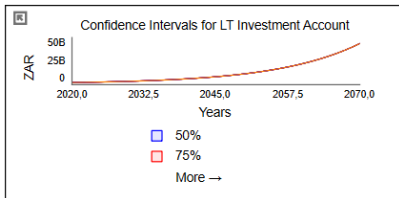


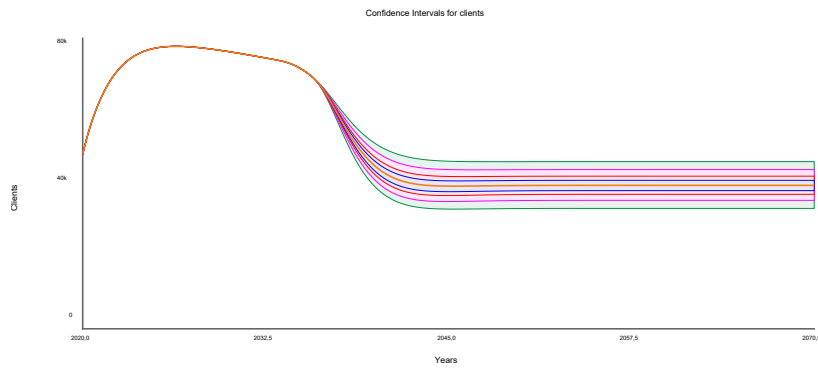


Scenario 8

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,2k	338	26,3M	0	4,97B
2037	63k	288	16,4M	0	5,26B
2038	57,1k	261	12,8M	0	5,57B
2039	52k	249	12,2M	0	5,9B
2040	48,3k	246	12,8M	0	6,26B
2041	45,9k	246	13,7M	0	6,64B
2042	44,5k	247	14,5M	0	7,04B
2043	43,7k	248	15,1M	0	7,48B
2044	43,3k	249	15,5M	0	7,95B
2045	43,2k	250	15,7M	0	8,45B

2046	43,1k	250	15,8M	0	8,99B
2047	43,1k	251	15,9M	0	9,57B
2048	43,2k	251	15,9M	0	10,2B
2049	43,2k	251	15,9M	0	10,9B
2050	43,2k	251	15,9M	0	11,6B
2051	43,2k	251	15,9M	0	12,3B
2052	43,2k	251	15,9M	0	13,2B
2053	43,2k	251	15,9M	0	14B
2054	43,2k	251	15,9M	0	15B
2055	43,2k	251	15,9M	0	16B
2056	43,2k	251	15,9M	0	17,1B
2057	43,2k	251	15,9M	0	18,2B
2058	43,2k	251	15,9M	0	19,5B
2059	43,2k	251	15,9M	0	20,8B
2060	43,2k	251	15,9M	0	22,2B
2061	43,2k	251	15,9M	0	23,8B
2062	43,2k	251	15,9M	0	25,4B
2063	43,2k	251	15,9M	0	27,2B
2064	43,2k	251	15,9M	0	29,1B
2065	43,2k	251	15,9M	0	31,1B
2066	43,2k	251	15,9M	0	33,3B
2067	43,2k	251	15,9M	0	35,6B
2068	43,2k	251	15,9M	0	38,2B
2069	43,2k	251	15,9M	0	40,8B
Final	43,2k	251	15,9M	0	43,7B

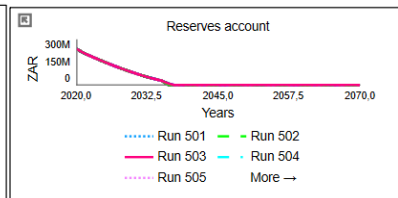
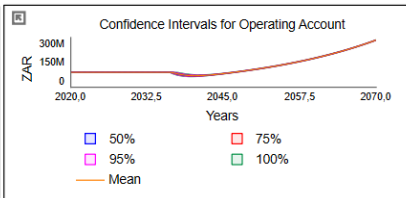
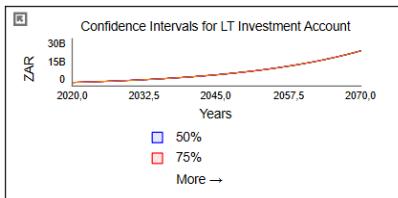




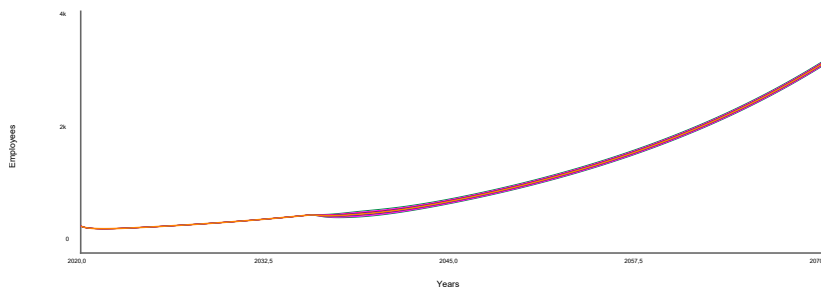
Scenario 9

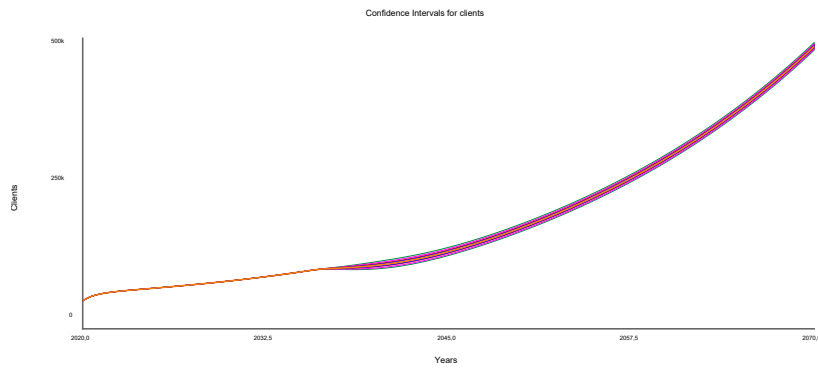
	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	58,8k	405	90M	217M	2,41B
2022	63,2k	403	90M	199M	2,52B
2023	65,9k	411	90M	182M	2,64B
2024	68,1k	422	90M	167M	2,76B
2025	70,2k	435	90M	151M	2,89B
2026	72,4k	449	90M	136M	3,02B
2027	74,7k	463	90M	122M	3,16B
2028	77k	479	90M	108M	3,31B
2029	79,6k	496	90M	94,2M	3,46B
2030	82,3k	513	90M	81,4M	3,62B
2031	85,1k	532	90M	69,3M	3,79B
2032	88,1k	552	90M	57,8M	3,97B
2033	91,3k	573	90M	47M	4,15B
2034	94,7k	595	90M	36,9M	4,35B
2035	98,3k	619	90M	27,6M	4,55B
2036	102k	631	90M	12M	4,76B
2037	105k	634	90M	497k	4,98B
2038	107k	654	82,4M	0	5,22B
2039	110k	676	76,6M	0	5,46B
2040	113k	698	73,5M	0	5,71B
2041	116k	725	72,8M	0	5,98B
2042	120k	758	73,9M	0	6,26B
2043	125k	796	76,4M	0	6,55B
2044	131k	838	79,8M	0	6,85B
2045	137k	884	83,8M	0	7,17B

2046	144k	933	88,1M	0	7,51B
2047	152k	985	92,8M	0	7,85B
2048	160k	1,04k	97,7M	0	8,22B
2049	169k	1,1k	103M	0	8,6B
2050	178k	1,16k	108M	0	9B
2051	188k	1,22k	114M	0	9,42B
2052	198k	1,28k	120M	0	9,86B
2053	209k	1,35k	126M	0	10,3B
2054	220k	1,42k	132M	0	10,8B
2055	232k	1,5k	139M	0	11,3B
2056	244k	1,58k	146M	0	11,8B
2057	257k	1,66k	153M	0	12,4B
2058	270k	1,75k	161M	0	13B
2059	284k	1,84k	169M	0	13,6B
2060	299k	1,93k	177M	0	14,2B
2061	315k	2,03k	186M	0	14,9B
2062	331k	2,13k	196M	0	15,5B
2063	348k	2,24k	205M	0	16,3B
2064	365k	2,35k	215M	0	17B
2065	384k	2,47k	226M	0	17,8B
2066	403k	2,6k	237M	0	18,6B
2067	423k	2,73k	249M	0	19,5B
2068	445k	2,86k	261M	0	20,4B
2069	467k	3k	273M	0	21,4B
Final	490k	3,15k	287M	0	22,4B



Confidence Intervals for Total number of employees

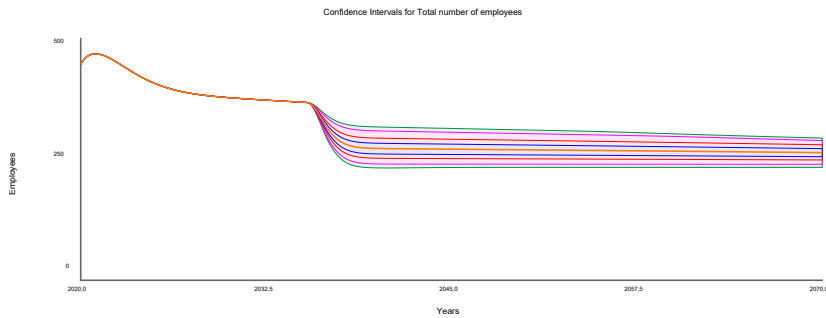
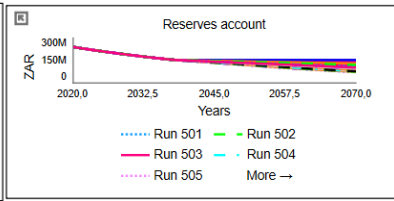
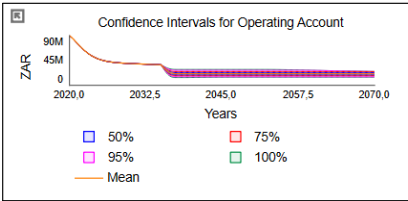
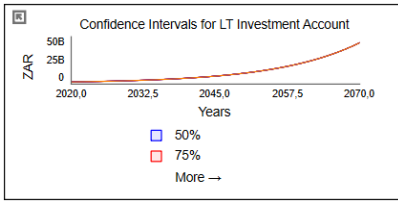


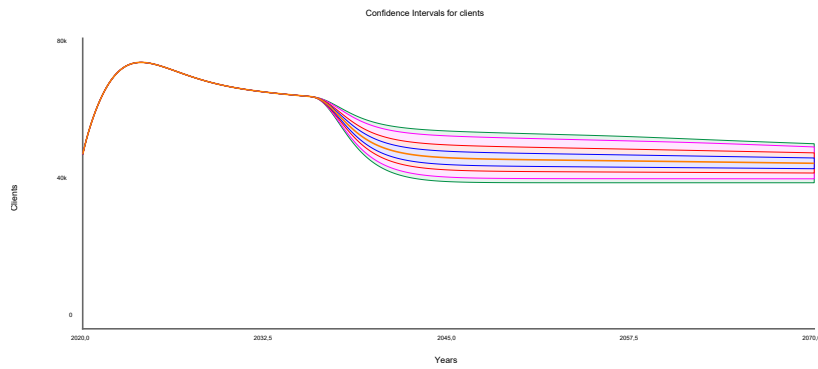


Scenario 10

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	468	79,4M	234M	2,39B
2022	68,8k	459	67,8M	228M	2,49B
2023	72,4k	440	58,2M	222M	2,6B
2024	73,4k	422	51,3M	217M	2,72B
2025	72,8k	407	46,6M	211M	2,84B
2026	71,5k	397	43,7M	206M	2,98B
2027	70k	389	41,9M	201M	3,12B
2028	68,7k	384	40,7M	196M	3,27B
2029	67,6k	380	40M	191M	3,44B
2030	66,7k	378	39,4M	187M	3,61B
2031	66k	376	38,9M	182M	3,8B
2032	65,4k	374	38,4M	177M	4,01B
2033	65k	372	38M	173M	4,22B
2034	64,5k	370	37,5M	169M	4,46B
2035	64,2k	368	37,1M	165M	4,71B
2036	63,6k	348	27,2M	161M	4,97B
2037	61,1k	307	22,8M	157M	5,26B
2038	57,4k	289	22,5M	153M	5,57B
2039	54,3k	283	22,5M	151M	5,9B
2040	52,1k	282	22,5M	150M	6,26B
2041	50,7k	282	22,5M	148M	6,64B
2042	49,8k	281	22,5M	147M	7,04B
2043	49,2k	281	22,5M	145M	7,48B
2044	48,9k	281	22,5M	144M	7,95B
2045	48,7k	280	22,5M	142M	8,45B

2046	48,5k	280	22,5M	141M	8,99B
2047	48,4k	280	22,5M	139M	9,57B
2048	48,3k	279	22,5M	138M	10,2B
2049	48,2k	279	22,5M	136M	10,9B
2050	48,1k	279	22,5M	134M	11,6B
2051	48k	278	22,5M	133M	12,3B
2052	48k	278	22,5M	131M	13,2B
2053	47,9k	277	22,5M	130M	14B
2054	47,9k	277	22,5M	128M	15B
2055	47,8k	277	22,5M	127M	16B
2056	47,7k	276	22,5M	125M	17,1B
2057	47,7k	276	22,5M	123M	18,2B
2058	47,6k	276	22,5M	122M	19,5B
2059	47,5k	275	22,5M	120M	20,8B
2060	47,5k	275	22,5M	119M	22,2B
2061	47,4k	275	22,5M	117M	23,8B
2062	47,4k	274	22,5M	115M	25,4B
2063	47,3k	274	22,5M	114M	27,2B
2064	47,2k	274	22,5M	112M	29,1B
2065	47,2k	273	22,5M	110M	31,1B
2066	47,1k	273	22,5M	109M	33,3B
2067	47k	272	22,5M	107M	35,6B
2068	47k	272	22,5M	105M	38,2B
2069	46,9k	272	22,5M	104M	40,8B
Final	46,9k	271	22,5M	102M	43,7B

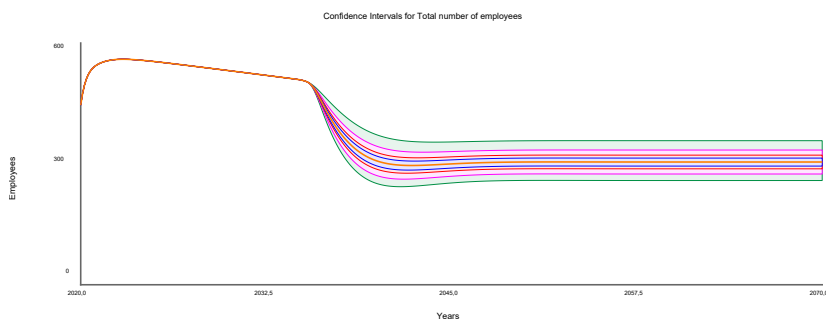
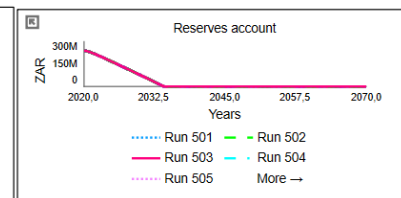
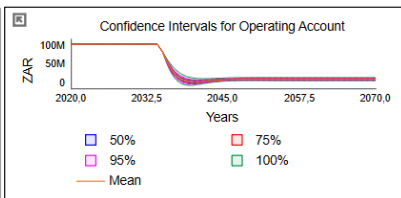
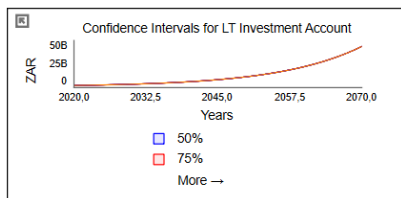


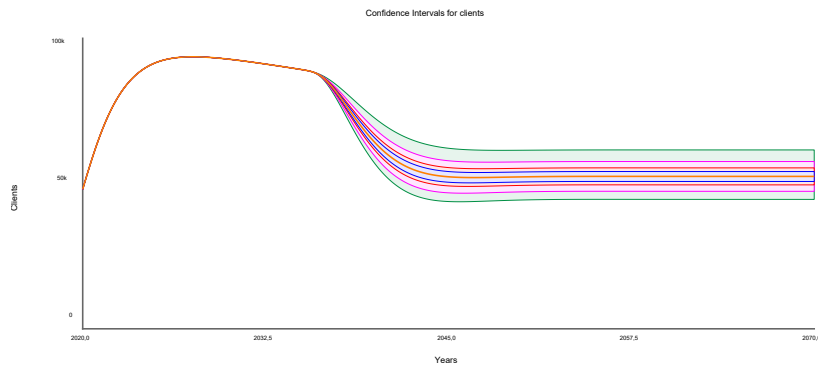


Scenario 11

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	64k	543	90M	231M	2,39B
2022	76k	557	90M	216M	2,49B
2023	84k	560	90M	200M	2,6B
2024	88,9k	558	90M	182M	2,72B
2025	91,6k	554	90M	165M	2,84B
2026	93k	550	90M	147M	2,98B
2027	93,6k	545	90M	130M	3,12B
2028	93,6k	541	90M	112M	3,27B
2029	93,3k	536	90M	93,8M	3,44B
2030	92,8k	531	90M	75,7M	3,61B
2031	92,2k	527	90M	57,6M	3,8B
2032	91,5k	522	90M	39,4M	4,01B
2033	90,8k	517	90M	21,1M	4,22B
2034	90k	513	90M	2,65M	4,46B
2035	89,2k	507	74,4M	0	4,71B
2036	87,9k	476	51,2M	0	4,97B
2037	84,2k	421	34,4M	0	5,26B
2038	78,6k	378	24,4M	0	5,57B
2039	72,6k	350	19,2M	0	5,9B
2040	67,3k	333	17,2M	0	6,26B
2041	63,1k	324	16,9M	0	6,64B
2042	60,1k	320	17,4M	0	7,04B
2043	58,1k	320	18,2M	0	7,48B
2044	56,9k	320	19M	0	7,95B
2045	56,3k	322	19,6M	0	8,45B

2046	55,9k	323	20,1M	0	8,99B
2047	55,8k	324	20,4M	0	9,57B
2048	55,8k	325	20,6M	0	10,2B
2049	55,9k	325	20,7M	0	10,9B
2050	56k	326	20,7M	0	11,6B
2051	56k	326	20,7M	0	12,3B
2052	56,1k	326	20,7M	0	13,2B
2053	56,1k	326	20,7M	0	14B
2054	56,1k	326	20,7M	0	15B
2055	56,1k	326	20,7M	0	16B
2056	56,1k	326	20,6M	0	17,1B
2057	56,1k	326	20,6M	0	18,2B
2058	56,1k	326	20,6M	0	19,5B
2059	56,1k	326	20,6M	0	20,8B
2060	56,1k	326	20,6M	0	22,2B
2061	56,1k	326	20,6M	0	23,8B
2062	56,1k	326	20,6M	0	25,4B
2063	56,1k	326	20,6M	0	27,2B
2064	56,1k	326	20,6M	0	29,1B
2065	56,1k	326	20,6M	0	31,1B
2066	56,1k	326	20,6M	0	33,3B
2067	56,1k	326	20,6M	0	35,6B
2068	56,1k	326	20,6M	0	38,2B
2069	56,1k	326	20,6M	0	40,8B
Final	56,1k	326	20,6M	0	43,7B

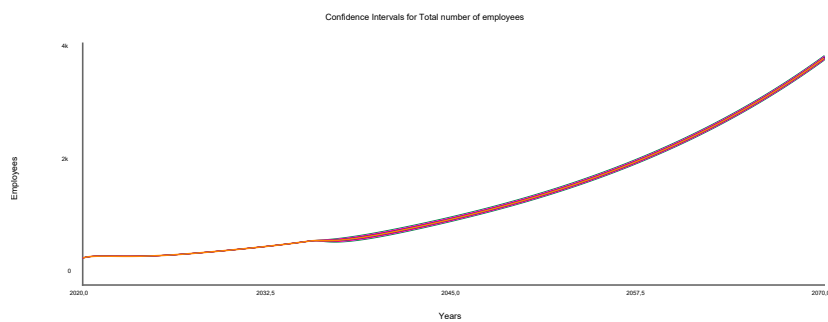
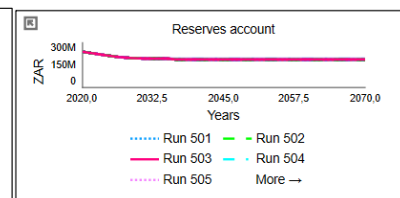
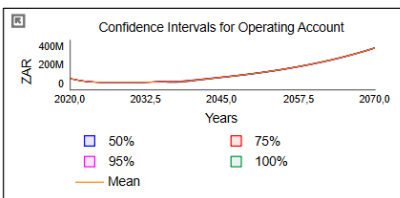
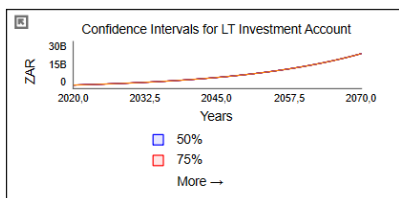


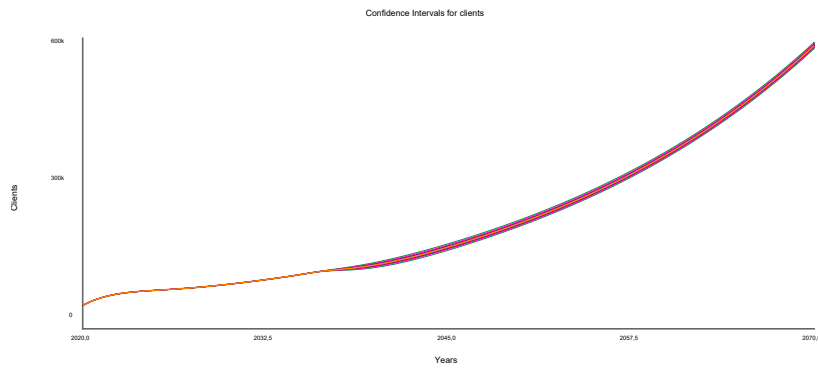


Scenario 12

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	737	65,8M	190M	4,76B
2037	121k	745	65,9M	189M	4,98B
2038	125k	770	68,1M	189M	5,22B
2039	129k	805	72M	189M	5,46B
2040	133k	847	76,7M	189M	5,71B
2041	139k	893	81,8M	189M	5,98B
2042	146k	943	87M	189M	6,26B
2043	154k	995	92,2M	189M	6,55B
2044	162k	1,05k	97,5M	189M	6,85B
2045	171k	1,11k	103M	189M	7,17B

2046	180k	1,17k	108M	189M	7,51B
2047	190k	1,23k	114M	189M	7,85B
2048	200k	1,29k	119M	189M	8,22B
2049	210k	1,36k	125M	189M	8,6B
2050	221k	1,43k	132M	189M	9B
2051	233k	1,5k	138M	189M	9,42B
2052	245k	1,58k	145M	189M	9,86B
2053	257k	1,66k	152M	189M	10,3B
2054	270k	1,74k	160M	189M	10,8B
2055	284k	1,83k	167M	189M	11,3B
2056	299k	1,92k	176M	189M	11,8B
2057	314k	2,02k	184M	189M	12,4B
2058	329k	2,12k	193M	189M	13B
2059	346k	2,23k	203M	189M	13,6B
2060	363k	2,34k	213M	189M	14,2B
2061	381k	2,45k	223M	189M	14,9B
2062	400k	2,57k	234M	189M	15,5B
2063	420k	2,7k	245M	189M	16,3B
2064	441k	2,83k	257M	189M	17B
2065	462k	2,97k	269M	189M	17,8B
2066	485k	3,11k	282M	189M	18,6B
2067	509k	3,27k	296M	189M	19,5B
2068	534k	3,43k	310M	189M	20,4B
2069	560k	3,59k	325M	189M	21,4B
Final	587k	3,77k	340M	189M	22,4B

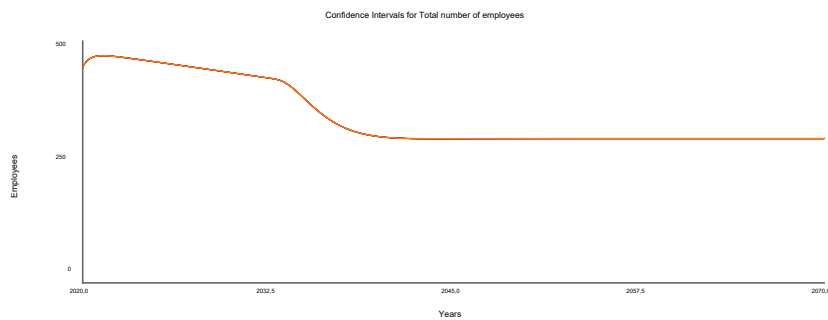
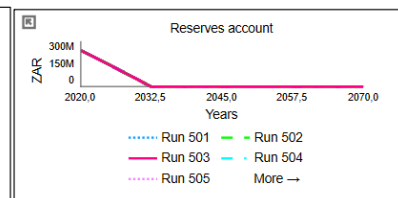
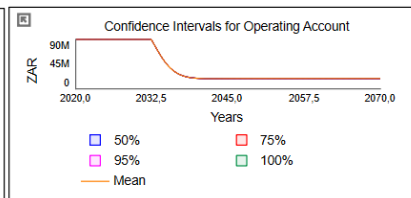
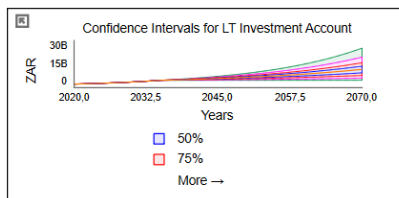


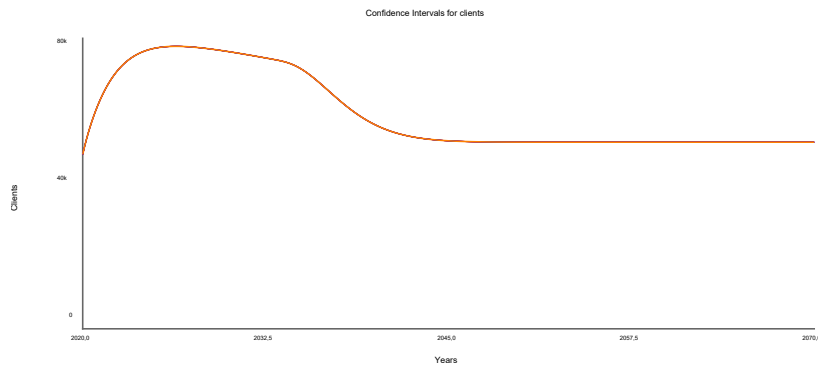


Scenario 13

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	4,81B
2037	64,8k	331	26,4M	0	4,91B
2038	61,4k	317	22,4M	0	5,02B
2039	58,5k	308	20,2M	0	5,13B
2040	56,2k	302	19,2M	0	5,25B
2041	54,5k	300	18,8M	0	5,37B
2042	53,3k	299	18,7M	0	5,49B
2043	52,6k	298	18,7M	0	5,62B
2044	52,1k	298	18,7M	0	5,76B
2045	51,8k	298	18,8M	0	5,9B

2046	51,6k	298	18,8M	0	6,04B
2047	51,5k	298	18,9M	0	6,19B
2048	51,4k	298	18,9M	0	6,35B
2049	51,4k	298	18,9M	0	6,51B
2050	51,4k	298	18,9M	0	6,67B
2051	51,4k	298	18,9M	0	6,85B
2052	51,4k	298	18,9M	0	7,03B
2053	51,4k	298	18,9M	0	7,21B
2054	51,4k	298	18,9M	0	7,4B
2055	51,4k	298	18,9M	0	7,6B
2056	51,4k	298	18,9M	0	7,81B
2057	51,4k	298	18,9M	0	8,02B
2058	51,4k	298	18,9M	0	8,25B
2059	51,4k	298	18,9M	0	8,48B
2060	51,4k	298	18,9M	0	8,71B
2061	51,4k	298	18,9M	0	8,96B
2062	51,4k	298	18,9M	0	9,22B
2063	51,4k	298	18,9M	0	9,48B
2064	51,4k	298	18,9M	0	9,76B
2065	51,4k	298	18,9M	0	10B
2066	51,4k	298	18,9M	0	10,3B
2067	51,4k	298	18,9M	0	10,6B
2068	51,4k	298	18,9M	0	11B
2069	51,4k	298	18,9M	0	11,3B
Final	51,4k	298	18,9M	0	11,6B

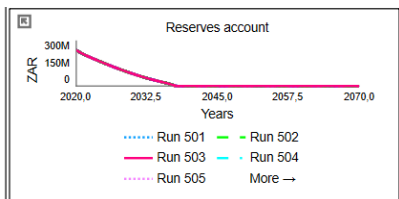
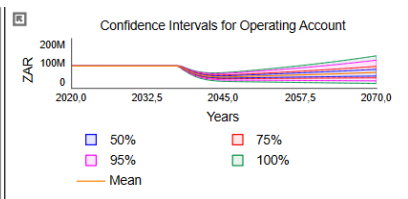
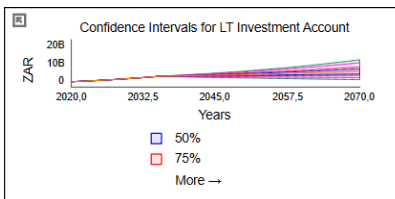




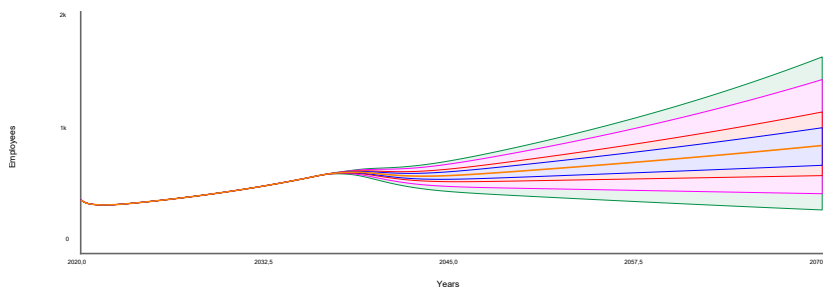
Scenario 14

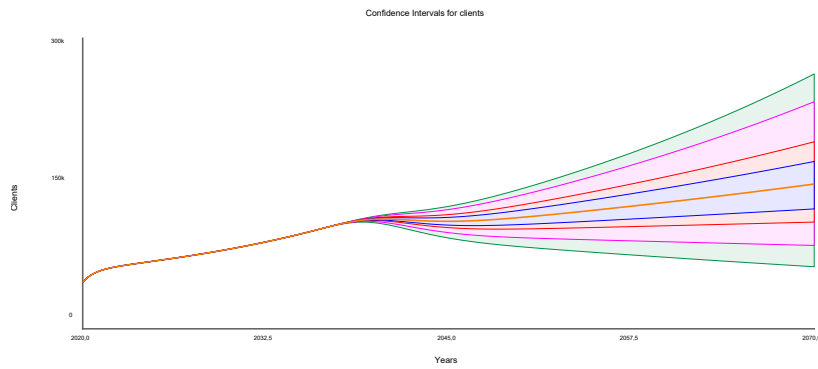
	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	58,8k	405	90M	217M	2,41B
2022	63,2k	403	90M	199M	2,52B
2023	65,9k	411	90M	182M	2,64B
2024	68,1k	422	90M	167M	2,76B
2025	70,2k	435	90M	151M	2,89B
2026	72,4k	449	90M	136M	3,02B
2027	74,7k	463	90M	122M	3,16B
2028	77k	479	90M	108M	3,31B
2029	79,6k	496	90M	94,2M	3,46B
2030	82,3k	513	90M	81,4M	3,62B
2031	85,1k	532	90M	69,3M	3,79B
2032	88,1k	552	90M	57,8M	3,97B
2033	91,3k	573	90M	47M	4,15B
2034	94,7k	595	90M	36,9M	4,35B
2035	98,3k	619	90M	27,6M	4,55B
2036	102k	644	90M	18,8M	4,63B
2037	106k	665	90M	8,18M	4,71B
2038	110k	677	86,5M	0	4,79B
2039	113k	683	75,2M	0	4,87B
2040	115k	680	65,8M	0	4,96B
2041	115k	675	59,1M	0	5,04B
2042	116k	674	55,2M	0	5,13B
2043	116k	677	53,2M	0	5,22B
2044	116k	685	52,6M	0	5,31B
2045	117k	695	52,8M	0	5,4B

2046	118k	707	53,5M	0	5,49B
2047	120k	721	54,5M	0	5,59B
2048	122k	736	55,6M	0	5,68B
2049	124k	751	56,8M	0	5,78B
2050	127k	766	57,9M	0	5,88B
2051	129k	782	59,1M	0	5,98B
2052	132k	798	60,3M	0	6,09B
2053	134k	814	61,5M	0	6,19B
2054	137k	830	62,7M	0	6,3B
2055	140k	847	64M	0	6,41B
2056	143k	864	65,3M	0	6,52B
2057	145k	882	66,5M	0	6,63B
2058	148k	899	67,8M	0	6,75B
2059	151k	917	69,2M	0	6,86B
2060	154k	935	70,5M	0	6,98B
2061	157k	954	71,9M	0	7,1B
2062	161k	973	73,3M	0	7,22B
2063	164k	992	74,7M	0	7,35B
2064	167k	1,01k	76,1M	0	7,48B
2065	170k	1,03k	77,6M	0	7,61B
2066	174k	1,05k	79,1M	0	7,74B
2067	177k	1,07k	80,6M	0	7,87B
2068	181k	1,09k	82,2M	0	8,01B
2069	184k	1,11k	83,7M	0	8,14B
Final	188k	1,14k	85,3M	0	8,28B



Confidence Intervals for Total number of employees

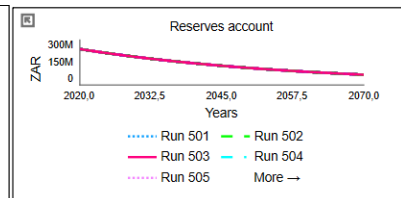
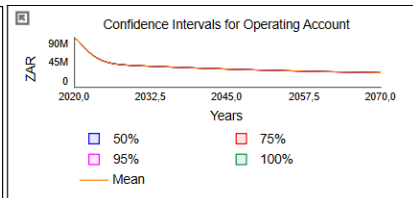
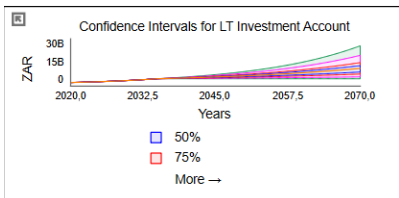




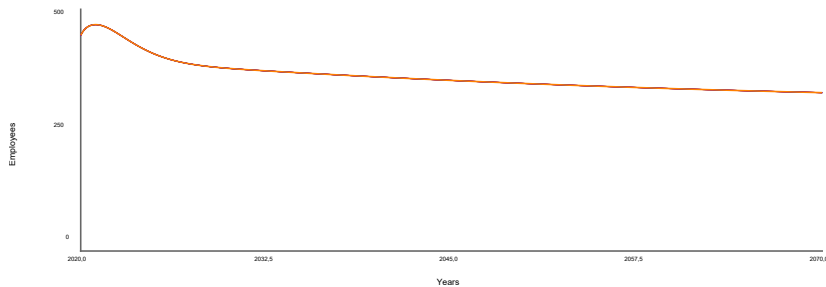
Scenario 15

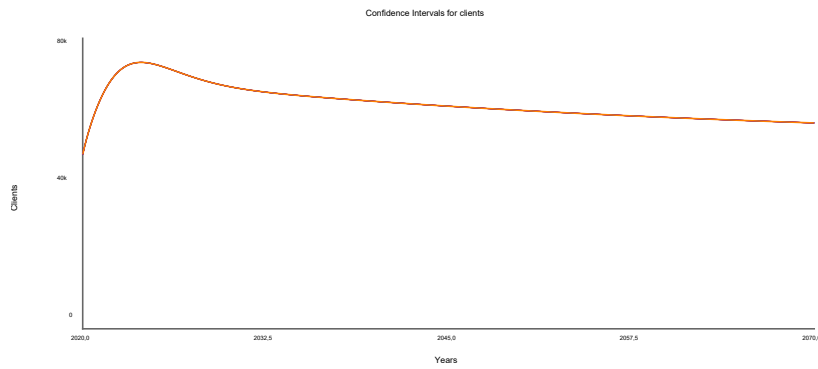
	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	468	79,4M	234M	2,39B
2022	68,8k	459	67,8M	228M	2,49B
2023	72,4k	440	58,2M	222M	2,6B
2024	73,4k	422	51,3M	217M	2,72B
2025	72,8k	407	46,6M	211M	2,84B
2026	71,5k	397	43,7M	206M	2,98B
2027	70k	389	41,9M	201M	3,12B
2028	68,7k	384	40,7M	196M	3,27B
2029	67,6k	380	40M	191M	3,44B
2030	66,7k	378	39,4M	187M	3,61B
2031	66k	376	38,9M	182M	3,8B
2032	65,4k	374	38,4M	177M	4,01B
2033	65k	372	38M	173M	4,22B
2034	64,5k	370	37,5M	169M	4,46B
2035	64,2k	368	37,1M	165M	4,71B
2036	63,8k	367	36,6M	161M	4,76B
2037	63,5k	365	36,2M	157M	4,82B
2038	63,2k	363	35,8M	153M	4,88B
2039	62,9k	362	35,4M	149M	4,95B
2040	62,6k	360	35M	145M	5,01B
2041	62,3k	359	34,6M	142M	5,08B
2042	62,1k	357	34,2M	138M	5,14B
2043	61,8k	356	33,8M	135M	5,21B
2044	61,6k	354	33,4M	131M	5,29B
2045	61,3k	353	33,1M	128M	5,36B

2046	61,1k	352	32,7M	125M	5,43B
2047	60,8k	350	32,4M	122M	5,51B
2048	60,6k	349	32,1M	119M	5,59B
2049	60,4k	348	31,7M	116M	5,67B
2050	60,1k	346	31,4M	113M	5,76B
2051	59,9k	345	31,1M	110M	5,84B
2052	59,7k	344	30,8M	108M	5,93B
2053	59,5k	343	30,5M	105M	6,02B
2054	59,3k	342	30,2M	102M	6,12B
2055	59,1k	341	29,9M	99,8M	6,21B
2056	58,9k	340	29,7M	97,4M	6,31B
2057	58,7k	339	29,4M	95M	6,41B
2058	58,6k	338	29,1M	92,6M	6,52B
2059	58,4k	337	28,9M	90,3M	6,62B
2060	58,2k	336	28,6M	88,1M	6,73B
2061	58k	335	28,4M	85,9M	6,85B
2062	57,9k	334	28,2M	83,8M	6,96B
2063	57,7k	333	27,9M	81,7M	7,08B
2064	57,6k	332	27,7M	79,7M	7,21B
2065	57,4k	331	27,5M	77,7M	7,33B
2066	57,3k	331	27,3M	75,8M	7,46B
2067	57,1k	330	27,1M	73,9M	7,59B
2068	57k	329	26,9M	72,1M	7,73B
2069	56,8k	328	26,7M	70,3M	7,87B
Final	56,7k	328	26,5M	68,6M	8,01B



Confidence intervals for Total number of employees

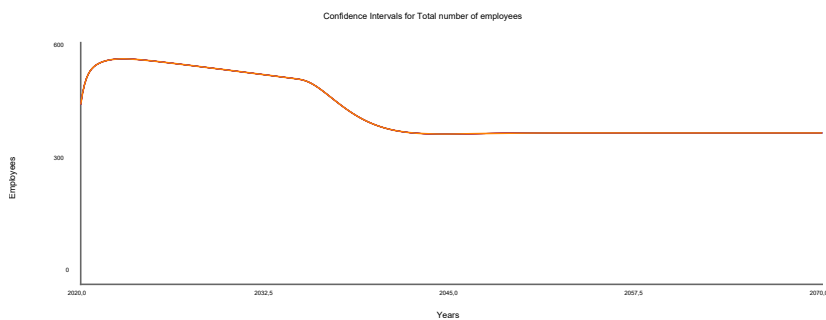
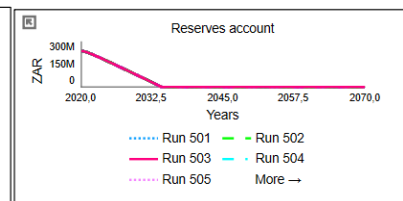
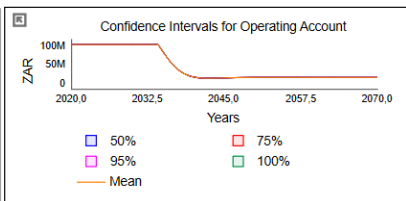
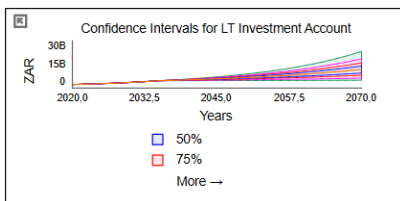


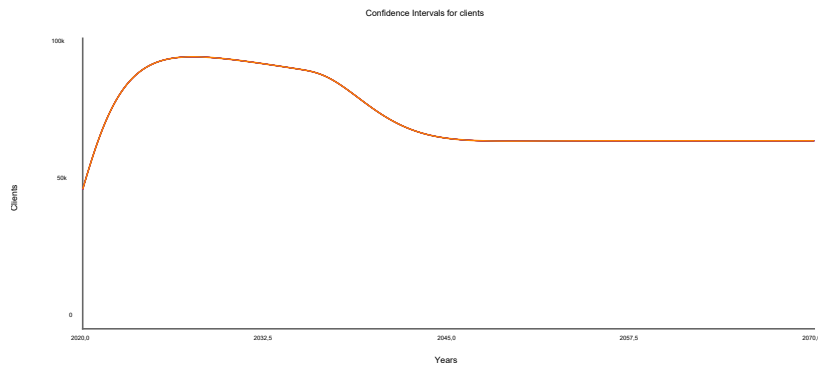


Scenario 16

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	64k	543	90M	231M	2,39B
2022	76k	557	90M	216M	2,49B
2023	84k	560	90M	200M	2,6B
2024	88,9k	558	90M	182M	2,72B
2025	91,6k	554	90M	165M	2,84B
2026	93k	550	90M	147M	2,98B
2027	93,6k	545	90M	130M	3,12B
2028	93,6k	541	90M	112M	3,27B
2029	93,3k	536	90M	93,8M	3,44B
2030	92,8k	531	90M	75,7M	3,61B
2031	92,2k	527	90M	57,6M	3,8B
2032	91,5k	522	90M	39,4M	4,01B
2033	90,8k	517	90M	21,1M	4,22B
2034	90k	513	90M	2,65M	4,46B
2035	89,2k	507	74,4M	0	4,71B
2036	88,1k	489	57,6M	0	4,81B
2037	85,9k	461	44M	0	4,91B
2038	82,6k	433	34,4M	0	5,02B
2039	78,9k	410	28,1M	0	5,13B
2040	75,3k	394	24,6M	0	5,24B
2041	72,1k	383	22,8M	0	5,36B
2042	69,5k	377	22,2M	0	5,49B
2043	67,7k	374	22,2M	0	5,62B
2044	66,4k	373	22,5M	0	5,75B
2045	65,5k	373	22,9M	0	5,89B

2046	65k	374	23,2M	0	6,03B
2047	64,8k	374	23,5M	0	6,18B
2048	64,7k	375	23,6M	0	6,33B
2049	64,6k	375	23,7M	0	6,49B
2050	64,6k	376	23,8M	0	6,66B
2051	64,6k	376	23,8M	0	6,83B
2052	64,7k	376	23,8M	0	7B
2053	64,7k	376	23,8M	0	7,19B
2054	64,7k	376	23,8M	0	7,38B
2055	64,7k	376	23,8M	0	7,58B
2056	64,7k	376	23,8M	0	7,78B
2057	64,7k	376	23,8M	0	7,99B
2058	64,7k	376	23,8M	0	8,21B
2059	64,7k	376	23,8M	0	8,44B
2060	64,7k	376	23,8M	0	8,67B
2061	64,7k	376	23,8M	0	8,92B
2062	64,7k	376	23,8M	0	9,17B
2063	64,7k	376	23,8M	0	9,43B
2064	64,7k	376	23,8M	0	9,71B
2065	64,7k	376	23,8M	0	9,99B
2066	64,7k	376	23,8M	0	10,3B
2067	64,7k	376	23,8M	0	10,6B
2068	64,7k	376	23,8M	0	10,9B
2069	64,7k	376	23,8M	0	11,2B
Final	64,7k	376	23,8M	0	11,6B

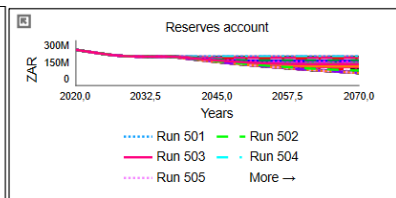
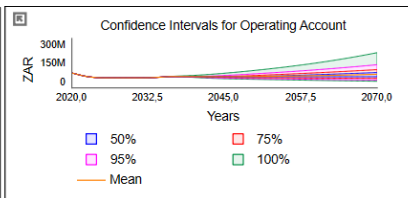
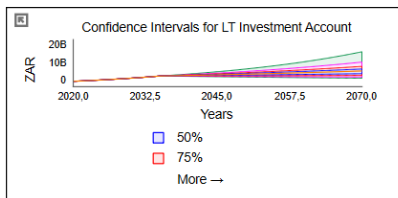




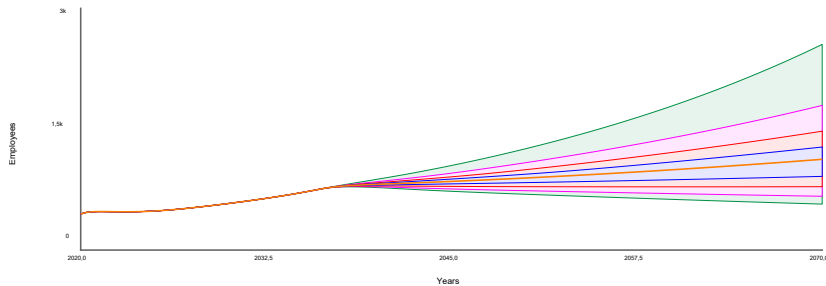
Scenario 17

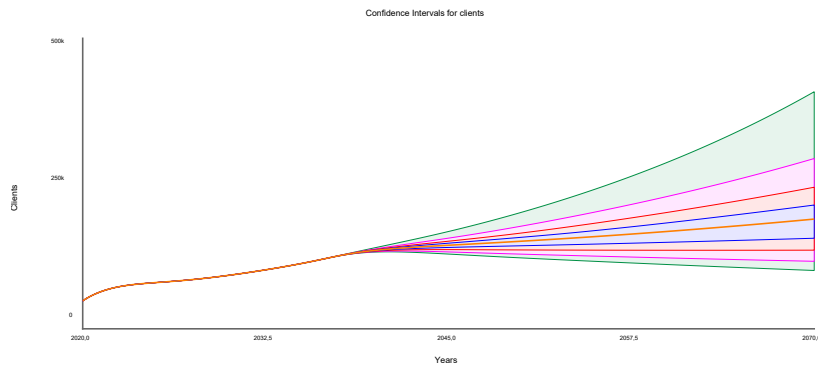
	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	752	68,6M	194M	4,59B
2037	123k	781	68,7M	194M	4,64B
2038	128k	798	68,7M	191M	4,68B
2039	132k	807	68,7M	188M	4,72B
2040	135k	814	68,7M	184M	4,77B
2041	137k	821	68,7M	181M	4,81B
2042	139k	827	68,7M	177M	4,86B
2043	140k	833	68,7M	174M	4,9B
2044	142k	840	68,7M	171M	4,95B
2045	143k	846	68,7M	168M	4,99B

2046	144k	853	68,7M	165M	5,04B
2047	145k	859	68,7M	163M	5,09B
2048	147k	866	68,7M	160M	5,13B
2049	148k	873	68,7M	158M	5,18B
2050	149k	880	68,7M	156M	5,23B
2051	150k	887	68,7M	154M	5,28B
2052	151k	895	68,7M	152M	5,33B
2053	153k	902	68,7M	150M	5,38B
2054	154k	909	68,7M	149M	5,43B
2055	155k	917	68,7M	147M	5,48B
2056	156k	925	68,7M	146M	5,53B
2057	158k	932	68,7M	145M	5,58B
2058	159k	940	68,7M	144M	5,63B
2059	160k	948	68,7M	144M	5,68B
2060	162k	957	68,7M	143M	5,74B
2061	163k	965	68,7M	143M	5,79B
2062	164k	973	68,7M	143M	5,84B
2063	166k	982	68,9M	143M	5,9B
2064	167k	991	69,2M	143M	5,95B
2065	169k	1000	69,7M	143M	6,01B
2066	170k	1,01k	70,3M	143M	6,06B
2067	172k	1,02k	70,9M	143M	6,12B
2068	174k	1,03k	71,6M	143M	6,18B
2069	175k	1,04k	72,4M	143M	6,23B
Final	177k	1,05k	73,1M	143M	6,29B



Confidence Intervals for Total number of employees

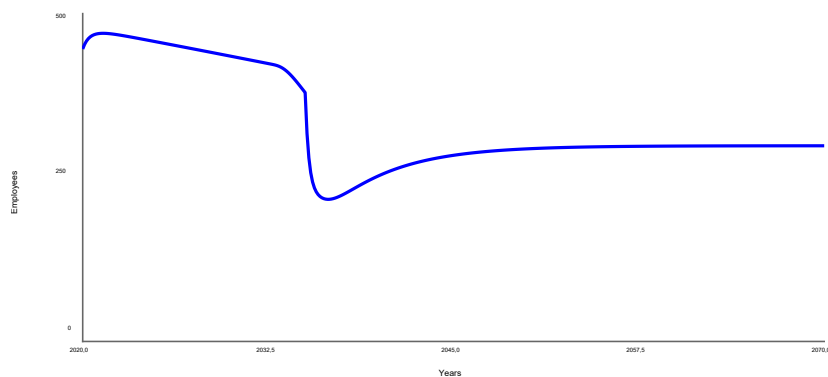
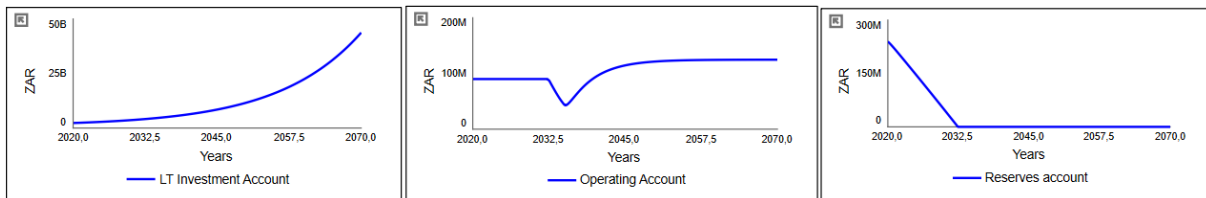


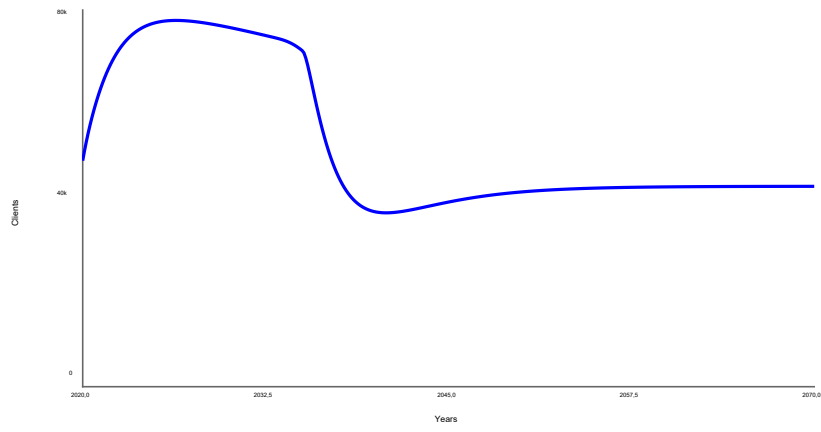
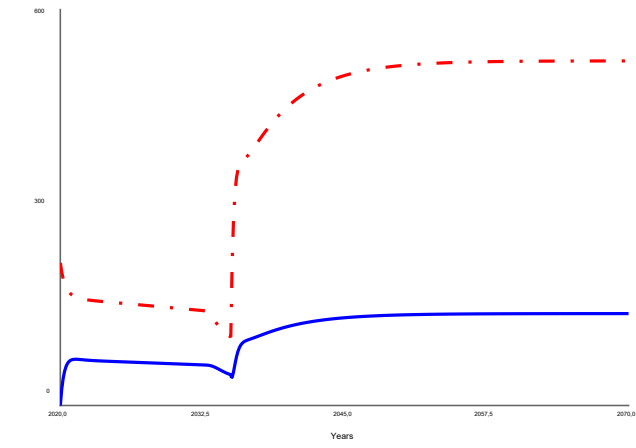


Scenario 18

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	59,5k	221	49,5M	0	4,97B
2037	48,3k	219	62,4M	0	5,26B
2038	41,7k	229	74,4M	0	5,57B
2039	38,4k	242	84,5M	0	5,9B
2040	37,1k	253	92,6M	0	6,26B
2041	37k	262	99,2M	0	6,64B
2042	37,3k	270	104M	0	7,04B
2043	37,9k	275	109M	0	7,48B
2044	38,6k	280	112M	0	7,95B
2045	39,2k	284	114M	0	8,45B

2046	39,8k	287	117M	0	8,99B
2047	40,3k	289	118M	0	9,57B
2048	40,7k	291	120M	0	10,2B
2049	41,1k	293	121M	0	10,9B
2050	41,4k	294	121M	0	11,6B
2051	41,6k	295	122M	0	12,3B
2052	41,8k	295	123M	0	13,2B
2053	42k	296	123M	0	14B
2054	42,1k	297	123M	0	15B
2055	42,2k	297	124M	0	16B
2056	42,3k	297	124M	0	17,1B
2057	42,3k	298	124M	0	18,2B
2058	42,4k	298	124M	0	19,5B
2059	42,4k	298	124M	0	20,8B
2060	42,4k	298	124M	0	22,2B
2061	42,5k	298	125M	0	23,8B
2062	42,5k	298	125M	0	25,4B
2063	42,5k	298	125M	0	27,2B
2064	42,5k	298	125M	0	29,1B
2065	42,5k	298	125M	0	31,1B
2066	42,5k	298	125M	0	33,3B
2067	42,5k	298	125M	0	35,6B
2068	42,6k	298	125M	0	38,2B
2069	42,6k	298	125M	0	40,8B
Final	42,6k	298	125M	0	43,7B

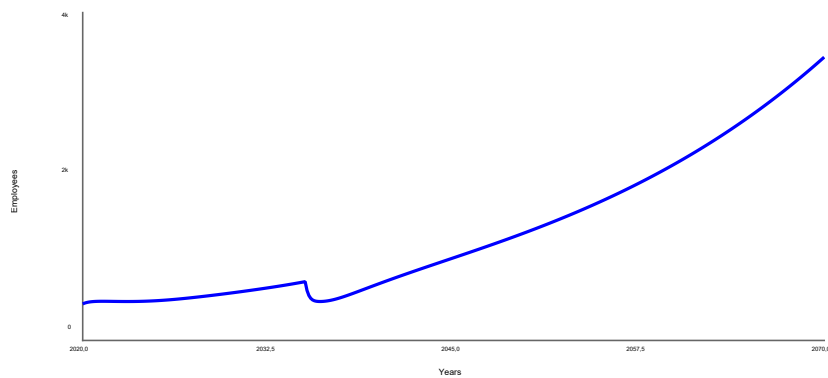
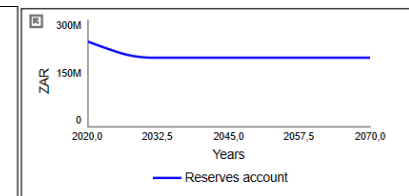
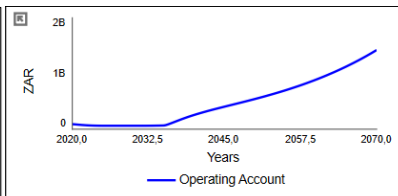
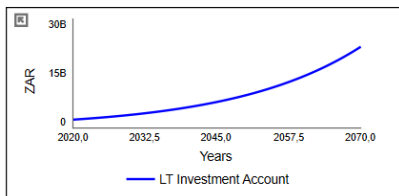


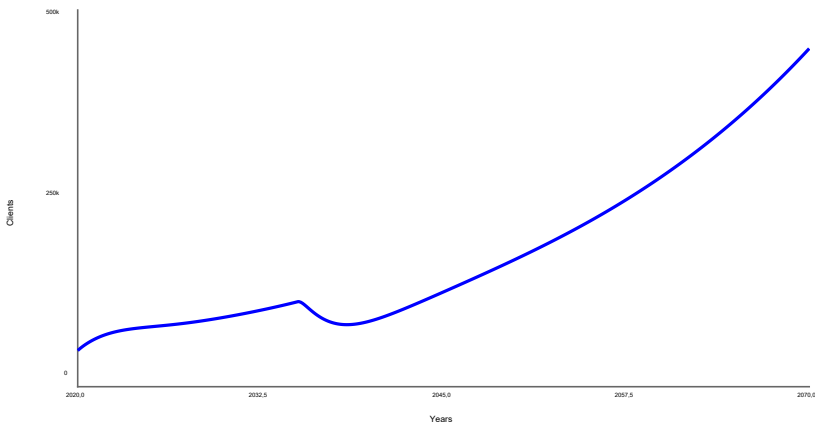
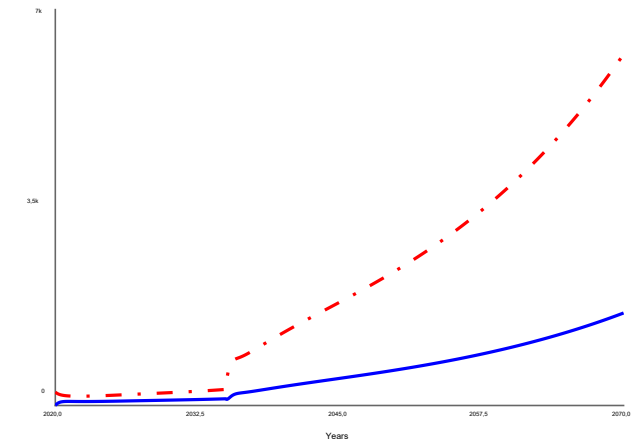


Scenario 19

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	100k	475	96,5M	194M	4,76B
2037	88k	502	138M	194M	4,98B
2038	82,7k	559	180M	194M	5,22B
2039	83,1k	626	219M	194M	5,46B
2040	87,2k	694	255M	194M	5,71B
2041	93,5k	759	288M	194M	5,98B
2042	101k	823	319M	194M	6,26B
2043	109k	885	348M	194M	6,55B
2044	117k	947	376M	194M	6,85B
2045	126k	1,01k	404M	194M	7,17B

2046	134k	1,07k	431M	194M	7,51B
2047	143k	1,13k	458M	194M	7,85B
2048	152k	1,19k	486M	194M	8,22B
2049	161k	1,26k	514M	194M	8,6B
2050	170k	1,33k	542M	194M	9B
2051	179k	1,4k	571M	194M	9,42B
2052	189k	1,47k	601M	194M	9,86B
2053	199k	1,54k	632M	194M	10,3B
2054	209k	1,62k	665M	194M	10,8B
2055	220k	1,7k	698M	194M	11,3B
2056	231k	1,78k	733M	194M	11,8B
2057	242k	1,87k	770M	194M	12,4B
2058	254k	1,96k	808M	194M	13B
2059	267k	2,06k	847M	194M	13,6B
2060	280k	2,16k	889M	194M	14,2B
2061	294k	2,27k	932M	194M	14,9B
2062	308k	2,38k	977M	194M	15,5B
2063	323k	2,49k	1,02B	194M	16,3B
2064	339k	2,61k	1,07B	194M	17B
2065	355k	2,74k	1,13B	194M	17,8B
2066	372k	2,87k	1,18B	194M	18,6B
2067	390k	3k	1,24B	194M	19,5B
2068	409k	3,15k	1,3B	194M	20,4B
2069	428k	3,3k	1,36B	194M	21,4B
Final	449k	3,46k	1,42B	194M	22,4B

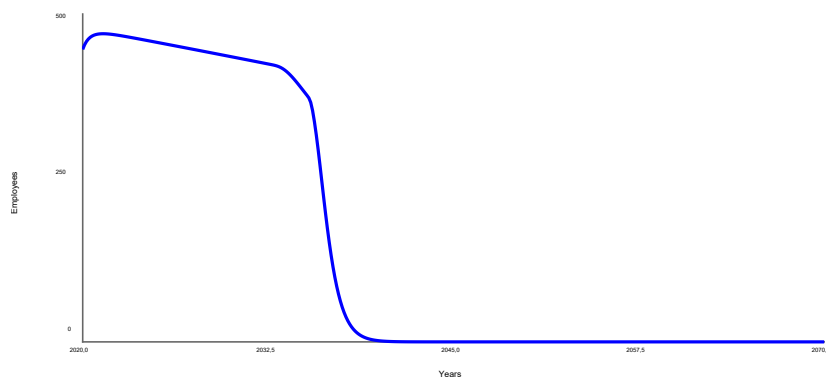
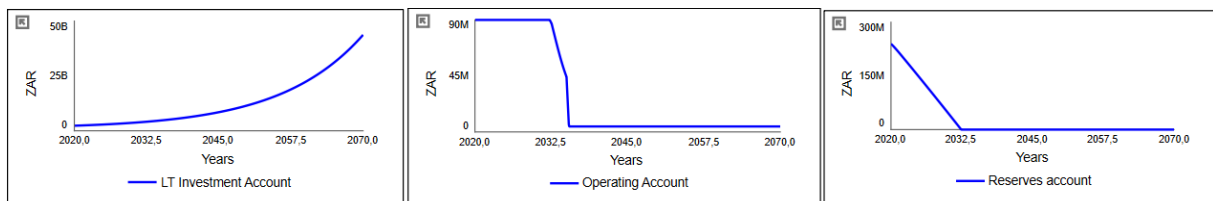


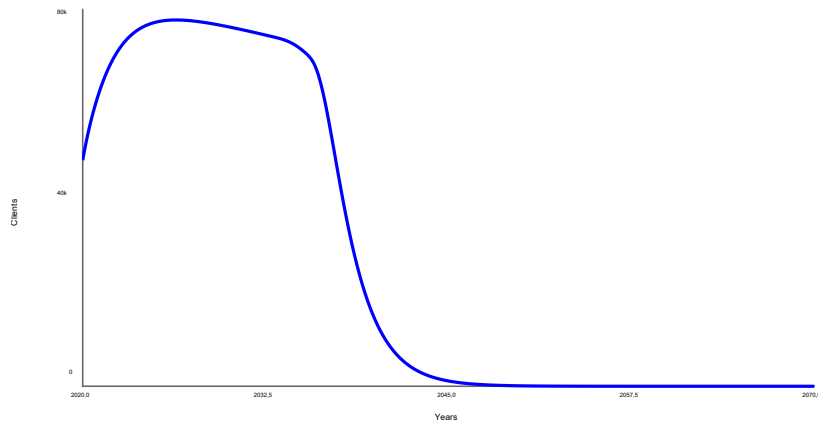


Scenario 20

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	67,1k	269	4,38M	0	4,97B
2037	53,2k	99	4,38M	0	5,26B
2038	36,1k	27,2	4,38M	0	5,57B
2039	22,8k	6,86	4,38M	0	5,9B
2040	14k	1,69	4,38M	0	6,26B
2041	8,49k	0,412	4,38M	0	6,64B
2042	5,13k	0,101	4,38M	0	7,04B
2043	3,09k	0,0246	4,38M	0	7,48B
2044	1,86k	0,006	4,38M	0	7,95B
2045	1,12k	0,00146	4,38M	0	8,45B

2046	673	0,000357	4,38M	0	8,99B
2047	405	0,0000872	4,38M	0	9,57B
2048	244	0,0000213	4,38M	0	10,2B
2049	147	0,00000519	4,38M	0	10,9B
2050	88,3	0,00000127	4,38M	0	11,6B
2051	53,1	3,09e-7	4,38M	0	12,3B
2052	32	7,55e-8	4,38M	0	13,2B
2053	19,2	1,84e-8	4,38M	0	14B
2054	11,6	4,5e-9	4,38M	0	15B
2055	6,96	1,1e-9	4,38M	0	16B
2056	4,19	2,68e-10	4,38M	0	17,1B
2057	2,52	6,53e-11	4,38M	0	18,2B
2058	1,52	1,59e-11	4,38M	0	19,5B
2059	0,912	3,89e-12	4,38M	0	20,8B
2060	0,549	9,5e-13	4,38M	0	22,2B
2061	0,33	2,32e-13	4,38M	0	23,8B
2062	0,199	5,66e-14	4,38M	0	25,4B
2063	0,12	1,38e-14	4,38M	0	27,2B
2064	0,072	3,37e-15	4,38M	0	29,1B
2065	0,0433	8,22e-16	4,38M	0	31,1B
2066	0,0261	2,01e-16	4,38M	0	33,3B
2067	0,0157	4,9e-17	4,38M	0	35,6B
2068	0,00943	1,2e-17	4,38M	0	38,2B
2069	0,00568	2,92e-18	4,38M	0	40,8B
Final	0,00342	7,12e-19	4,38M	0	43,7B

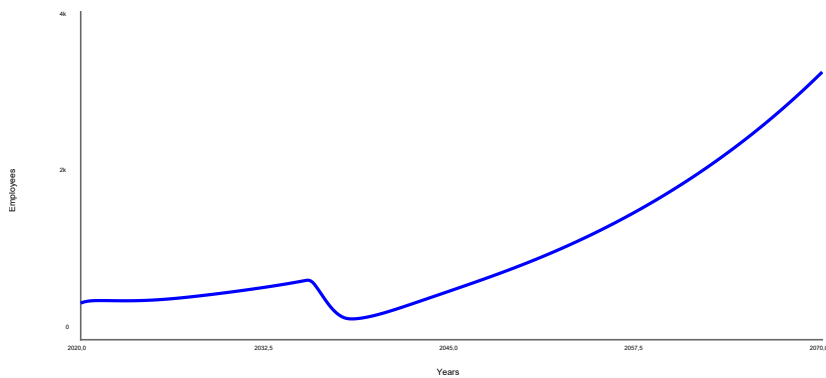
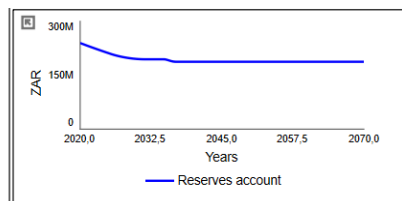
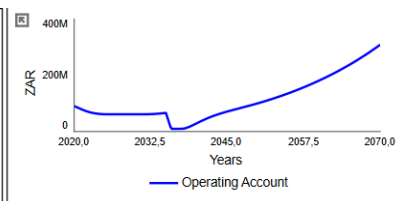
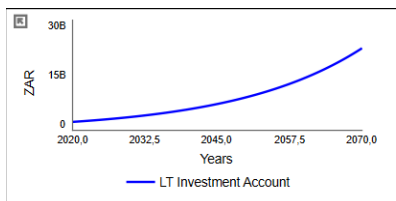


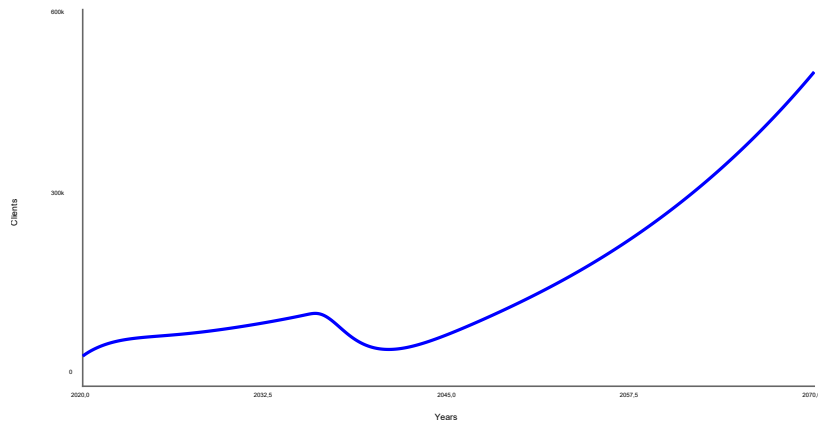


Scenario 21

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	116k	617	9,45M	190M	4,76B
2037	105k	370	9,48M	188M	4,98B
2038	85,3k	258	10,6M	188M	5,22B
2039	69,3k	266	18,4M	188M	5,46B
2040	60,8k	305	28,9M	188M	5,71B
2041	58,6k	357	39,4M	188M	5,98B
2042	61,1k	416	49M	188M	6,26B
2043	66,6k	478	57,3M	188M	6,55B
2044	74,2k	540	64,5M	188M	6,85B
2045	83k	602	70,9M	188M	7,17B

2046	92,6k	664	76,8M	188M	7,51B
2047	103k	728	82,5M	188M	7,85B
2048	113k	793	88,2M	188M	8,22B
2049	124k	860	94,1M	188M	8,6B
2050	135k	930	100M	188M	9B
2051	147k	1k	107M	188M	9,42B
2052	159k	1,08k	113M	188M	9,86B
2053	171k	1,16k	121M	188M	10,3B
2054	184k	1,24k	128M	188M	10,8B
2055	198k	1,33k	136M	188M	11,3B
2056	213k	1,42k	144M	188M	11,8B
2057	228k	1,52k	153M	188M	12,4B
2058	243k	1,62k	162M	188M	13B
2059	260k	1,73k	171M	188M	13,6B
2060	277k	1,84k	181M	188M	14,2B
2061	295k	1,95k	191M	188M	14,9B
2062	314k	2,07k	202M	188M	15,5B
2063	334k	2,2k	213M	188M	16,3B
2064	355k	2,33k	225M	188M	17B
2065	376k	2,47k	238M	188M	17,8B
2066	399k	2,62k	251M	188M	18,6B
2067	423k	2,77k	264M	188M	19,5B
2068	448k	2,93k	278M	188M	20,4B
2069	474k	3,09k	293M	188M	21,4B
Final	501k	3,27k	309M	188M	22,4B

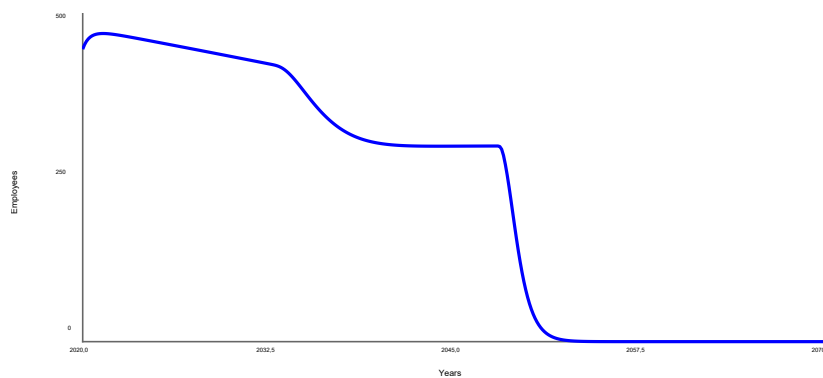
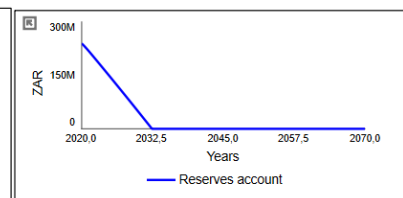
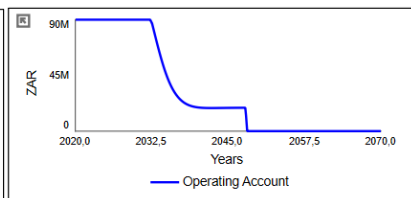
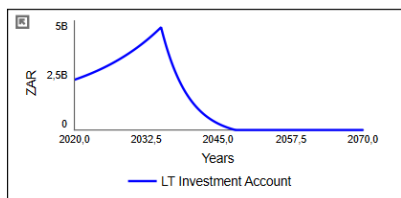


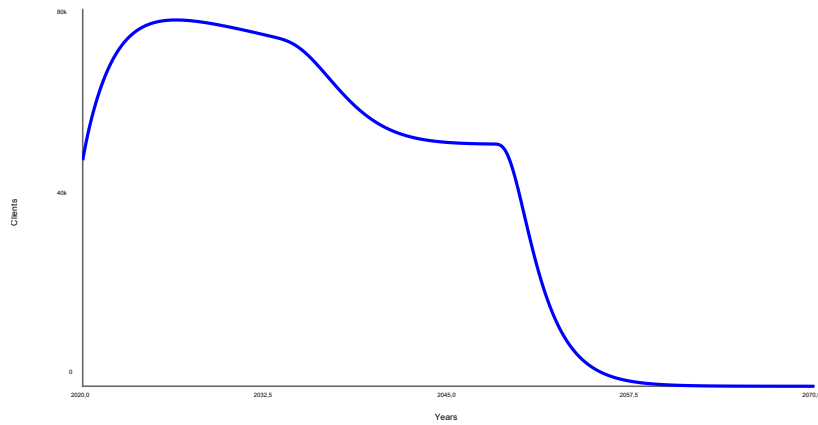


Scenario 22

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	3,75B
2037	64,8k	331	26,4M	0	2,97B
2038	61,4k	317	22,4M	0	2,34B
2039	58,5k	308	20,2M	0	1,83B
2040	56,2k	302	19,2M	0	1,42B
2041	54,5k	300	18,8M	0	1,08B
2042	53,3k	299	18,7M	0	814M
2043	52,6k	298	18,7M	0	596M
2044	52,1k	298	18,7M	0	419M
2045	51,8k	298	18,8M	0	275M

2046	51,6k	298	18,8M	0	159M
2047	51,5k	298	18,9M	0	65,5M
2048	51,4k	298	8,28M	0	0
2049	49,4k	196	0	0	0
2050	38,8k	67,8	0	0	0
2051	26,1k	18,3	0	0	0
2052	16,4k	4,58	0	0	0
2053	10,1k	1,13	0	0	0
2054	6,11k	0,275	0	0	0
2055	3,69k	0,0671	0	0	0
2056	2,22k	0,0164	0	0	0
2057	1,34k	0,004	0	0	0
2058	804	0,000976	0	0	0
2059	484	0,000238	0	0	0
2060	291	0,0000581	0	0	0
2061	175	0,0000142	0	0	0
2062	105	0,00000346	0	0	0
2063	63,5	8,45e-7	0	0	0
2064	38,2	2,06e-7	0	0	0
2065	23	5,03e-8	0	0	0
2066	13,8	1,23e-8	0	0	0
2067	8,32	3e-9	0	0	0
2068	5	7,31e-10	0	0	0
2069	3,01	1,78e-10	0	0	0
Final	1,81	4,36e-11	0	0	0

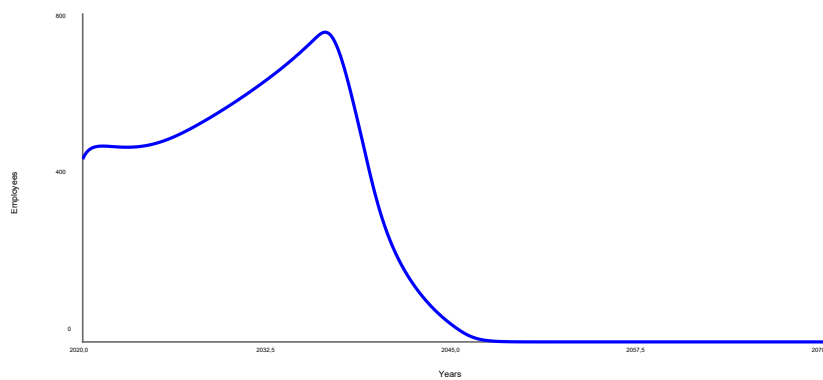
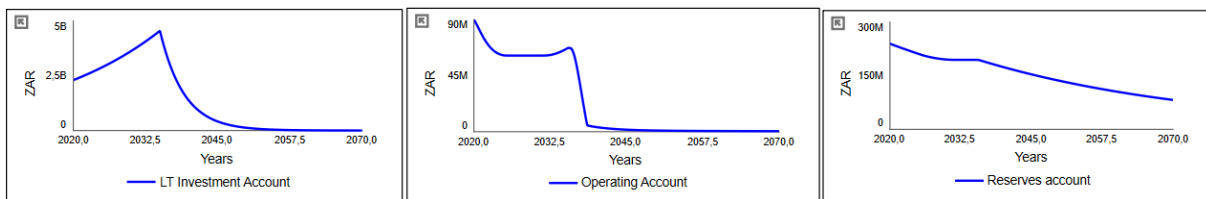


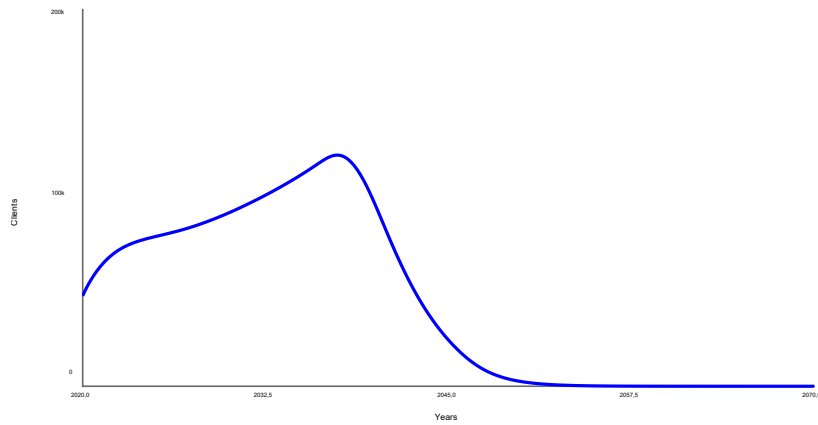


Scenario 23

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	751	66,6M	193M	3,58B
2037	122k	732	48,7M	188M	2,82B
2038	121k	620	20,1M	183M	2,22B
2039	112k	468	4,54M	179M	1,74B
2040	96,3k	324	3,73M	174M	1,37B
2041	77,9k	224	3,09M	170M	1,08B
2042	60,8k	157	2,59M	166M	849M
2043	46,2k	107	2,19M	162M	668M
2044	34,2k	68,9	1,87M	158M	525M
2045	24,5k	38,9	1,61M	154M	413M

2046	16,7k	16,1	1,41M	150M	325M
2047	10,8k	4,8	1,24M	146M	256M
2048	6,67k	1,24	1,11M	143M	201M
2049	4,06k	0,307	1M	139M	158M
2050	2,46k	0,0752	913k	136M	124M
2051	1,48k	0,0184	841k	132M	97,9M
2052	892	0,00449	781k	129M	77M
2053	537	0,00109	731k	126M	60,6M
2054	323	0,000267	689k	123M	47,6M
2055	194	0,0000652	653k	120M	37,5M
2056	117	0,0000159	622k	117M	29,5M
2057	70,4	0,00000388	595k	114M	23,2M
2058	42,3	9,48e-7	571k	111M	18,2M
2059	25,5	2,31e-7	549k	108M	14,3M
2060	15,3	5,65e-8	530k	106M	11,3M
2061	9,22	1,38e-8	512k	103M	8,88M
2062	5,55	3,36e-9	496k	101M	6,98M
2063	3,34	8,21e-10	481k	98,1M	5,49M
2064	2,01	2e-10	467k	95,7M	4,32M
2065	1,21	4,89e-11	454k	93,3M	3,4M
2066	0,728	1,19e-11	441k	91M	2,67M
2067	0,438	2,91e-12	429k	88,7M	2,1M
2068	0,263	7,1e-13	418k	86,5M	1,65M
2069	0,158	1,73e-13	407k	84,4M	1,3M
Final	0,0954	4,23e-14	396k	82,3M	1,02M

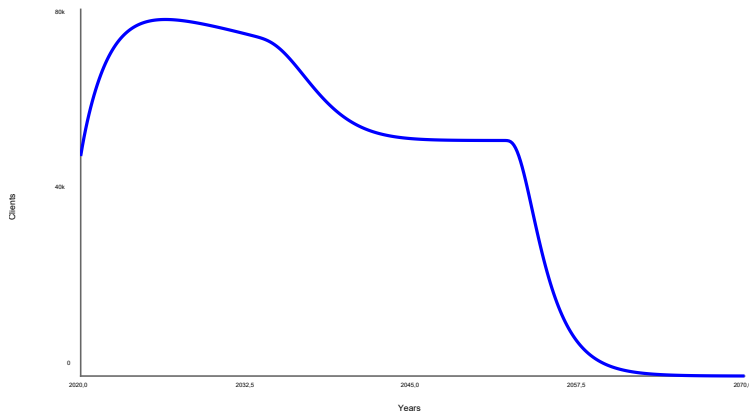
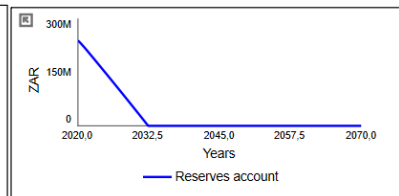
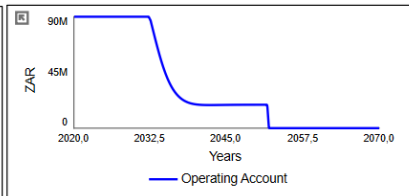
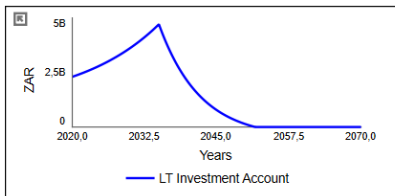


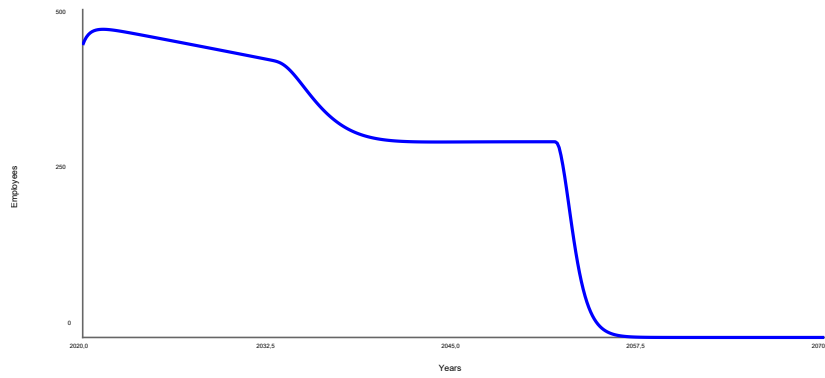


Scenario 24

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	4,02B
2037	64,8k	331	26,4M	0	3,43B
2038	61,4k	317	22,4M	0	2,91B
2039	58,5k	308	20,2M	0	2,47B
2040	56,2k	302	19,2M	0	2,08B
2041	54,5k	300	18,8M	0	1,74B
2042	53,3k	299	18,7M	0	1,45B
2043	52,6k	298	18,7M	0	1,19B
2044	52,1k	298	18,7M	0	969M
2045	51,8k	298	18,8M	0	776M

2046	51,6k	298	18,8M	0	609M
2047	51,5k	298	18,9M	0	463M
2048	51,4k	298	18,9M	0	337M
2049	51,4k	298	18,9M	0	227M
2050	51,4k	298	18,9M	0	132M
2051	51,4k	298	18,9M	0	48,8M
2052	51,4k	296	0	0	0
2053	48k	167	0	0	0
2054	36,4k	53,8	0	0	0
2055	24,1k	14,2	0	0	0
2056	15k	3,54	0	0	0
2057	9,19k	0,867	0	0	0
2058	5,56k	0,212	0	0	0
2059	3,36k	0,0517	0	0	0
2060	2,02k	0,0126	0	0	0
2061	1,22k	0,00308	0	0	0
2062	732	0,000752	0	0	0
2063	441	0,000183	0	0	0
2064	265	0,0000448	0	0	0
2065	160	0,0000109	0	0	0
2066	96	0,00000267	0	0	0
2067	57,7	6,51e-7	0	0	0
2068	34,7	1,59e-7	0	0	0
2069	20,9	3,88e-8	0	0	0
Final	12,6	9,46e-9	0	0	0

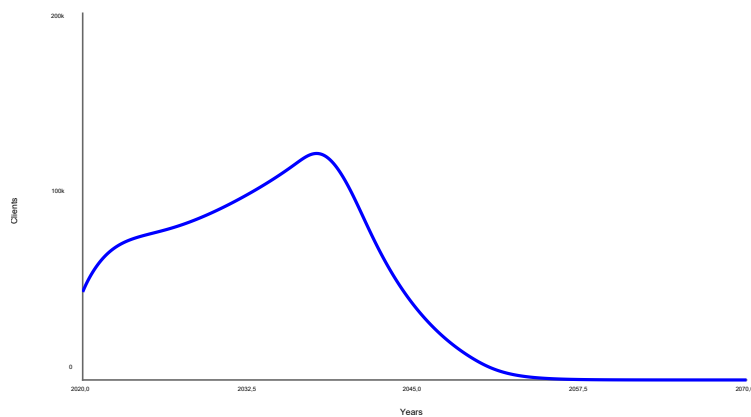
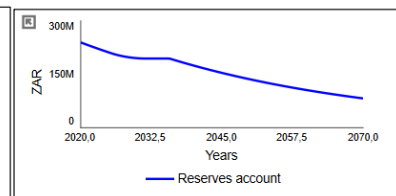
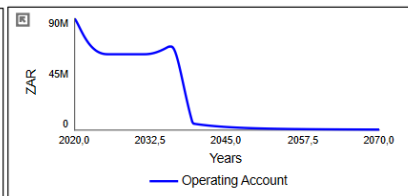
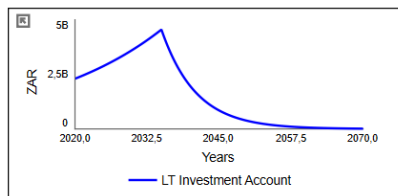


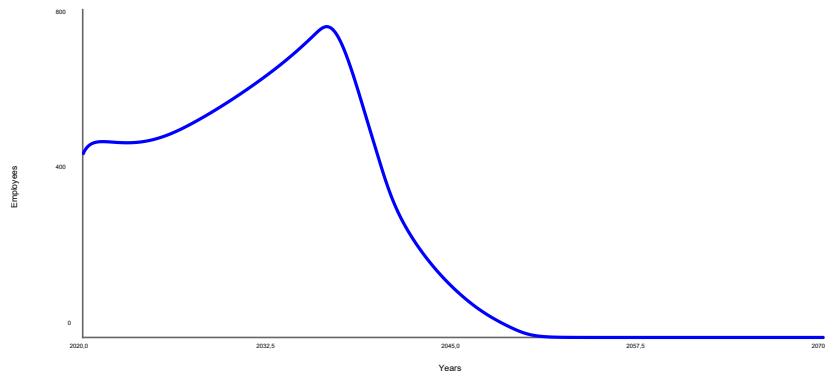


Scenario 25

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	751	67,3M	193M	3,85B
2037	122k	746	55,1M	188M	3,25B
2038	123k	666	33,4M	184M	2,75B
2039	117k	551	12,2M	179M	2,33B
2040	106k	432	4,82M	175M	1,97B
2041	90,8k	327	4,18M	170M	1,66B
2042	75,6k	256	3,64M	166M	1,4B
2043	61,9k	202	3,18M	162M	1,19B
2044	50,2k	158	2,79M	158M	1B
2045	40,2k	121	2,46M	154M	848M

2046	31,8k	88,7	2,17M	150M	717M
2047	24,6k	62	1,93M	147M	606M
2048	18,6k	40,3	1,72M	143M	512M
2049	13,4k	22,1	1,54M	139M	433M
2050	9,17k	8,41	1,39M	136M	366M
2051	5,87k	2,38	1,26M	133M	309M
2052	3,63k	0,607	1,15M	129M	261M
2053	2,21k	0,15	1,05M	126M	221M
2054	1,33k	0,0366	968k	123M	187M
2055	804	0,00894	895k	120M	158M
2056	484	0,00218	831k	117M	133M
2057	291	0,000533	775k	114M	113M
2058	175	0,00013	726k	111M	95,4M
2059	106	0,0000317	683k	109M	80,6M
2060	63,5	0,00000774	645k	106M	68,1M
2061	38,2	0,00000189	611k	103M	57,6M
2062	23	4,61e-7	581k	101M	48,7M
2063	13,8	1,13e-7	554k	98,3M	41,2M
2064	8,32	2,75e-8	529k	95,8M	34,8M
2065	5,01	6,7e-9	507k	93,5M	29,4M
2066	3,01	1,64e-9	487k	91,1M	24,9M
2067	1,81	3,99e-10	468k	88,9M	21M
2068	1,09	9,74e-11	451k	86,7M	17,8M
2069	0,656	2,38e-11	435k	84,6M	15M
Final	0,395	5,8e-12	421k	82,5M	12,7M

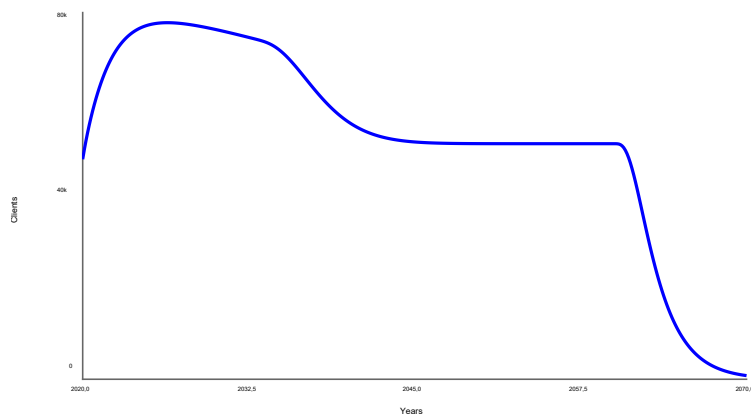
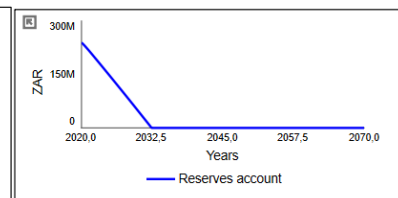
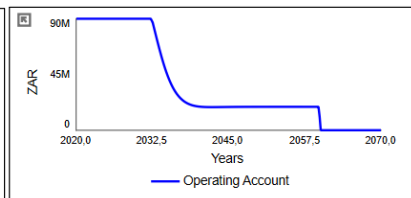
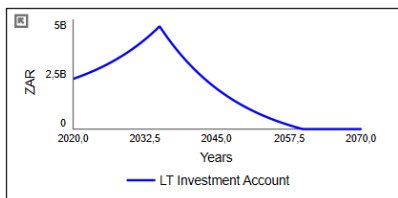


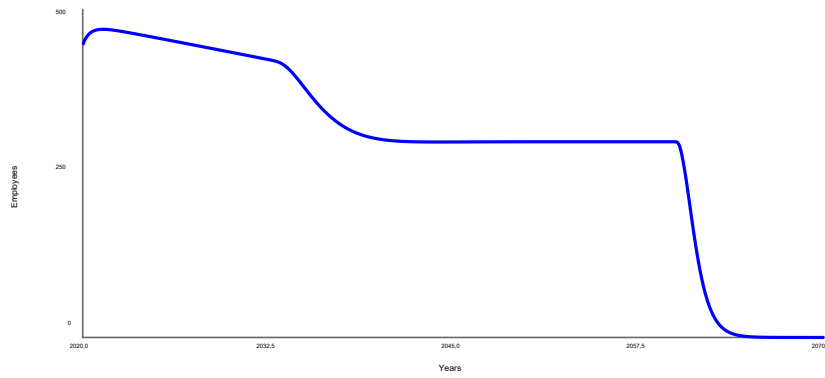


Scenario 26

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	4,32B
2037	64,8k	331	26,4M	0	3,96B
2038	61,4k	317	22,4M	0	3,62B
2039	58,5k	308	20,2M	0	3,31B
2040	56,2k	302	19,2M	0	3,02B
2041	54,5k	300	18,8M	0	2,75B
2042	53,3k	299	18,7M	0	2,49B
2043	52,6k	298	18,7M	0	2,26B
2044	52,1k	298	18,7M	0	2,04B
2045	51,8k	298	18,8M	0	1,83B

2046	51,6k	298	18,8M	0	1,64B
2047	51,5k	298	18,9M	0	1,46B
2048	51,4k	298	18,9M	0	1,29B
2049	51,4k	298	18,9M	0	1,14B
2050	51,4k	298	18,9M	0	992M
2051	51,4k	298	18,9M	0	857M
2052	51,4k	298	18,9M	0	731M
2053	51,4k	298	18,9M	0	614M
2054	51,4k	298	18,9M	0	505M
2055	51,4k	298	18,9M	0	403M
2056	51,4k	298	18,9M	0	308M
2057	51,4k	298	18,9M	0	219M
2058	51,4k	298	18,9M	0	137M
2059	51,4k	298	18,9M	0	59,6M
2060	51,4k	298	6,69M	0	0
2061	49,2k	192	0	0	0
2062	38,4k	65,5	0	0	0
2063	25,8k	17,6	0	0	0
2064	16,2k	4,4	0	0	0
2065	9,93k	1,08	0	0	0
2066	6,02k	0,264	0	0	0
2067	3,63k	0,0645	0	0	0
2068	2,19k	0,0157	0	0	0
2069	1,32k	0,00384	0	0	0
Final	793	0,000938	0	0	0

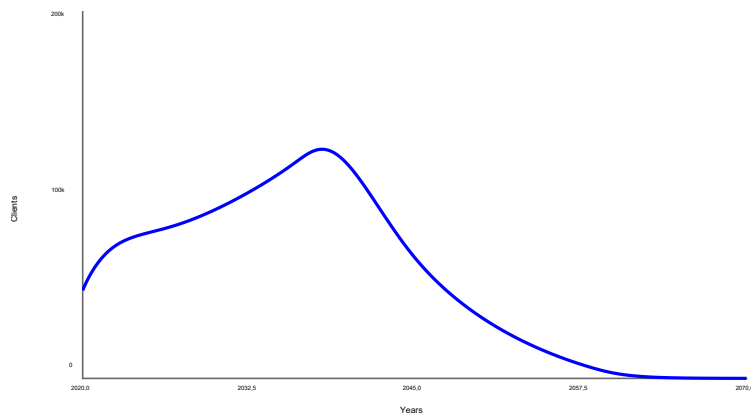
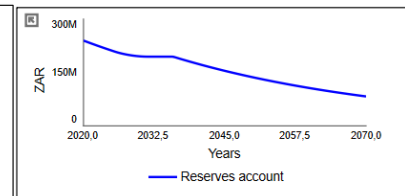
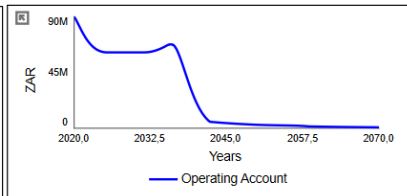
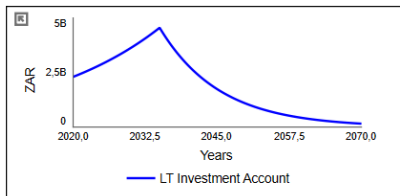


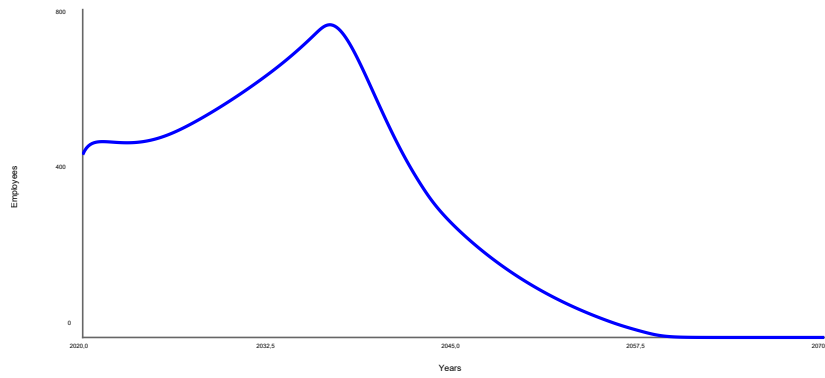


Scenario 27

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	751	67,7M	194M	4,13B
2037	123k	760	61,7M	189M	3,75B
2038	125k	717	48,3M	184M	3,41B
2039	123k	645	33,7M	180M	3,09B
2040	116k	566	21,4M	175M	2,81B
2041	107k	490	12,3M	171M	2,55B
2042	96,6k	421	6,27M	167M	2,32B
2043	85,7k	362	4,87M	163M	2,1B
2044	75,3k	313	4,47M	159M	1,91B
2045	66k	274	4,11M	155M	1,73B

2046	57,8k	240	3,78M	151M	1,57B
2047	50,6k	210	3,48M	147M	1,43B
2048	44,2k	182	3,21M	143M	1,3B
2049	38,5k	157	2,96M	140M	1,18B
2050	33,4k	134	2,75M	136M	1,07B
2051	28,8k	113	2,58M	133M	972M
2052	24,7k	93,6	2,46M	130M	882M
2053	20,9k	76,2	2,36M	127M	801M
2054	17,4k	60,4	2,27M	123M	727M
2055	14,3k	46	2,19M	120M	660M
2056	11,5k	33	2,09M	117M	600M
2057	8,92k	21,7	1,94M	115M	544M
2058	6,59k	11,8	1,65M	112M	494M
2059	4,53k	4,3	1,39M	109M	449M
2060	2,91k	1,2	1,3M	106M	408M
2061	1,8k	0,303	1,22M	104M	370M
2062	1,09k	0,0746	1,14M	101M	336M
2063	660	0,0182	1,06M	98,6M	305M
2064	398	0,00445	999k	96,1M	277M
2065	240	0,00109	938k	93,8M	252M
2066	144	0,000265	882k	91,5M	228M
2067	86,8	0,0000647	830k	89,2M	207M
2068	52,2	0,0000158	782k	87M	188M
2069	31,4	0,00000386	738k	84,8M	171M
Final	18,9	9,41e-7	698k	82,7M	155M

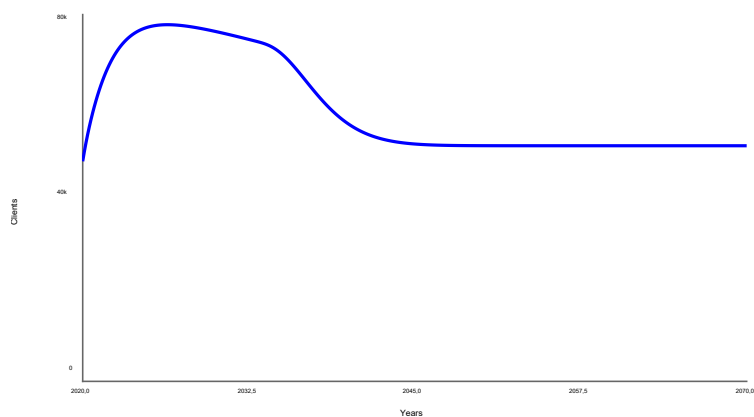
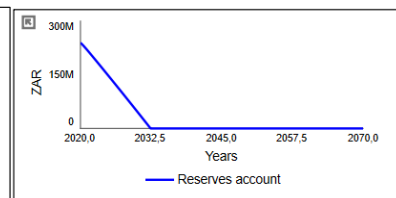
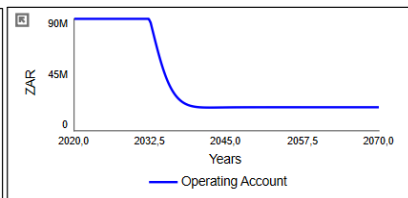
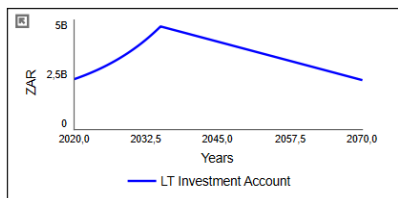


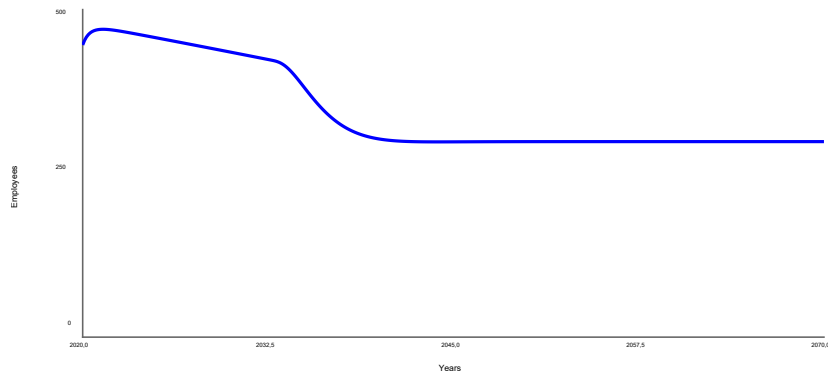


Scenario 28

	clients	total number of employees	Operating Account	Reserves account	L1 Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,2k	469	90M	223M	2,39B
2022	69,1k	469	90M	204M	2,49B
2023	73,6k	465	90M	185M	2,6B
2024	76,1k	461	90M	166M	2,72B
2025	77,3k	457	90M	146M	2,84B
2026	77,8k	452	90M	127M	2,98B
2027	77,7k	448	90M	107M	3,12B
2028	77,4k	444	90M	87,7M	3,27B
2029	76,9k	439	90M	68M	3,44B
2030	76,3k	435	90M	48,2M	3,61B
2031	75,7k	431	90M	28,3M	3,8B
2032	75k	426	90M	8,26M	4,01B
2033	74,2k	421	78,3M	0	4,22B
2034	73,3k	407	59,5M	0	4,46B
2035	71,4k	380	44,2M	0	4,71B
2036	68,4k	352	33,3M	0	4,64B
2037	64,8k	331	26,4M	0	4,57B
2038	61,4k	317	22,4M	0	4,5B
2039	58,5k	308	20,2M	0	4,43B
2040	56,2k	302	19,2M	0	4,36B
2041	54,5k	300	18,8M	0	4,29B
2042	53,3k	299	18,7M	0	4,22B
2043	52,6k	298	18,7M	0	4,15B
2044	52,1k	298	18,7M	0	4,08B
2045	51,8k	298	18,8M	0	4,01B

2046	51,6k	298	18,8M	0	3,94B
2047	51,5k	298	18,9M	0	3,87B
2048	51,4k	298	18,9M	0	3,8B
2049	51,4k	298	18,9M	0	3,73B
2050	51,4k	298	18,9M	0	3,66B
2051	51,4k	298	18,9M	0	3,59B
2052	51,4k	298	18,9M	0	3,52B
2053	51,4k	298	18,9M	0	3,45B
2054	51,4k	298	18,9M	0	3,38B
2055	51,4k	298	18,9M	0	3,31B
2056	51,4k	298	18,9M	0	3,24B
2057	51,4k	298	18,9M	0	3,17B
2058	51,4k	298	18,9M	0	3,1B
2059	51,4k	298	18,9M	0	3,03B
2060	51,4k	298	18,9M	0	2,96B
2061	51,4k	298	18,9M	0	2,89B
2062	51,4k	298	18,9M	0	2,82B
2063	51,4k	298	18,9M	0	2,75B
2064	51,4k	298	18,9M	0	2,68B
2065	51,4k	298	18,9M	0	2,61B
2066	51,4k	298	18,9M	0	2,54B
2067	51,4k	298	18,9M	0	2,47B
2068	51,4k	298	18,9M	0	2,4B
2069	51,4k	298	18,9M	0	2,33B
Final	51,4k	298	18,9M	0	2,26B

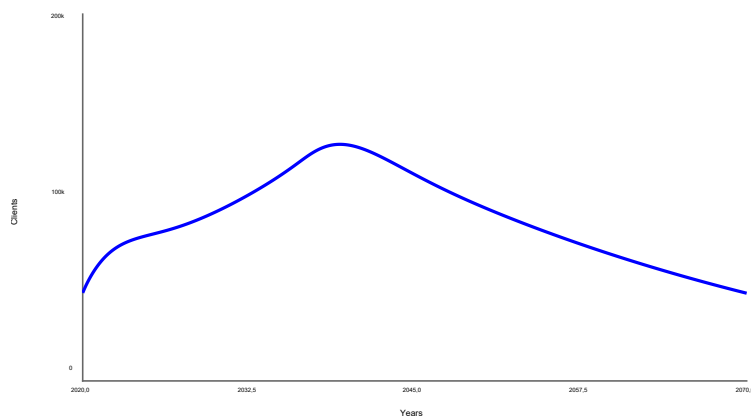
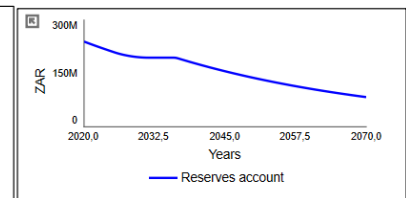
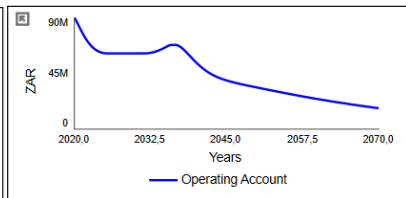
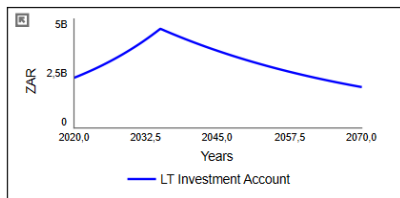


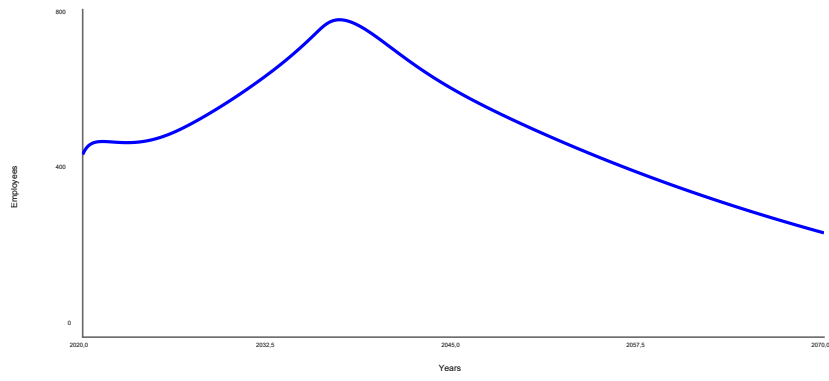


Scenario 29

	clients	total number of employees	Operating Account	Reserves account	LI Investment Account
2020	48k	446	90M	240M	2,3B
2021	61,5k	477	80,9M	234M	2,41B
2022	69,7k	477	72,2M	228M	2,52B
2023	74,6k	475	66,2M	222M	2,64B
2024	77,5k	477	62,8M	217M	2,76B
2025	79,6k	485	61,3M	211M	2,89B
2026	81,4k	498	61,2M	206M	3,02B
2027	83,5k	515	61,2M	202M	3,16B
2028	86k	535	61,2M	199M	3,31B
2029	88,9k	556	61,2M	197M	3,46B
2030	92,1k	579	61,2M	195M	3,62B
2031	95,7k	603	61,2M	195M	3,79B
2032	99,5k	629	61,3M	194M	3,97B
2033	104k	656	62,2M	194M	4,15B
2034	108k	685	63,9M	194M	4,35B
2035	113k	717	66,2M	194M	4,55B
2036	118k	752	68,1M	194M	4,44B
2037	123k	774	67,7M	191M	4,33B
2038	127k	771	64,1M	186M	4,22B
2039	129k	753	59,1M	181M	4,11B
2040	129k	728	54M	177M	4,01B
2041	127k	702	49,5M	173M	3,91B
2042	124k	675	46M	168M	3,81B
2043	120k	650	43,2M	164M	3,72B
2044	116k	627	41,1M	160M	3,62B
2045	113k	605	39,4M	156M	3,53B

2046	109k	585	38M	152M	3,44B
2047	105k	566	36,8M	149M	3,36B
2048	102k	548	35,7M	145M	3,27B
2049	98,4k	531	34,7M	141M	3,19B
2050	95,3k	514	33,7M	138M	3,11B
2051	92,2k	498	32,7M	134M	3,03B
2052	89,3k	482	31,7M	131M	2,96B
2053	86,5k	467	30,7M	128M	2,88B
2054	83,7k	452	29,7M	125M	2,81B
2055	81k	437	28,8M	122M	2,74B
2056	78,4k	422	27,8M	119M	2,67B
2057	75,8k	408	26,9M	116M	2,61B
2058	73,3k	395	26M	113M	2,54B
2059	70,9k	381	25,1M	110M	2,48B
2060	68,5k	368	24,3M	107M	2,42B
2061	66,2k	356	23,5M	105M	2,36B
2062	64k	343	22,7M	102M	2,3B
2063	61,8k	331	21,9M	99,6M	2,24B
2064	59,6k	319	21,1M	97,1M	2,18B
2065	57,5k	308	20,4M	94,7M	2,13B
2066	55,5k	297	19,6M	92,4M	2,07B
2067	53,5k	286	18,9M	90,1M	2,02B
2068	51,6k	275	18,2M	87,8M	1,97B
2069	49,7k	265	17,6M	85,7M	1,92B
Final	47,8k	255	16,9M	83,6M	1,87B





Appendix - B

Model Documentation

	Equation / Initial Value	Properties	Units	Documentation	Annotation
Delivery:					
Actual_Field_Staff_to_Client_Ratio	Total_Number_of_Clients/Field_Staff		Clients/Employees	The number of Clients being served by each field staff member Source: PBO	
Actual_Support_Staff_to_Field_Staff_Ratio	Field_Staff/Support_Staff		Dimensionless	A ratio of Support to Field Staff which is added to the minimum number	
average_salary	total_salaries/Total_number_of_employees		ZAR/Employees/Year	The total salary bill divided by the total number of staff gives the average salary	
Average_Salary_Field_Staff	12000*12		ZAR/Employees/Year	Source: PBO	
Average_Salary_Support_Staff	20000*12		ZAR/Employees/Year	Source: PBO	
benefits	0		Dimensionless	This is to allow for additional benefits or allowances paid to staff	
budget_growth_objective	,05		dmnl	This details the annual growth in the budget	
budgeted_employees	SMTH3(max_affordable_employees; budgeting_delay)*(1+budget_growth_objective)		employees	The number of employees the organisation will have according to the budget	
budgeting_delay	1		Years	Budgeting process happens once a year	
Field_Staff	Siyakhula_Field_Staff+Rest_Field_Staff		Employees	These are the staff that work on the front-line delivering services to beneficiaries / clients	
max_affordable_employees	MAX(0; (spend_down_allowance+total_revenue-administrative_costs)/average_salary)		Employees	Refers to the maximum number of employees which the organisation	

				can afford in its employ based on financial resources available	
Productivity_Ratio	,5		Dimensionless	The ratio of the productivity of a rookie in comparison with that of a fully integrated employee	
Rest_Field_Staff	115		Employees	The field staff not working on the Siyakhula program which will be phased out Source: PBO	
Rest_of_Clients	31600		Clients	The clients of all other programs from Siyakhula Source: PBO	
Rest_of_Support_Staff	35		Employees	Support staff not part of the Siyakhula program Source: PBO	
Siyakhula_Clients	16400		Clients	Clients of the Siyakhula program Source: PBO	
Siyakhula_Field_Staff	101		Employees	Field Staff of the Siyakhula program Source: PBO	
Siyakhula_Support_Staff	7		Employees	Support staff of the Siyakhula program Source: PBO	
"staff_to_client_ratio_(integrated)"	Total_Number_of_Clients/Total_Employees		Clients/Employees	The ratio of clients to each experienced staff member	
"staff_to_client_ratio_(rookie)"	"staff_to_client_ratio_(integrated)"*Productivity_Ratio		Clients/Employees	The ratio of clients to each new (not yet experienced) staff member	
Support_Staff	Rest_of_Support_Staff+Siyakhula_Support_Staff		Employees	These are the back-office staff that support the field workers as well as undertake the administrative duties of the organisation. This	

				will include: 1. A minimum number of support staff regardless of the number of field staff. 2. A support staff to field staff ratio which is the added onto the minimum number	
Total_Employees	Field_Staff+Support_Staff		Employees	The total number of employees in the organisation which equals the field staff	
Total_Number_of_Clients	Siyakhula_Clients+Rest_of_Clients		Clients	The number of clients or beneficiaries of the programs / projects of the organisation	
total_salaries	$(\text{Average_Salary_Field_Staff} * \text{Total_number_of_employees} * (\text{Actual_Support_Staff_to_Field_Staff_Ratio} / (\text{Actual_Support_Staff_to_Field_Staff_Ratio} + 1))) + (\text{Average_Salary_Support_Staff} * \text{Total_number_of_employees} * (1 / (\text{Actual_Support_Staff_to_Field_Staff_Ratio} + 1))) * (1 + \text{benefits})$		ZAR/Year	The combined salary bill of the all employees in the entire organization	
Finance:					
"<average>"	,07		Dimensionless/Year	Assuming an average market growth of 7% per annum	
"<seed>"	INIT(INT(UNIFORM(0; 10000)))		Dimensionless	Introducing stochasticity by using a series of random number generated by the system	
"<stdev>"	,05		Dimensionless/Year	Assuming a standard deviation of 5%	
administrative_costs	(12357800+10000000)		ZAR/Year	All the administrative and operational expenses of the organisation across all existing programs	
cash_withdrawals	IF ("Reserves_Usage_Policy_0_=_n		ZAR/Year	This refers to amounts which	

	o_1 =_yes" = 1) THEN MIN(Reserves_account*max_reserves_usage_per_year; -MIN(0; "surplus_\\(deficit)") ELSE MIN (Reserves_account/DT; -MIN(0; "surplus_\\(deficit)")			are drawn down from cash reserves for purposes of funding the operations. Source: PBO Annual Financial Statements	
change_in_market_value	market_growth*LT_Investment_Account		ZAR/Year	This is the calculates the change to the investment account based on market growth	
cost_per_client	(administrative_costs+salaries)/clients		ZAR/(Clients*Years)	The cost per client is an averager calculated by summing up all the costs and dividing it by the number of clients. With increased productivity, this average could decrease.	
"dividend_payout_ratio_policy_0 =_no_1 =_yes"	1		Dimensionless	This policy allows for a minimum dividend payout per annum	
Dividends_from_Investments	34340541		ZAR/Year	The ZAR value of dividends earned annually	
divident_payout_ratio	0,025		Dimensionless/Year	The assumption is that 5% of the value of the Investment Account is paid annually as a dividend	
Donor_Funds	IF "Donor_Funds_Policy_0 =_no_1 =_yes" = 1 THEN (expenses*Donor_Funds_as_a_Percentage_of_Expenses) ELSE 0		ZAR/Year	These would include funds or grants received from donors ring-fenced for specific programs. None exist currently, however, this could prove useful in the sustainability of carrying out the mission of the organisation and to diversify income streams.	

Donor_Funds_as_a_Percentage_of_Expenses	0,15		Dimensionless	Policy to raise up to 10% of expenses in funds from donors annually.	
"Donor_Funds_Policy_0_=_no_1_=_yes"	1		Dimensionless	Policy switch	
expenses	MAX(0; salaries+administrative_costs)		ZAR/Year	This is the sum of all the expenses. Source: PBO Annual Financial Statements and validated	
fixed_minimum_payout	70000000		ZAR/Year	This is the minimum dividend payout to be paid annually Source: PBO	
Income	Donor_Funds+Interest		ZAR/Year	Income is the sum of interest earned and donor funds received. Source: PBO	UNIFLOW
Interest	Reserves_account*interest_recieved		ZAR/Year	The organisation holds some cash in cash reserves which earn interest. When cash draw downs / withdrawals are necessary due to dividends being insufficient to cover the annual expenses budget, this not only reduces the value of the Cash reserves but also negatively impacts the value of interest earned. Source: PBO	
interest_recieved	,04		Dimensionless/Year	Source: PBO	
investment_income	MAX(0; minimum_payout)		ZAR/Year	This is the amount of income earned from the investments. Source: PBO Annual Financial Statements and validated	UNIFLOW

LT_Investment_Account(t)	$LT_Investment_Account(t - dt) + (change_in_market_value - investment_income) * dt$	INIT LT_Investment_Account = 230000000	ZAR	The value of all the organisation's investments. Source: PBO Annual Financial Statements and validated	NON-NEGATIVE
market_growth	NORMAL("<average>"; "<stdev>"*stdev_switch)		Dimensionless/Year	Calculates the average growth of the market per annum	
max_portion_of_accounts_to_use_per_year	0,30		per year	This is the maximum percentage of the value of the Operating Account which is allowable for use for expenses.	
max_reserves_usage_per_year	0,025		Dimensionless/Years	This policy limits the total funds which can be drawn down from cash reserves.	
minimum_payout	IF "dividend_payout_ratio_policy_0 =_no_1_=_yes" = 0 THEN fixed_minimum_payout ELSE dividend_payout_ratio*reported_income		ZAR/Year	Sets a minimum amount to be earned in dividends annually Source: PBO	
Operating_Account(t)	$Operating_Account(t - dt) + (Income + investment_income + cash_withdrawals - expenses) * dt$	INIT Operating_Account = 90000000	ZAR	This is the operating cash account that receives income and pays expenses Source: PBO	NON-NEGATIVE
reported_income	SMTH3(LT_Investment_Account; reporting_delay)		ZAR	Calculation to determine investment income after a time delay	
reporting_delay	,5		Years	Relates to the period in which dividends are declared and then paid Source: PBO	
Reserves_account(t)	$Reserves_account(t - dt) + (- cash_withdrawals) * dt$	INIT Reserves_account = 239641407	ZAR	This is the amount of Cash reserves which the organisation has in call accounts. Source: PBO Annual Financial	

				Statements and validated	
"Reserves_Usage_Policy_0=_no_1=_yes"	1		Dimensionless	Policy switch	
salaries	total_salaries		ZAR/Year	The salaries paid to all employees of the organisation across all existing programs Source: PBO	
spend_down_allowance	(Operating_Account)*max_portion_of_accounts_to_use_per_year		ZAR/year	This is the amount which is allowable to spend on expenses each year from the Operating Account.	
stdev_switch	0		Dimensionless	Policy switch for the standard deviation	
"surplus_\\(deficit)"	Income+investment_income-expenses		ZAR/Year	Indicates whether the total income covers all expenses	
total_revenue	Income+investment_income		ZAR/Year	In sources of income combined	
Resilience_Testing:					
average_duration	1		Years	Determines the average duration of a shock	
average_magnitude	0,5		Dimensionless	Calculates the average magnitude of a shock	
duration	INIT(NORMAL(average_duration; stdev_duration; "<seed>" + 2; 1; NAN))		Years	Determines the duration of a shock	
magnitude	INIT(NORMAL(average_magnitude; stdev_magnitude; "<seed>" + 1; 0; NAN))		Dimensionless	Determines the magnitude of a shock	
polarity	1		Dimensionless	Determines the polarity of a shock	
shock	1+STEP(magnitude*polarity; start_time)+STEP(magnitude*-polarity; start_time+duration)*0		Dimensionless	Calculation of a series of shocks to be applied	
single_shock	1+STEP(average_magnitude*polarity; start_time)+STEP(average_magnitude*-polarity; start_time+average_duration)*0		Dimensionless	Calculation of a single shock to be applied	

start_time	2035		Year	Start time for a shock	
stdev_duration	,1		Years	Determines the standard deviation of the duration of a shock	
stdev_magnitude	,1		Dimensionless	Determines the standard deviation of the magnitude of a shock	
Skills:					
Becoming_Integrated	new_employees/training_time	OUTFLOW PRIORITY: 1	Employees/Years	This process refers to the orientation period when a new employee is on-boarded into the organisation and into their role. Even candidates who meet the skills match threshold, upon entry require specific orientation.	UNIFLOW
clients(t)	clients(t - dt) + (New_Clients - letting_go_of_clients) * dt	INIT clients = 48000	Clients	Initial number of clients is 48 000. Source for data is PBO and validated	NON-NEGATIVE
exits	integrated_employees*turnover	OUTFLOW PRIORITY: 1	Employees/Years	This is the number of employees who leave the employee of the organisation each year. This number is based on the turnover rate.	UNIFLOW
expansion_time	2		Years	The time for the organization ramp up in terms of staff numbers	
indicated_clients	("staff_to_client_ratio_(rookie)" *new_employees)+("staff_to_client_ratio_(integrated)"*integrated_employees)		Clients	The number of clients which the organisation can service based on the number and productivity ratio of employees	
integrated_employees(t)	integrated_employees(t - dt) + (Becoming_Integrated - exits - layoffs) * dt	INIT integrated_	Employees	Integrated employees are the number of	NON-NEGATIVE

		employees = 258+188		employees who have completed the training period.	
layoffs	layoffs_needed/time_to_layoff	OUTFLOW PRIORITY: 2	Employees/Years	The number of employees to be laid off over the layoff time due to budgetary constraints.	UNIFLOW
layoffs_needed	MAX(0; Total_number_of_employees- budgeted_employees)		Employees	Refers to the number of employees to be laid off to align with affordability	
letting_go_of_clients	-MIN(0; (indicated_clients- clients)/rightsizing_time)		Clients/Years	The number of clients who are exited out of programs over the rightsizing time due to budgetary constraints.	UNIFLOW
New_Clients	(MAX(0; (indicated_clients- clients)/expansion_time))		Clients/Years	The take-on of new indicated clients over the expansion time. This is determined by the number of employees and the staff to client ratio of "rookies" and integrated employees.	UNIFLOW
new_employees(t)	new_employees(t - dt) + (Recruitment - Becoming_Integrated - quitting) * dt	INIT new_emplo yees = 0	Employees	This refers to the number of employees who have been through the recruitment process and are employed by the organisation.	NON- NEGATIVE
quitting	turnover*new_employees	OUTFLOW PRIORITY: 2	Employees/Years	The number of new employees who leave the employ of the organisation prior to becoming integrated. This is based on the turnover rate.	UNIFLOW
Recruitment	MAX(0; vacancy_gaps/time_to_hire)		Employees/Years	The number of people recruited into the organisation based on the	UNIFLOW

				vacancy gap over the time to hire	
rightsizing_time	2		Years	The time it takes for the organisation to rightsize after observing a sustained period of financial decline or less than expected performance	
Rookie_fraction	$\text{new_employees}/\text{Total_number_of_employees}$		Dimensionless	The ratio of new employees to experienced employees	
service_quality	$\text{indicated_clients}/\text{clients}$		Dimensionless	An indicator of whether the quality of service drops due to the client to staff ratio being too high	
time_to_hire	6/12		Years	The average time it takes to employ staff	
time_to_layoff	1		Years	Refers to the time it takes to effect layoffs	
Total_number_of_employees	$\text{new_employees}+\text{integrated_employees}$		Employees	The total number of employees (inexperienced and experienced) in the organization	
training_time	,5		Years	The time it takes for an employee to be fully trained and able to work independently after joining the organisation.	
turnover	turnover_init		Dimensionless/Years	Annual staff turnover rate	
turnover_init	0,35		Dimensionless/Years	The initial turnover rate	
vacancy_gaps	$\text{MAX}(0; \text{budgeted_employees}-\text{Total_number_of_employees})$		Employees	The number of vacancies indicating the number of staff to hire	

Total	Count	Including Array Elements
Variables	91	91
Sectors	4	
Stocks	6	6
Flows	12	12
Converters	73	73
Constants	39	39
Equations	46	46
Graphicals	0	0
Macro Variables	20	

Run Specs	
Start Time	2020
Stop Time	2070
DT	1/16
Fractional DT	True
Save Interval	0,0625
Sim Duration	1,5
Time Units	Years
Pause Interval	0
Integration Method	Euler
Keep all variable results	True
Run By	Run
Calculate loop dominance information	True
Exhaustive Search Threshold	1000

Bibliography

- Château, P.-A., Chang, Y.-C., Chen, H., & Ko, T.-T. (2012). Building a stakeholder's vision of an offshore wind-farm project: A group modeling approach. *Science of The Total Environment*, 420, 43–53. <https://doi.org/10.1016/j.scitotenv.2012.01.031>
- Engemann, K., & Henderson, D. (2012). *Business Continuity and Risk Management: Essentials of Organizational Resilience*.
- Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global Environmental Change*, 16(3), 253–267. <https://doi.org/10.1016/j.gloenvcha.2006.04.002>
- Forrester, J. W. (1978). *Tests for Building Confidence in System Dynamics Models*. System Dynamics Group, Sloan School of Management, Massachusetts Institute of Technology.
- Goldstein, M., Martinez, P. G., Papineni, S., & Wimpey, J. (2020, September 8). *The Global State of Small Business during COVID-19: Gender Inequalities*. <https://blogs.worldbank.org/developmenttalk/global-state-small-business-during-covid-19-gender-inequalities>
- Gunderson, L., & Holling, C. (2003). Panarchy: Understanding Transformations In Human And Natural Systems. *Bibliovault OAI Repository, the University of Chicago Press*, 114. [https://doi.org/10.1016/S0006-3207\(03\)00041-7](https://doi.org/10.1016/S0006-3207(03)00041-7)
- Haji Gholam Saryazdi, A., Ghatari, A., Mashayekhi, A. N., & Hasanzadeh, A. (2021). *Group Model Building: A Systematic Review of the Literature*. 3, 98–136. <https://doi.org/10.26677/TR1010.2020.631>

- Herrera, H. (2017). From Metaphor to Practice: Operationalizing the Analysis of Resilience Using System Dynamics Modelling. *Systems Research and Behavioral Science*, 34(4), 444–462. <https://doi.org/10.1002/sres.2468>
- Holling, C. S. (1996). *Engineering Within Ecological Constraints*. National Academies Press.
- Ibrisevic, I. (2020, November 16). *Top Funding Sources for Nonprofits and Charities in 2022*. Nonprofit Blog. <https://donorbox.org/nonprofit-blog/nonprofit-funding-sources>
- Kim, D. (2016, March 9). *Systems Archetypes I: Diagnosing Systemic Issues and Designing Interventions*. The Systems Thinker. <https://thesystemsthinker.com/systems-archetypes-i-diagnosing-systemic-issues-and-designing-interventions/>
- Pimm, S. L. (1984). The complexity and stability of ecosystems. *Nature*, 307(5949), 321–326. <https://doi.org/10.1038/307321a0>
- Saunders, M. N. K. (2015). Using questionnaire surveys to gather data for within organisation HRD research. *Handbook of Research Methods on HRD*. https://www.academia.edu/23139410/Using_questionnaire_surveys_to_gather_data_for_within_organisation_HRD_research
- Sraders, A., & Lambert, L. (2020, September 28). *Nearly 100,000 establishments that temporarily shutdown are now out of business*. Fortune. <https://fortune.com/2020/09/28/covid-buisnesses-shut-down-closed/>
- Sterman, J. (2000). *Business Dynamics, System Thinking and Modeling for a Complex World*. [Http://Lst-liep.liep-Unesco.Org/Cgi-Bin/Wwwi32.Exe/\[In=epidoc1.in\]/?T2000=013598/\(100\), 19](http://Lst-liep.liep-Unesco.Org/Cgi-Bin/Wwwi32.Exe/[In=epidoc1.in]/?T2000=013598/(100), 19).
- Stuart, L. (2013, April 3). *The South African non-profit sector: Struggling to survive, needing to thrive*. <https://www.polity.org.za/article/the-south-african-non-profit-sector-struggling-to-survive-needing-to-thrive-2013-04-03>

Vaus, D. D., & Vaus, D. de. (2013). *Surveys In Social Research* (6th ed.). Routledge.

<https://doi.org/10.4324/9780203519196>

Warren, K. (2015). *Strategy Dynamics Essentials*. CreateSpace Independent Publishing Platform.