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Enterprise Risk Management

Master's Dissertation

Digital, Enterprise Risk Management Tool
Based on ISO31000:2018 - Risk management guidelines

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Abstract

This thesis aims to the development of a digital enterprise risk management tool that is designed to facilitate the risk management process according to the requirements of ISO 31000:2018. The tool is developed on MS Access 2016 with a focus on user-friendly interfaces and comprehensive reporting capabilities. It includes libraries of risks, organizational objectives, and treatment strategies. The tool provides functions to identify, analyze, evaluate, and address risks, and to analyze the results of the risk management process over time. The tool is intended for use by consultants, risk managers, and managers in organizations of any size. The development of the tool is discussed in detail, including its design and implementation; its potential benefits and limitations are also considered.

The tool is expected to enhance the organization's risk management processes by improving data management, increasing transparency, and providing valuable insights into potential risks and hazards. The results of this project are expected to contribute to the development of effective risk management strategies for organizations and demonstrate the potential benefits of using database systems in risk management.

Acknowledgements

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I am also grateful to my beloved wife Vasilia for her unwavering support and encouragement during this long and often challenging process.

Finally, I would like to thank my dear son for bringing joy and happiness into my life every day. His presence kept me motivated to pursue my goals.

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Introduction

Risk management is a critical process in any organization to identify, assess, and treat potential risks that could impact its objectives. To achieve effective risk management, it is important to have an efficient and reliable system to support the process. In this thesis, we present a database system for risk management that incorporates various reports and forms to facilitate the risk management process.

The Digital, Enterprise Risk Management tool is developed using Microsoft Access, which provides a user-friendly interface to manage data and generate reports. The database is designed to support the risk management process in an iterating manner, as recommended by ISO 31000:2018. The tool is composed of several forms that capture information related to risk management, such as risk identification, risk analysis, risk evaluation, risk treatment, and risk communication. The forms also include functionalities to generate reports that help in decision-making. The reports included in the Digital Risk Management tool provide critical information on objectives, risk management team, risks identified and assessed, treatment actions, and communication plans.

The Digital Enterprise Risk Management Tool is designed with a specific focus on Enterprise Risk Management (ERM). As such, the tool contains a range of data and features specifically aimed at helping organizations identify, assess, and manage risks at the enterprise level. This includes a prefilled risk registry with enterprise risks, as soon as a prefilled enterprise's objectives index.

In summary, this thesis presents a comprehensive database management system tool for risk management that incorporates various forms and reports to support the risk management process. It is designed to be user-friendly and to facilitate decision-making by providing critical information on risks, objectives, and treatment actions. The digital risk management tool is also scalable and can be customized to fit the specific needs of any organization.
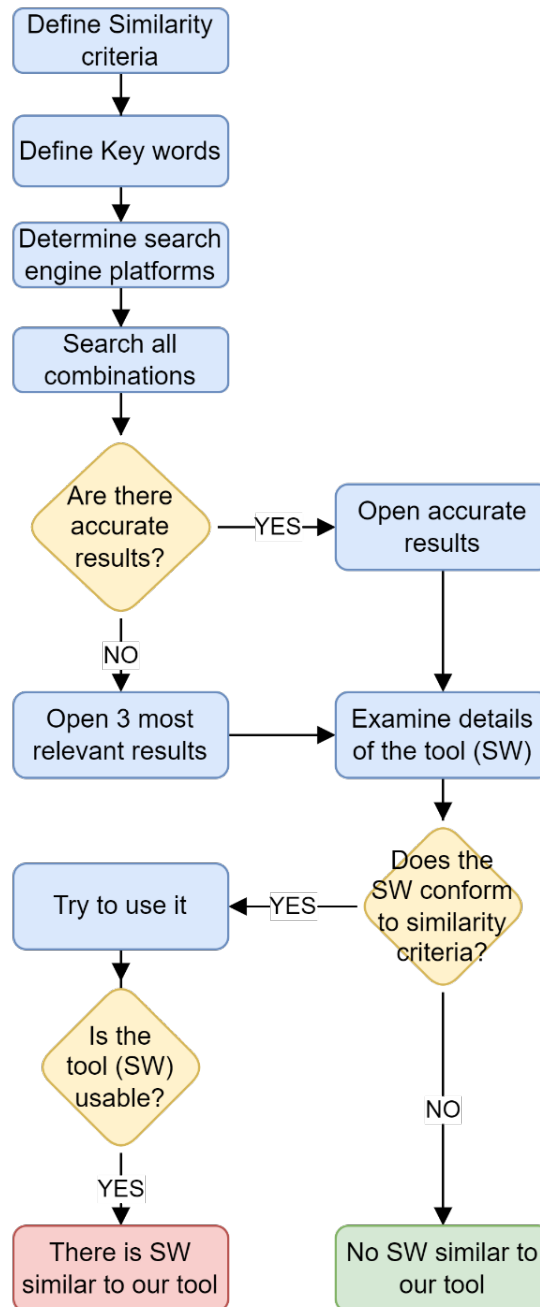
1. Research on "Free Enterprise Risk Management Softwares"

Before developing our Risk Management Tool, we conducted a brief research on the web for available, free of cost, Risk management tools (softwares).

1.1. Methodology

The methodology used for our brief research of current available enterprise risk management tools research is described in diagram 1, below:

Diagram 1

```
        ┌─────────────────────┐
        │ Define Similarity   │
        │      criteria       │
        └──────────┬──────────┘
                   ↓
        ┌─────────────────────┐
        │  Define Key words   │
        └──────────┬──────────┘
                   ↓
        ┌─────────────────────┐
        │ Determine search    │
        │  engine platforms   │
        └──────────┬──────────┘
                   ↓
        ┌─────────────────────┐
        │    Search all       │
        │   combinations      │
        └──────────┬──────────┘
                   ↓
            ◇ Are there
              accurate       ──YES→  ┌─────────────────┐
              results? ◇             │  Open accurate  │
                   │                 │    results      │
                  NO                 └────────┬────────┘
                   ↓                          ↓
        ┌─────────────────┐        ┌─────────────────┐
        │  Open 3 most    │───────→│ Examine details │
        │ relevant results│        │  of the tool(SW)│
        └─────────────────┘        └────────┬────────┘
                                            ↓
        ┌─────────────┐          ◇ Does the
        │ Try to use it│←──YES──   SW conform
        └──────┬──────┘            to similarity
               ↓                   criteria? ◇
          ◇ Is the                    │
            tool (SW)                 NO
            usable? ◇                 ↓
               │                ┌─────────────────┐
              YES               │ No SW similar to│
               ↓                │    our tool     │
        ┌─────────────────┐     └─────────────────┘
        │  There is SW    │
        │similar to our tool│
        └─────────────────┘
```

1.2. Research details

To start, we established a set of criteria that would identify whether an existing software for Enterprise Risk Management is similar to our Digital, Enterprise Risk Management Tool. These criteria are:

1. Free of cost
2. Conforming to the requirements of ISO 31000.

The key words used for our searches were:

1. "Free Enterprise risk management software"
2. "Free risk management software"
3. "Enterprise risk management tool"

The platforms used for our search were the following:

- www.google.com : Google.com is a search engine developed by Google LLC that allows users to search for information on the internet. It uses a complex algorithm to crawl and index web pages and delivers relevant search results to users based on factors such as the content of the page, its popularity, and the user's location and search history. Google.com also offers a range of search options and filters to refine search results, such as image and video search, news search, and advanced search. Additionally, Google.com provides other features and services, such as maps, email, and document editing, making it a comprehensive and reliable tool for internet users.

- www.capterra.com : Capterra.com is an online directory and reviews platform that helps businesses find and compare software solutions for their needs. The platform features over one million user reviews of software products in hundreds of categories, such as CRM, accounting, and project management. Capterra.com provides users with tools to filter and compare software products based on features, pricing, and user ratings, making it easier for businesses to find the right software solution for their specific requirements. The platform also offers resources such as blog articles, e-books, and webinars to help businesses stay informed about the latest trends and best practices in software technology.

- www.sourceforge.net : SourceForge.net is a web-based platform that provides developers with tools to develop, manage, and distribute software projects. The platform offers a range of features, including version control, bug tracking, and collaborative coding tools. SourceForge.net hosts thousands of open-source software projects across a wide range of categories, including business, education, gaming, and multimedia. The platform allows developers to create and manage their projects, collaborate with other developers, and distribute their software to users around the world. Additionally, SourceForge.net provides resources such as forums, documentation, and user reviews to help developers improve their projects and connect with the wider software development community.

- www.g2.com : G2.com is a business software review and comparison platform that helps businesses find and choose the best software solutions for their needs.

The platform features millions of user reviews and ratings of software products across hundreds of categories, such as CRM, HR, and project management. G2.com provides users with tools to filter and compare software products based on features, pricing, and user ratings, making it easier for businesses to make informed purchasing decisions. The platform also offers resources such as blog articles, webinars, and reports to help businesses stay informed about the latest trends and best practices in business software.

1.3. Research results

1.3.1. Elaborate findings

This paragraph provides a detailed analysis of the research's outcomes. The softwares found for enterprise risk management are provided in line with their conformity or not with our similarity criteria.

Software	Description	Free?	ISO 31000?
Search results on Google Platform			
Workviva	"Real-time risk management has never been this easy. Tie data across risk assessments, controls, and audit—enabling more accurate, connected decisions and real-time insights across all three lines of defense." (www.workiva.com, n.d.)	No	No
Ideagen Pentana Risk	"Ideagen Pentana Risk provides complete visibility and control of your organization's risks. Track and report on any type of risk that could impact your business, and adapt quickly to the unexpected." (Ideagen solutions For Regulated Industries, n.d.)	No	Yes
DecisionRules	"Business Rule Engine for Insurance. DecisionRules intelligently helps you improve product pricing and client rating calculations in a transparent and user-friendly environment." (DecisionRules, n.d.)	No	No
SimpleRisk	"SimpleRisk is a comprehensive GRC platform that can be used for all of your Governance, Risk Management and Compliance needs. It boasts functionality that is comprehensive enough to be utilized by some of the largest organizations on the planet while presenting a user interface that is so simple and intuitive it can be used by the least technical people in your organization." (Simplerisk, n.d.)	No	Yes
MetricStream ERM software	"MetricStream Enterprise Risk Management (ERM) software enables a structured approach towards managing your organizational risks. Built on the MetricStream Platform and supported by uniform risk assessment methodologies and standards, the ERM software helps you accurately understand risk exposure at multiple levels of your organization. Multi-dimensional risk and control assessments based on qualitative and quantitative parameters can be performed to establish your risk profile. Real-time insights into your risk management processes through	No	No

Software	Description	Free?	ISO 31000?
	powerful analytics, advanced heat maps, reports, dashboards, and charts empower you to make smarter and risk-aware decisions." (www.metricstream.com, n.d.)		
ZohoCreator	A client can built custom software to streamline his/her risk management. Zoho creator is a software to create your ERM system, not a ready to use solution (www.zoho.com, n.d.)	No	No
www.project-risk-manager.com	"A fundamental aspect of successfully managing projects is to have both the right understanding and the right tools to efficiently manage risks which are inherent in every project. To help achieve this, we have developed our Project Risk Management software application, which is designed to be as intuitive as possible, guiding users to accurately identify, quantify and mitigate all risks on their projects. Our Project Risk Manager software application is now better and more accessible than ever before. We have improved the functionality of our FREE version to allow you to add any number of guest users, who are able to view and run reports on all your projects and risks, but are unable to edit any of your data. That way, your project and risk data cannot be changed or deleted by anyone other than yourself, and you control who gets to see your projects and risks, and who can't." (www.project-risk-manager.com, n.d.)	Yes	No
JamaSoftware	"Develop Quality Products with Integrated Risk Management Software As regulatory requirements become more complex and product recalls more common, documenting and controlling risk must be a byproduct of development, not something done after the fact. Jama Connect allows for risk analysis aligned to industry standards and regulations, treating risk management as an integral part of the product lifecycle process. Your organization can standardize and integrate your risk analysis, evaluation, and risk management processes in our platform to create a single source of truth for everything risk related." (Jamasoftware, n.d.)	No	Yes
Search results on Capterra Platform			
Granite Risk Management	"Granite Risk Management is an easy-to-use enterprise risk management tool for robust risk management. Low cost and customisable, Granite Risk Management comes with ready-made risk management templates, adaptable workflows, automated action tracking and incident reporting - no coding needed. Assess likelihood and impact of risks, reveal enterprise-wide risks with real-time data and automate continuous	No	Yes

Software	Description	Free?	ISO 31000?
	monitoring and ensure visibility of existing and emerging risks." (Capterra.com, n.d.)		
GOAT Risk	"GOAT is an easy to use, low cost Enterprise Risk Management software solution packed with all the tools you need to manage risk effectively. Track, collaborate and report on risk from anywhere in the world using a modern, intuitive interface. Sensible, transparent pricing. Suitable for businesses of all shapes and sizes." (www.capterra.com, n.d.)	No	No
Risk Warden	"Risk Warden is a cloud-based software platform that provides a digital framework to manage all your property risk and compliance, from compliance governance to data capturing through to analysis and everything in between, providing you with a single source of truth. Key benefits: - Increases efficiency, lowers costs - Reduces risk, increases compliance - Improves strategic performance - Increases accuracy & consistency - Gives you a competitive advantage" (www.capterra.com, n.d.)	No	No
@RISK	"@RISK performs risk analysis using Monte Carlo simulation to show you many possible outcomes in your spreadsheet model and how likely each are to occur. It mathematically and objectively computes and tracks many different possible future scenarios, then tells you the probabilities and risks associated with each different one. This means you can judge which risks to take and which ones to avoid, allowing for the best decision-making under uncertainty." (www.capterra.com, n.d.)	No	No
BIC GRC	"Optimize your enterprise risk management with BIC Enterprise Risk, which lays the foundation for your successful governance, risk and compliance strategy. The professional, digital solution gives you an overview of the entire risk situation in your company and ensures conformity with popular risk management standards. Bank on state-of-the-art technology to evaluate risks intuitively and efficiently as well as define appropriate actions." (www.capterra.com, n.d.)	No	No
Search results on SourceForge Platform			
Enterprise Process Center (EPC)	"Interfacing's Digital Twin Organization software provides transparency and Governance to improve Quality, Efficiency, and ensure Regulatory Compliance. Map, analyze, and automate processes, manage regulatory compliance, assess risks within a single platform! Interfacing's digital twin solution (Enterprise Process Center - EPC) is an enterprise management system that helps companies digitalize	No	No

Software	Description	Free?	ISO 31000?
	processes to streamline operations, increase productivity, and continuously improve. Interfacing's digital business platform – Rapid Application Development (RAD) Tools, with its Low-Code Development methodology will optimize usage of your technical resources and maximize transparency for ongoing improvement." (sourceforge.net, n.d.)		
Qualityze EQMS Suite	"Qualityze is a leading provider of enterprise quality management solutions, utilizing the Salesforce.com Technology Platform to build our EQMS Software solutions. Our team is 100% devoted to quality processes, compliance, and regulatory guidelines to address our customers' business environments. We do not distract ourselves with custom work or quality concerns." (sourceforge.net/, n.d.)	No	No
IriusRisk	"IriusRisk is the industry's leading threat modeling and secure design solution in Application Security. With enterprise clients including Fortune 500 banks, payments, and technology providers, it empowers security and development teams to ensure applications have security built-in from the start - using its powerful threat modeling platform. Whether teams are implementing threat modeling from scratch, or scaling-up their existing operations, the IriusRisk approach results in improved speed-to-market, collaboration across security and development teams, and the avoidance of costly security flaws." (sourceforge.net, n.d.)	No	No
Risk Management Studio	"Risk Management Studio is the Integrated Risk Management Framework companies and institutions are choosing to clarify their vision for governance, risk and compliance. The IRMF software provides an extensive toolkit of solutions that guide you through the implementation of risk management policies, processes and procedures. Compliance is an organizations willingness to implement and follow requirements set by third parties, such as certifying agents, government bodies, and/or internal standards. RM Studio's Integrated Risk Management framework provides a holistic and systematic approach as a turnkey solution ready for your deployment now. The compliance to a standard, regulation, or law requires several key elements to come together in an organization. A Gap analysis is most commonly used and often required for proof of compliance." (sourceforge.net, n.d.)	No	No
Vulcan Enterprise	"At Vulcan Cyber we're changing the way businesses reduce cyber risk through vulnerability remediation orchestration. We help IT security teams go beyond remedial vulnerability management to help them drive vulnerability remediation outcomes. The Vulcan platform consolidates vulnerability and asset data, with	No	No

Software	Description	Free?	ISO 31000?
	threat intelligence and customizable risk parameters to deliver risk-based vulnerability prioritization insights. But we don't stop there. Vulcan remediation intelligence takes the vulnerabilities that matter to your business and attaches the remedies and fixes needed to mitigate the threat. Then Vulcan orchestrates and measures the rest of the remediation process with integrations and inputs into application security, DevSecOps, patch management, configuration management, and cloud security tools, teams and functions. From scan to fix, Vulcan Cyber delivers the unique ability to orchestrate the entire vulnerability remediation process to GET FIX DONE at scale." (sourceforge.net, n.d.)		
Search results on G2 Platform			
Percona Monitoring and Management (PMM)	"Percona Monitoring and Management (PMM) is an open source database observability, monitoring, and management tool. It allows database users to observe the health of their systems, explore new patterns in database behavior, quickly troubleshoot issues, and perform database management operations no matter where they are located - on-premises or in the cloud. PMM insights help catch and fix database issues before they start affecting end-users, enabling Developers, DBAs & SREs to focus on important projects instead of spending most of their time hunting down the root cause of the database performance degradation or downtime incidents." (www.g2.com, n.d.)	No	No
Auditrunner	"Auditrunner is designed to provide a user-friendly, comprehensive low-code software platform that encompasses all facets of Internal Audit, Risk, Compliance (GRC), and Quality Management. The architecture allows organizations of all sizes to interconnect people and systems to design and run GRC processes seamlessly. SOX, Internal Audit and Audit Analytics can all be managed on one platform. Previous Audits, Risk Scores and many other details can be copied from previous years." (www.g2.com, n.d.)	No	Yes
Effivity Food Safety Management	"Effivity Food Safety and HACCP Management Software is a comprehensive solution designed to help food industry professionals manage food safety and quality assurance processes. Our software offers a user-friendly platform for tracking and analyzing food safety data, automating compliance with food safety regulations, and streamlining internal and external audits. With features like supplier management, HACCP (Hazard Analysis and Critical Control Points) tracking, and incident management, Effivity Food Safety Management Software helps your companies improve	No	No

Software	Description	Free?	ISO 31000?
	food safety, reduce risks, and maintain the highest standards of quality in the food industry." (www.g2.com, n.d.)		
Pricefx	"For Enterprises facing pricing challenges, who need to reliably accelerate profitable growth, and want precision, visibility, and efficiency in their pricing execution, Pricefx is The cloud pricing optimization, management, and CPQ platform that provides a transparent and responsive solution to price right, every time.Unlike Excel, home-grown tools or legacy Gen1 solutions, our product is the pricing platform for you to dynamically plan, price, and profit." (www.g2.com, n.d.)	No	No
Pirani	"We are democratizing risk management with easily accessible software and a collaborative knowledge community for companies to protect what matters to them, easily solve their regulatory compliance and ensure their business continuity." (www.g2.com, n.d.)	No	Yes
Proteus	"Proteus is an end to end project management solution, providing real-time visibility over key metrics. This gives you the power to make data-driven decisions that will improve your project profitability and deliver higher quality project outcomes. Use Proteus to implement simple, robust project performance controls for your business, helping you achieve digital acceleration. Low-cost and feature-rich, Proteus provides an integrated platform for project planning, project management and project controls. Starting at the earliest project planning or proposal stage, Proteus hard-wires data accuracy and consistency into the full project life cycle. Designed to sit at the heart of your business, Proteus connects to your existing business systems and provides full, real-time visibility over key metrics. If you need to make a demonstrable change to the way your organisation manages projects, if you want to achieve digital acceleration, if your remit is business success, you have a responsibility to implement the right digital system. Proteus comes with a team of project management experts, strategists and developers designed to deliver success for our customers." (www.g2.com, n.d.)	No	No
Procipient	"Procipient® is a next-generation, ERM/GRC and universal evaluation software. It includes integrated multi-factor assessment, document management, audit tracking, issue remediation, workflow, alerting, and reporting capabilities. Procipient® delivers an intuitive, user-friendly and configurable interface, and its intelligent design is able to offer an incredibly fast and easy implementation process. The software is built around a structured framework which can be fully configured by the user, or we offer prebuilt,	No	Yes

Software	Description	Free?	ISO 31000?
	configurable templates. The system also allows you to associate documents with specific parts of your framework, and map them to related laws, regulations, or guidance. Procipient® is perfectly suited for when you are conducting risk assessments, evaluations, readiness scorecards or similar functions. The applications are limitless, with current templates available for areas such as Enterprise Risk Management, GRC, Cybersecurity, RFP Analysis, and more." (www.g2.com, n.d.)		
FileHandler Enterprise	"FileHandler Enterprise is an intuitive Claim Administration System designed to help streamline and automate the workflow for claims and risk management companies. Complete with new dashboards, reporting functionality, business intelligence tools, and the latest security technology, the FileHandler Enterprise system is the new benchmark for all claims management systems in the industry. FileHandler Enterprise helps TPA's, Carriers, Risk Pools, Risk Managers, and a variety of other business professionals administer claims, payment, and employee data to effectively manage their business." (www.g2.com, n.d.)	No	No

1.3.2. Summary of results

The summary of results obtained from the platforms used for the two defined similarity criteria are presented in Table 1.

Table 1

	Google	Capterra	Sourceforge	G2	Summary
Accurate Results (Conform with both criteria)	0/8	0/5	0/5	0/8	0/26
Free of Cost	1/8	0/5	0/5	0/8	1/26
Solution for Enterprise Risk Management	3/8	1/5	0/5	3/8	7/26

We have made some notices below according to the results:

1. Risk management tools are costly and priced up to thousands $ annually.
2. There was found only one risk management tool free of cost.
3. Only a few percentage of risk management tools are based on the requirements of the international standard ISO 31000.
4. None of the softwares found was both free of cost and based on ISO 31000 requirements.

1.4. Conclusion of similar tool research

After conducting a search using our defined similarity criteria, we found that there were no existing tools that met our specific requirements for Digital, Enterprise Risk Management Tool based on the requirements of the international standard ISO31000:2018. Therefore, we proceeded with the development of our own tool without any revisions to our criteria and objectives. We believe that our tool will fill a significant gap in the market, particularly for small and medium enterprises who may not have the resources to invest in costly risk management solutions. Our tool is available free of charge and provides an accessible and comprehensive solution for those interested in conducting enterprise risk management.

2. Definitions

Basic definitions related to risk management are used as presented below:

Risk: effect of uncertainty on objectives (ISO 31000:2018 - Risk Management Guidelines, 2018)

Risk management: coordinated activities to direct and control an organization with regard to risk. (ISO 31000:2018 - Risk Management Guidelines, 2018)

Stakeholder: person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or activity (ISO 31000:2018 - Risk Management Guidelines, 2018)

Consequence: outcome of an event affecting objectives.

Likelihood: chance of something happening (ISO 31000:2018 - Risk Management Guidelines, 2018)

3. Risk Management Process

3.1. General Information

The risk management process of our tool is based on the risk management process as defined by the international standard ISO 31000:2018, as shown on diagram 2.

Diagram 2 - (ISO 31000:2018 - Risk Management Guidelines, 2018)
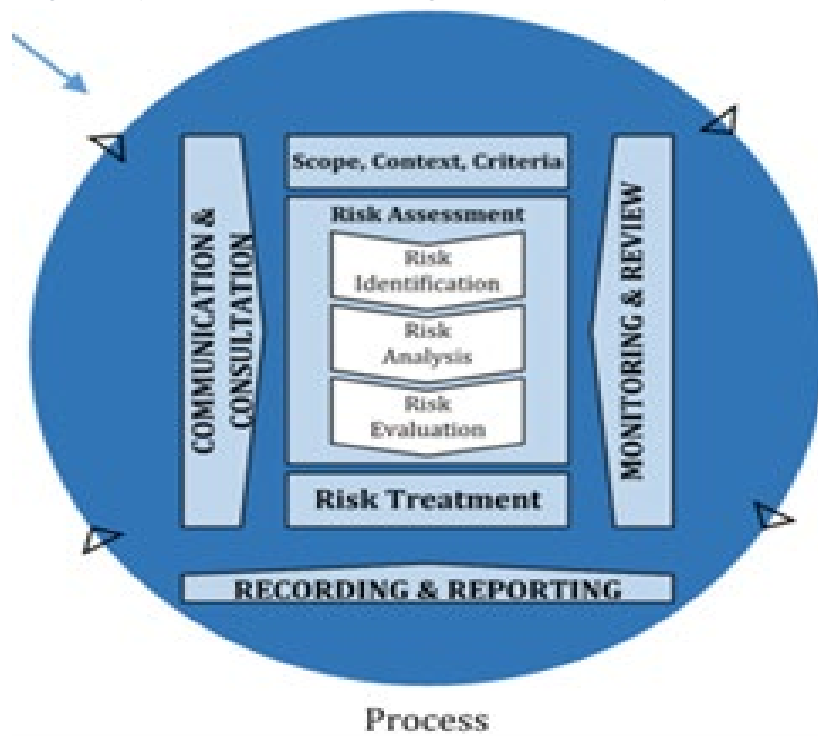
3.2. Flowchart

A more analytical step by step representation of risk management cycle is shown in diagram 3 and it is described in next paragraphs.

Diagram 3
Risk Management Process Cycle
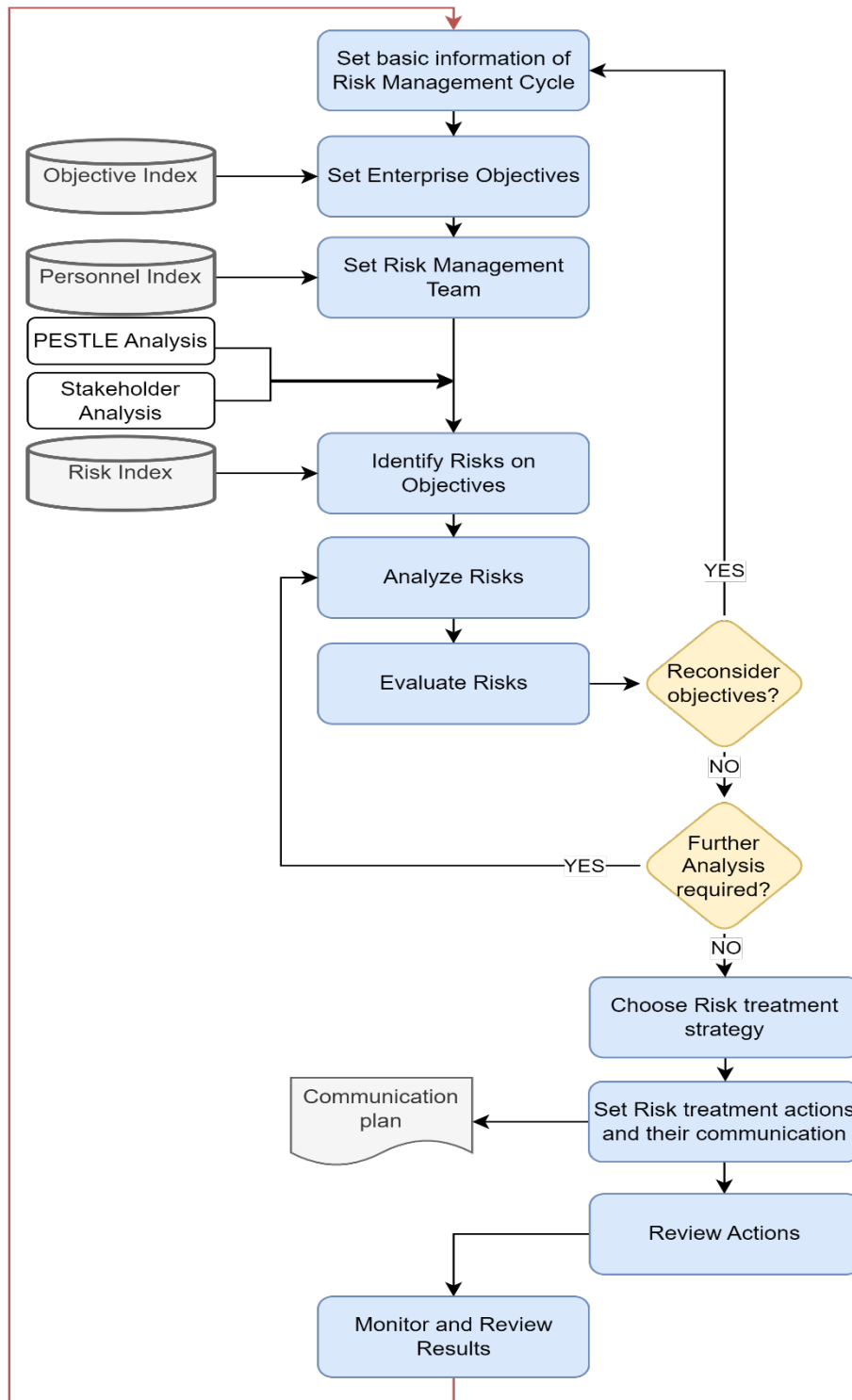
3.3. Preliminary Information

3.3.1. Analysis Of Environment

The analysis of the internal and external environment is required to support the proper conduction of risk analysis. It is suggested to have been conducted before the risk management cycle.

3.3.2. Risk Evaluation Criteria

Risks are classified based on the probability of occurrence and the severity of their consequences. Our risk management process follows the specific classification criteria as provided below.

Table 2: Probability of occurrence (S)

TERM	RATE	DESCRIPTION
very likely to occur	5	At least once in a week
likely to occur	4	At least once in 6 months (no more than once in a week)
May occur	3	At least once in 2 years (no more than once in 6 months)
unlikely to occur	2	At least once in 7 years and (no more than once in 2 years)
very unlikely to occur	1	Less than once in 7 years

Table 3 : Severity of consequences (S)

TERM	RATE	DESCRIPTION - EFFECTS - HARM
Catastrophic	5	Consequences can stop Enterprise's activities forever
Serious	4	Enterprise requires 1 year or more to recover to normal activity from consequences
Moderate	3	Enterprise requires up to 1 year or more to recover to normal activity from consequences
Minor	2	Enterprise does not deviate from its normal activity, but suffers some damage that cannot be repaired immediately or it can cause further consequences in case of immediate repair.
Negligible	1	Enterprise does not deviate from its normal activity and any damage can be repaired immediately without further consequences.

At implementing the above evaluation, by combining P and S, risks are classified in four levels:

  i. Low
 ii. Moderate
iii. High
 iv. Very High

Classification of risks according to probability/severity combination is presented on the table 4, below:

Table 4: (P x S) Classification of Risks

			SEVERITY (S)				
			NEGLIGIBLE	MINOR	MODERATE	SERIOUS	CATASTROPHIC
			1	2	3	4	5
PROBABILITY (P)	VERY LIKELY TO OCCUR	5	High	High	Very High	Very High	Very High
	LIKELY TO OCCUR	4	Moderate	Moderate	High	Very High	Very High
	MAY OCCUR	3	Low	Moderate	Moderate	High	Very High
	UNLIKELY TO OCCUR	2	Low	Low	Moderate	Moderate	High
	VERY UNLIKELY TO OCCUR	1	Low	Low	Low	Moderate	High

3.4. Risk management process' steps

3.4.1. Basic information of risk Management Process cycle

Within the first step of risk management process cycle there have to be provided basic information about the conducted cycle.

The information include:
– Date the cycle started [mandatory]
– Reason (Scheduled/Urgent/After implemented actions/ Reconsider Objectives/ Other) [mandatory]
– Location [optional]
– Scope for this risk management cycle [mandatory]
– Exclusions (if any)
– Expected outcomes of this risk management cycle [optional]
– Available resources to manage risks [optional]
– Any comments regarding this risk management cycle [optional]

3.4.2. Set Enterprise Objectives

Enterprise objectives are set regarding the scope set on the previous step. They are categorized for easier management and review. The objective categories are based on their subject and according to (Quezada, Cordova, Palominos, Godoy, & Ross, 2009) they are:

- ✦ FINANCIAL
- ✦ CLIENTS
- ✦ PROCESSES
- ✦ DEVELOPMENT
- ✦ PRODUCT
- ✦ HUMAN RESOURCES

- ✦ MARKET/COMPETITION
- ✦ ENVIRONMENTAL
- ✦ SOCIAL
- ✦ GOVERNMANCE
- ✦ LEGAL
- ✦ HEALTH AND SAFETY
- ✦ POLITICAL
- ✦ SUPPLIERS

Objectives are the basis of risk management as every risk refers to, at least one, objective.

3.4.3. Set Risk Management Team

The risk management team consists of persons that either are part of the enterprise or collaborators.

Every risk management team may have members, experts and a leader. While setting the team, users must define for every team member:

- - Name and
- - role in the team

3.4.4. Risk Identification

Risks are being identified on objectives. For every objective set, there are being identified risks. Any objective may be affected by many risks. On the other hand, the same risk may affect many objectives.

For easier management of Risks, we separate them into different categories. So, for every risk identified there must be defined:

- - The risk
- - Its category

The risk categories are listed on table 5, based on the list provided in (Segal, 2011):

Table 5: Risk Categories

Risk Category	Definition
Financial	A category of risks related to unexpected changes in external markets, prices, rates, and liquidity supply and demand. See also market risk, credit risk, and liquidity risk.
Strategic	A category of risks related to unexpected changes in key elements of strategy formulation or execution. This is highly variable by company and must be customized. It includes risks about viability of strategy, its execution, Governance, strategic relationships, competitors, suppliers, changes in economy, external relations, as soon as legislative/regulatory and international risks.
Operational	A category of risks related to unexpected changes in elements related to operations, such as human resources, technology, level of compliance, litigation, external fraud, processes and disasters.

3.4.5. Risk Analysis

Risk analysis aims to analyse every risk as much as possible, in order to understand its nature and characteristics and determine its level.

To analyse the identified risks, it is useful to use the Enterprise's PESTLE analysis, as soon as the stakeholder analysis that may have been conducted.

For the risk analysis there must be determined for every risk:

- The Risk owner (who have the accountability and authority to manage risk)
- Probability of occurrence (according to §5.3.2)
- Severity of consequences (according to §5.3.2)
- Information about risk (to the extent RM team decides)
    - consideration of uncertainties,
    - risk sources, events, scenarios,
    - risk consequences,
    - involvement of stakeholders
    - controls and their effectiveness
    - divergence of opinions, biases, perceptions of risk and judgements
    - communications and consultation

Based on Probability of Occurrence and Severity of consequences, according to risk evaluation table (see §5.3.2), it is determined the risk level.

3.4.6. Risk Evaluation

Based on risk analysis conducted, RM team decides:

- Stop any action about the risk and do nothing about it.
- Proceed to determine risk treatment actions.
- Return to risk analysis step, to better understand the risk.
- Maintain existing controls, but take no additional actions.
- Conduct a new RM cycle reconsidering Enterprise objectives.

Additional to the evaluation decision, there must be recorded any notes about the consequences of the decision taken, communications and consultation related to this step.

3.4.7. Risk Treatment

Risk treatment includes a decision of the treatment strategy the Enterprise will follow to address risk as soon as any action required to support this strategy.

Treatment strategies that may be followed are (Borge, 2001)(p.68-78):

a) **Prevention**: Prevent or avoid the unwanted risk.

b) **Creation**: Create desirable risks. Desirable risks are those embedded in attractive opportunities where you believe that the potential gain outweighs the risks.

c) **Buying and selling**: If you cannot prevent or avoid an unwanted risk, you may be able to sell it. If you cannot create a desired risk, you may be able to buy it

d) **Diversification**: Don't put all your eggs in one basket.

e) **Concentration**: Put all your eggs in one basket.

f) **Hedging**: You hedge when you acquire a new risk that exactly offsets the unwanted risk, leaving you with no risk.

g) **Leveraging**: When you leverage a risk, you magnify all of its potential outcomes, good and bad. One such case is when you would rather preserve the possibility of extremely good outcomes than reduce the probabilities of very bad outcomes.

h) **Insurance**: When you insure a risk, you pay a premium to an insurer who will pay you money *if and only if* a loss event occurs.

After formulating a risk treatment strategy, the necessary actions to address the identified risks are determined. These actions are then summarized to create a communication plan for risk management. The risk management team is responsible for determining:

- ✓ category of communication (inform, train, assign)
- ✓ Receiver of communication
- ✓ Media of communication
- ✓ Actions that must be taken

3.5. Monitor and Review

3.5.1. Risk Management Process

Every risk management process can be reviewed any time. This includes reviewing selected objectives, the risk management team, identified risks, risk analysis, risk evaluation, and risk treatment. These aspects of the risk management process can also be reviewed at any point during the process.

3.5.2. Risks

Risks can be reviewed by running the risk management process again any time.

Monitoring of any risk includes:

- Risk level through time,
- risk management processes that identified the risk and the analysis conducted,
- objectives affected by the risk,
- actions determined to address the risk and their status.

3.5.3. Objectives

Objectives are selected and reviewed for every risk management process.

Monitoring of each objective includes:

- Risks affecting the objective and their level
- risk management processes that set the objective

3.5.4. Treatment

In the process of risk management, communications are categorized according to their related risks, resulting in a communication plan. This plan includes information about the status of each action, indicating whether it is "Pending," "Cancelled," or "Completed."

All actions are being monitored till they are completed or cancelled.

4. Enterprise Risk Management tool

The Digital Enterprise Risk Management Tool is a powerful and versatile software tool designed to support effective enterprise risk management practices in organizations of all sizes. Developed based on the ISO 31000:2018 standard, this tool provides a comprehensive set of features and functions to enable users to identify, assess, and manage risks across their organization.

To maximize the benefits of this tool, it is essential to understand its key features and functions, and how to use them effectively. This set of instructions provide step-by-step guidance on how to use the tool, from setting up the initial parameters to managing risks over time. Whether you are a risk manager, consultant, or manager, this guide will help you harness the power of the Digital Enterprise Risk Management Tool to enhance risk management practices and ensure the continued success of your organization.

4.1. Technical Specifications

Developer: Savvas P. Fengos

Date: May 2023

Software used: MS Access (2016) .accdb file

Objects Index: §4.7.

Entity-relationship diagram: §4.8.

Scalability: MS Access (2016) limitations

Performance: MS Access (2016) limitations

Security: MS Access (2016) limitations

4.2. Initial parameters

When using the Digital Enterprise Risk Management Tool, the initial parameters refer to the settings and configurations that need to be set up before using the tool for the first time. These parameters typically include technical parameters (MS Access file options) and user parameters (setting organizational objectives, risk tolerance levels, organization personnel).

4.2.1. Technical Parameters

These parameters are related to the database file that the tool operates on and are important to ensure that the functions and macros of the software operate smoothly without any interruptions.

- Save file in a trusted location

   1. Save the file of the software in a location of your choice.
   2. Open file
   3. file>options>trust_center>trust_center_setting>trusted_locations>add_new_location>[add the location the file is saved]>"ok"

- Enable Macros

   file> options> trust_center> trust_center_setting> macro_settings> [choose "enable all macros"]

- Enable ActiveX controls

   file> options> trust_center> trust_center_setting> ActiveX_settings> [choose "enable all controls without restrictions and without prompting"]

- Disable confirmations

   file> options> client_settings> [on "Confirm" list uncheck "record changes", "action queries",

By considering these technical parameters, users can ensure that the Digital Enterprise Risk Management Tool operates efficiently and effectively, without any interruptions or technical issues that could impact its performance.

4.2.2. User Parameters (optional)

In addition to technical parameters, there are also user parameters that need to be set in the software when it is used for the first time. These parameters are specific to the organization of the user. By setting these parameters, users can customize the software to their specific needs and preferences, making it easier to use and more effective in managing risks.

- Set organizations Personnel (see §4.5.5)

- Set organization objectives (see §4.5.4)

- Confirm/Edit risk evaluation criteria (see §4.6.2)

4.3. Main Menu

The main menu panel of the Digital Enterprise Risk Management Tool is the central hub of the software, providing users with easy access to all of the key features and functions of the tool. From this panel, users can navigate through the various modules of the software, access the libraries of risks, objectives, and treatment strategies, and view reports and analytics related to their risk management activities. The main menu panel is designed to be intuitive and user-friendly, with clear buttons to guide users

through the different sections of the tool. By using the main menu panel, users can efficiently manage their risk management activities, saving time and enhancing their overall effectiveness.

The main menu of the Digital Enterprise Risk Management Tool contains four navigation buttons (labeled as 1-4) and an exit button, as indicated in the image. These navigation buttons are designed to provide users with quick and easy access to the key features and functions of the software.

SCREEN 1 – Main Menu
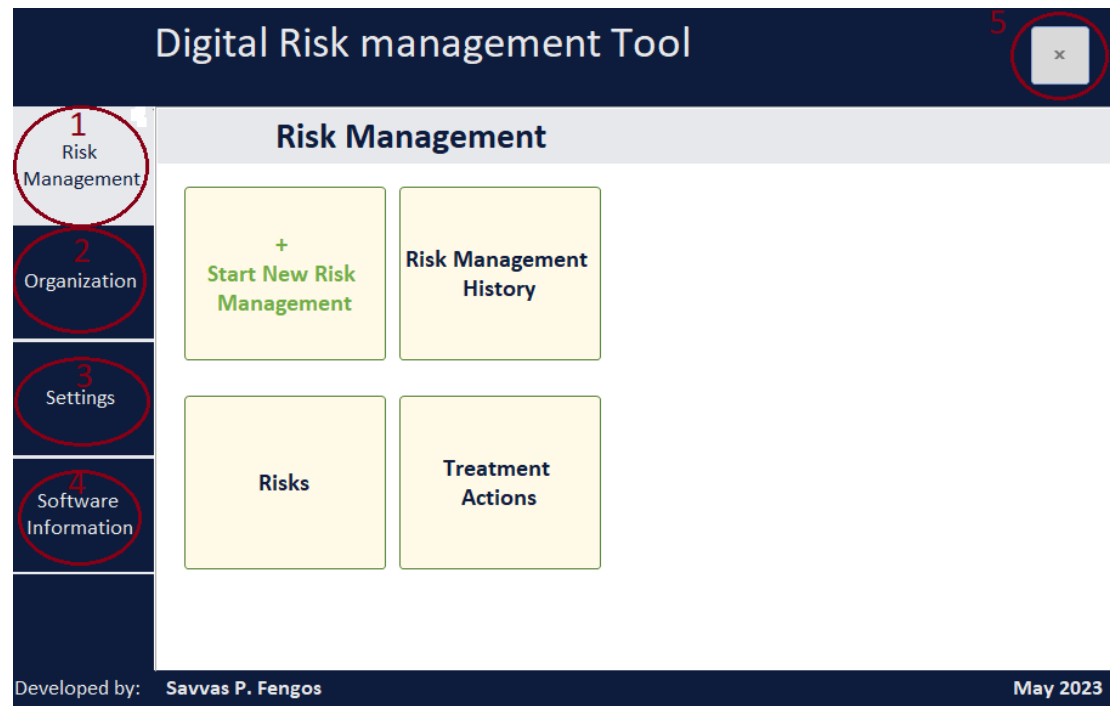
1. Risk Management: Shows options regarding Risk management process. (Image 4)
   a) Start new risk management process (§4.2.3)
   b) See risk management history (§4.5.1)
   c) Review risks (§4.5.2)
   d) Review treatment actions (§4.5.3)
2. Organization: Shows option buttons for organization settings:
   a) Manage organization's personnel (see §4.5.5)
   b) Manage organization objectives (see §4.5.4)
   c) Confirm/Edit risk evaluation criteria.
3. Settings: See database management systems tables and libraries (§4.6.1)
4. Software Information: Shows general information about the software.
5. Exit button: Closes the applications.

The chosen navigation button is indicated by grey background colour (instead of blue). In SCREEN 1, the chosen navigation button is "Risk Management".

The "Start New Risk Management" button allows users to initiate a new risk management process cycle and access the various modules of the tool for identifying, analysing, evaluating, and treating risks.

4.4. Risk Management Process Cycle

The Digital Enterprise Risk Management Tool enables users to digitally run the risk management process in four steps. These steps include:

1. Providing general information about the current risk management process implementation, such as identifying the scope of the risk management process and defining the context of the organization.

2. Setting up the risk management team and organizational objectives, including defining the roles and responsibilities of team members and aligning the objectives of the organization with the risk management process.

3. Identifying, analyzing, and evaluating risks using the libraries of risks included in the tool. This step involves assessing the likelihood and impact of identified risks and determining their level of importance.

4. Setting treatment plans for the identified risks, including selecting and implementing appropriate risk mitigation and control measures to address the identified risks.

Once these steps are completed, users can then monitor the results of their risk management activities and rerun the process as necessary, as the risk management process is an iterative process that requires ongoing monitoring and review.

By following these four steps and using the features and functions of the Digital Enterprise Risk Management Tool, users can effectively manage risks within their organization and ensure the continued success of their operations.

Next paragraph includes all screens that incorporated in these four steps using our tool. Notes on images are made in red color. Sentences in blue indicate the actions for the process' flow.

4.4.1. STEP 1/4 – Basic information

SCREEN 2 – RM Basic information screen (process step 1)
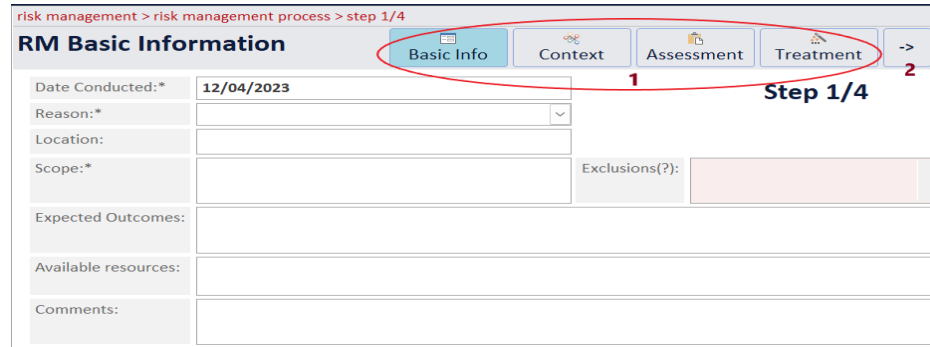
The user sets the basic information of the running risk management process.

- Each step includes a navigation pane on top of the screen. The selected step is highlighted with light blue (Screen 2, point 1)
- The arrows in navigation pane move user to next (or previous) step (Screen 2, point 2)
- Fields with * are mandatory for normal operation of the process.

4.4.2. STEP 2/4 - Context

SCREEN 3 - RM Context screen (process step 2)
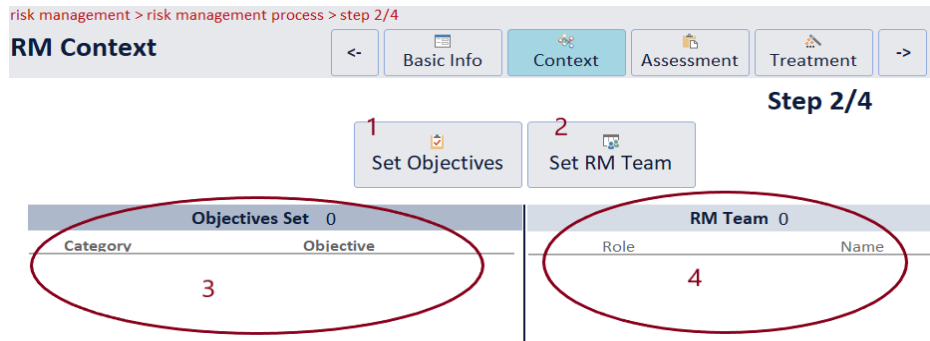
Point 1: Button for setting objectives (go-to screen 4)

Point 2: Button for setting risk management team (go-to screen 6)

Point 3: Overview of objectives set.

Point 4: Overview of selected risk management team.

SCREEN 4 – Set Enterprise Objectives Screen
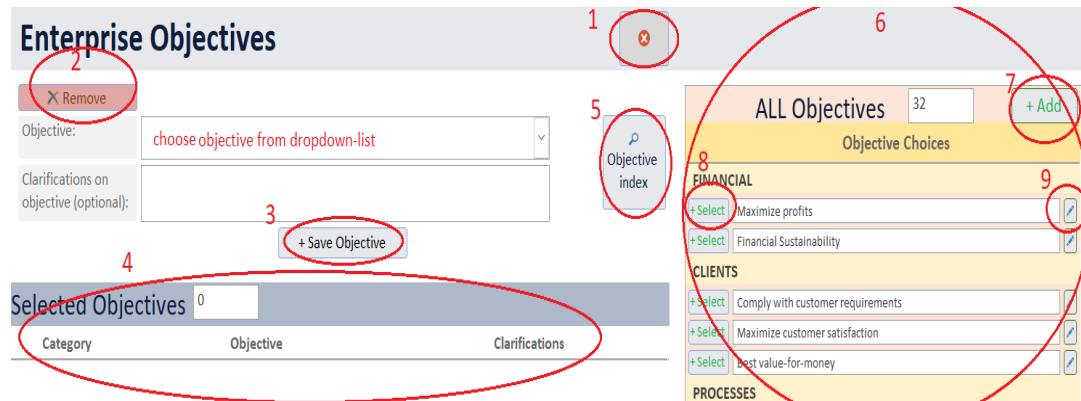
The screen to set objectives for the running risk management process is mandatory every time the user runs the risk management process. The user can only set objectives included in the objectives index of the organization.

1. "Close window" button.
2. Button to remove the picked selected objective. (to pick an objective, click on the objective in selected objectives overview (point 4).
3. Save and set the chosen objective.
4. Overview of objectives already set.
5. Appear/disappear index of all objectives (point 6).
6. Organization's objectives index (includes objectives set in any risk management process run in the past or defined in tool configuration).
7. Add new objective in the objectives index of the organization (go-to Image yyy).
8. Select objective and set it as current objective.
9. Edit objective in the objectives index. NOTE: This is for correction of mistakes and NOT for change of an objective.

SCREEN 5 – Risk Management Team
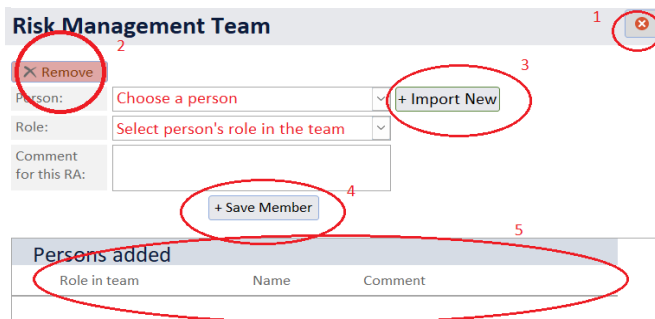
The RM team shall be set every time the risk management process runs. All persons added in the team must be imported in the personnel index of the organization.

1. "Close window" button.
2. Button to remove the selected added person. (to select an added person, click on the person in Person added overview (point 5).
3. Add new person in personnel's index.
4. Save and set the chosen person in RM team.
5. Overview of persons added in risk management.

4.4.3. STEP 3/4 – Risk Assessment

SCREEN 6 -RM Assessment
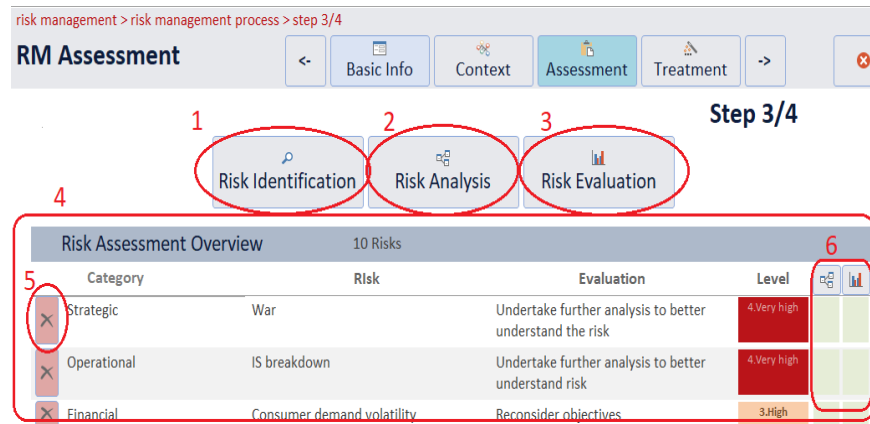
1. Start risk identification on objectives (opens screen 7).
2. Opens risk analysis for identified risks (screen 8)
3. Opens risk evaluation for identified risks (screen 9). Completed risk analysis is prerequisite.
4. Overview of identified risks, their analysis and their evaluation.
5. Button to remove risk from identified risks' index (there is verification message to complete this action)
6. Indication of completed analysis and completed evaluation for each risk (Green square=completed)

SCREEN 7 /A
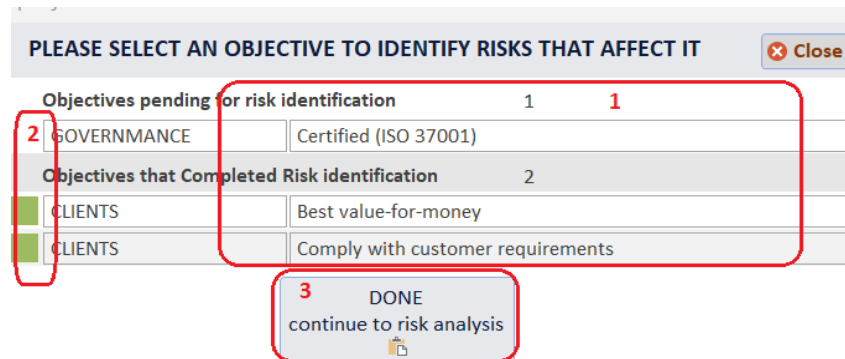
1. List of objectives. Click on objective to identify related risks (screen 7/B).
2. Indication of completed risk identification for each objective (Green square=completed).
3. Button to go-to risk analysis (after identification is completed for all objectives.

SCREEN 7/B Risk Identification on objective
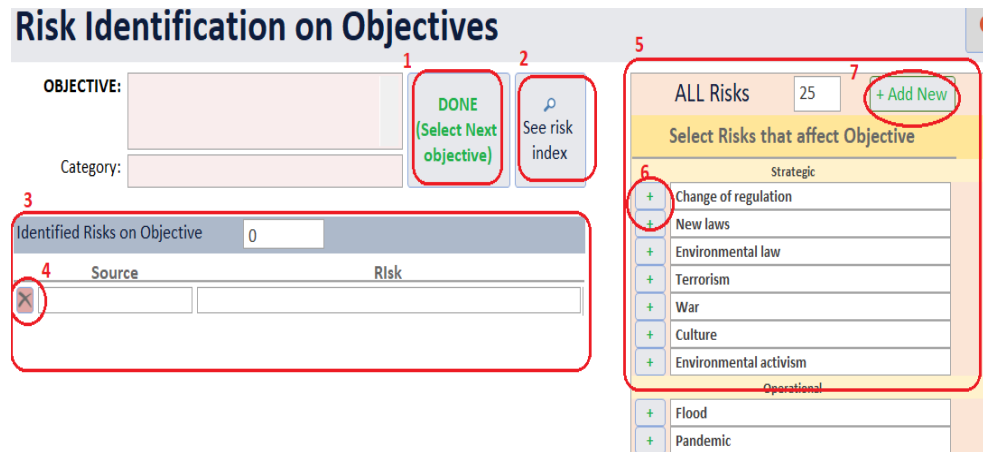
User identifies risks on selected objective (from screen 7/A). The user can only choose risks included in risk index (point 5).

1. Button to set risk identification on this objective as "completed" (go-to screen 7/A)
2. Appear/disappear of risk index (point 5).
3. Overview of risks identified on this selected objective.
4. Button to remove the selected risk.
5. Risk index (includes all active risks from all times RM process conducted)
6. Save and set the chosen risk.
7. Add new risk in the risk index (go-to screen yyy).

SCREEN 8 – Risk analysis
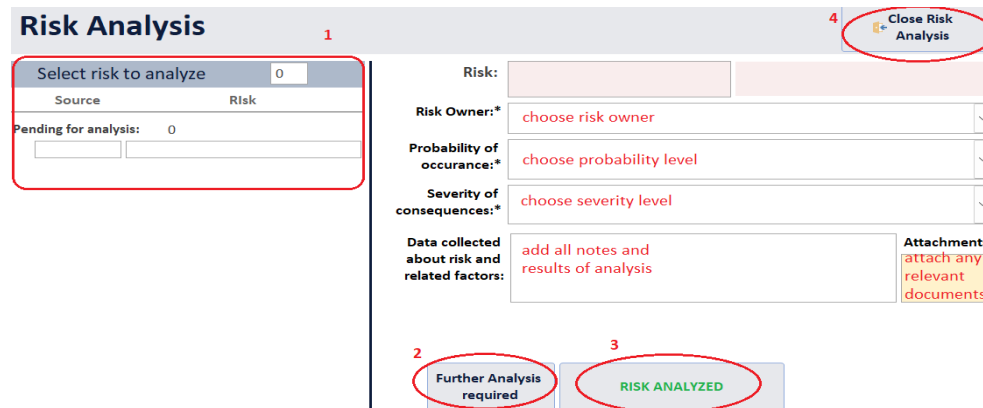
1. List of risks identified (click on a risk to select for analysis)
2. Button to set risk as "not analyzed yet".
3. Save and set the chosen risk as "analyzed".
4. Close window (go-to SCREEN 6).

All identified risks must be analyzed before proceeding to risk evaluation.

After the risk is analyzed, the risk level is being calculated automatically.

SCREEN 9 – Risk Evaluation

1. List of risks identified (click on a risk to select for evaluation)
2. Button to appear/disappear risk's analysis information.
3. Save and set the chosen risk as "evaluated".
4. Close window (go-to SCREEN 6).

All identified risks must be evaluated before proceeding to risk evaluation.

If the team decides to "Undertake further analysis" then the risk is set as "not analyzed" and requires to go back to analysis (screen 8).

If the team decides to reconsider objectives, then a new risk assessment must be conducted in the futere.

4.4.4. STEP 4/4 – Risk Treatment

SCREEN 10 – RM Treatment
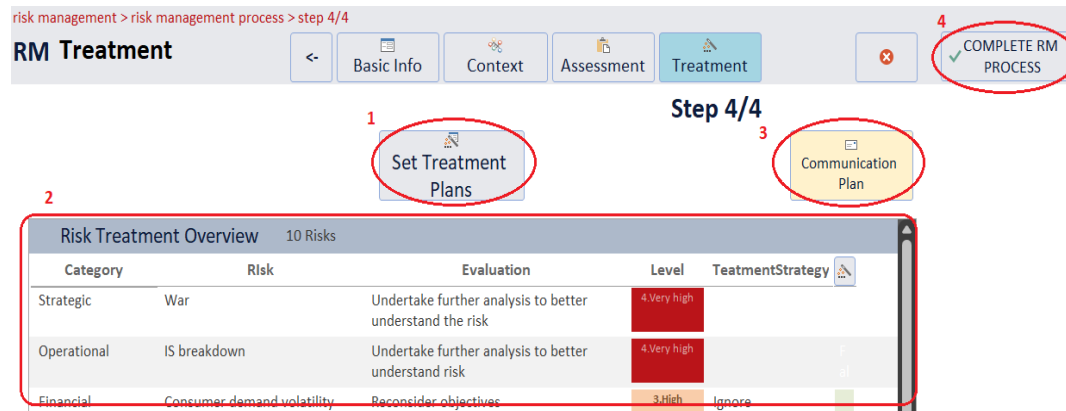
1. Opens risk treatment for identified risks (screen 11).
2. Overview of identified risks, their analysis and their treatment strategy.
3. Button to open list with all actions decided for treatment of risks and their status, constituting a communication plan of the process.
4. Button to set the running risk management process as "completed" (there is verification message to complete this action). Risk treatment actions' status does is irrelevant of this action; the team follows up and manages actions after the completion of the process.

SCREEN 11 – Risk Treatment plans
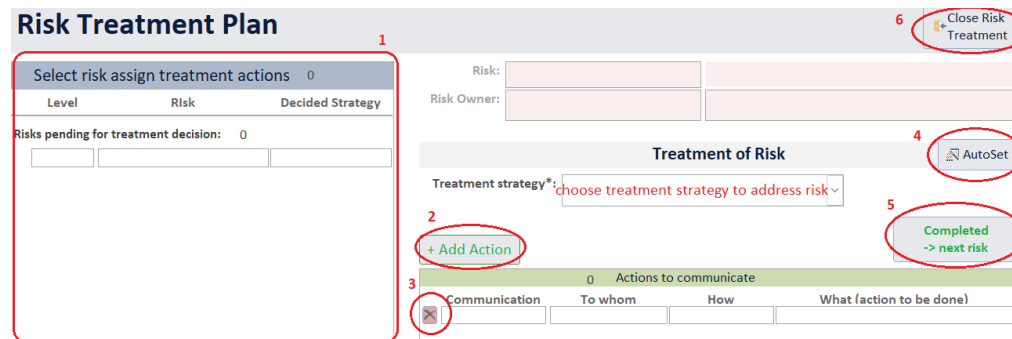
1. List of risks identified (click on a risk to select for treatment)
2. Button to add a new action for risk treatment.
3. Delete treatment action.
4. Button to optionally auto-set treatment strategy and action (only if the team has decided to "Do nothing further", "Maintain existing controls" or "Reconsider objectives" in the evaluation stage (SCREEN 9).
5. Save and set the chosen risk's treatment plan as "completed".
6. Close window (go-to SCREEN 10).

User adds an action in line with its communication parameters. In that way action plans constitute at the same time a communication plan.

4.5. Monitoring and Review

The Digital Enterprise Risk Management Tool offers users the capability to review and monitor critical parameters of the risk management processes conducted within the software. Users can track the progress of their risk management activities by monitoring various parameters of their risk management processes, risks, and treatment actions, including the likelihood and impact of identified risks, the effectiveness of risk mitigation and control measures, and the overall risk profile of the organization.

Through the tool's monitoring and reporting features, users can obtain a comprehensive view of their organization's risk profile and performance, enabling them to make informed decisions and take proactive measures to manage risks effectively. The tool also allows users to rerun the risk management process as necessary, ensuring that risk management activities are kept up-to-date and relevant to the current context of the organization.

In summary, the Digital Enterprise Risk Management Tool provides users with a robust set of features and functions for reviewing and monitoring critical parameters of their risk management activities, helping them to manage risks effectively and ensure the continued success of their organization.

The following are the options available in the Risk Management menu and Organization Menu (SCREEN 12):

SCREEN 12 – Risk Management Menu & Organization Menu

1. Run Risk management process: This option allows users to initiate a new cycle of the risk management process. Users can identify new risks, assess their potential impact, and develop strategies to mitigate them effectively.

2. Risk Management History: This option allows users to monitor all previous risk management cycles and parameters related to them. Users can review the risks identified in previous cycles, track the actions taken to mitigate them, and evaluate their effectiveness.

3. Manage Risks: This option allows users to monitor and manage all risks in the risk registry and parameters related to them. Users can view the status of active and inactive risks, edit risk information, and prioritize risks for mitigation.

4. Treatment Actions: This option allows users to monitor and manage all planned treatment actions to address risks for all previous risk management cycles. Users can review the actions taken, track their progress, and evaluate their effectiveness in mitigating risks.

5. Objectives: The objectives function allows users to monitor, add, and manage objectives related to the organization's risk management process. This feature can help ensure that the organization is aligned with its risk management goals and that all objectives are being tracked and addressed as necessary.

6. Personnel: The personnel function enables users to monitor and manage the individuals within the organization who are part of the risk management team and who are risk owners.

4.5.1. Risk Management History

The Digital Enterprise Risk Management Tool enables users to monitor all previous risk management cycles and the parameters related to each cycle. Through the tool's monitoring and reporting features, users can access historical information about the risks identified, analyzed, and evaluated in previous cycles, along with the treatment plans and control measures implemented to address them.

With this capability, users can gain a comprehensive view of their organization's risk management activities over time. The tool also allows users to rerun previous risk management cycles as needed, ensuring that risk management activities remain up-to-date and relevant to the current context of the organization.

Through the tool's monitoring and reporting features, users can track the progress of risk management activities, assess the effectiveness of implemented risk control measures, and make data-driven decisions to manage risks effectively. By reviewing the parameters related to previous risk management cycles, users can identify areas for improvement and take proactive measures to enhance the overall effectiveness of their organization's risk management efforts.

SCREEN 13 – Risk Management History

1. This button generates a report that includes all risk management cycles conducted, along with their associated risks.
2. This button generates a report that includes all risk management cycles conducted, along with the treatment actions set to address the identified risks.
3. This button allows the user to edit a specific risk management cycle, and brings up the corresponding editing screen (SCREEN 2).
4. This point displays the status of the selected risk management cycle, either as "ongoing" if it is not completed, or "completed" if it has been finished.
5. "Communication Plan" button: This button opens up the communication plan associated with the selected risk management cycle, showing the status of all treatment actions. The user can also manage the progress of the treatment actions from this screen.
6. This button displays a summary of the results of the selected risk management cycle.

4.5.2. Risks

With the Digital Enterprise Risk Management Tool, users have the ability to monitor and manage all risks stored in the risk registry, along with the parameters associated with each risk. The tool provides a centralized location for storing and tracking risks, allowing users to easily view and manage the risks that are relevant to their organization.

Through the tool's risk management modules, users can analyze and evaluate risks, assign likelihood and impact ratings, and develop treatment plans to address identified risks. The tool also allows users to monitor the progress of risk treatment plans and assess the effectiveness of implemented risk control measures.

By using the risk registry and related parameters, users can obtain a comprehensive understanding of their organization's risk profile and take proactive measures to manage risks effectively. The tool enables users to identify and prioritize risks, allocate resources to risk treatment activities, and monitor the ongoing effectiveness of risk management efforts.

SCREEN 14 – Risk Registry

1. Allows users to open a form to add a new risk to the risk registry.
2. Enables users to view all risks in the risk registry. The risks are sorted by the date of their last evaluation, with the most recent evaluations appearing first.

3. Enables users to filter and view only active risks in the risk registry. The risks are sorted by the date of their last evaluation, with the most recent evaluations appearing first.
4. Enables users to filter and view only high level and very high level risks in the risk registry, based on their last evaluation. The risks are sorted by the date of their last evaluation, with the most recent evaluations appearing first.
5. Displays the status of risks in the risk registry. Active risks are indicated with a green status, while inactive risks are indicated with an orange status. It is important to note that inactive risks cannot be selected for inclusion in a new risk management cycle.
6. Displays the last evaluation date in line with last evaluation level of each risk.
7. Edit risk's basic information:
   - Title
   - Description
   - Category
   - Date added
   - Set as active/inactive
8. Opens a form (SCREEN 15) to overview of the parameters associated with each risk in the risk registry. This includes information such as the risk's description, likelihood and impact ratings, risk owner, treatment plan status, and more. Users can access this overview to gain a comprehensive understanding of each risk.

The form on SCREEN 15 provides users with an overview of each risk's parameters, including their history, risk level over time in diagram form, objectives related to the risk, and actions determined to address the risk from all previous risk management cycles.

Users can view the risk's complete history and how it has evolved over time, including any changes to its likelihood and impact ratings, as well as any treatment plans that have been implemented. The form also displays any objectives that are related to the risk, along with the status of those objectives.

Additionally, the form provides a comprehensive overview of all actions that have been taken to address the risk, including any completed or canceled treatment plans, as well as any actions that have been planned but not yet implemented. This information can help users to identify any gaps in their risk management process and take proactive steps to mitigate potential risks.

SCREEN 15 – Overview of Risk
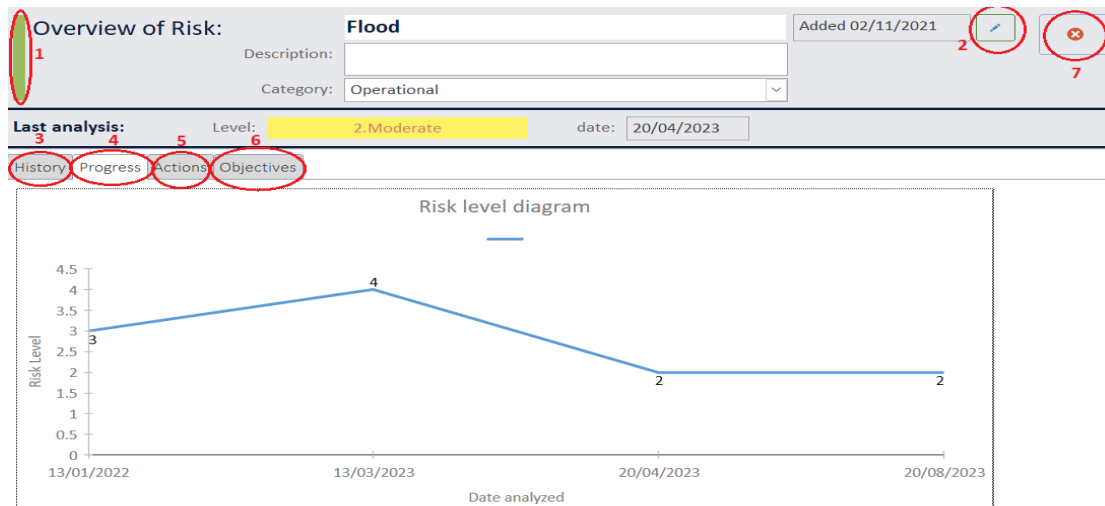
1. Risk Status: The Risk Form displays the status of risks in the risk registry. Active risks are indicated with a green status, while inactive risks are indicated with an orange status. It is important to note that inactive risks cannot be selected for inclusion in a new risk management cycle.

2. Edit Risk Information: Users can edit the basic information of a risk, such as its title, description, category, and date added. They can also set the risk as active or inactive.

3. History Tab: The History tab provides a summary of the risk parameters through risk management cycles conducted. This tab allows users to track the evolution of the risk and the actions taken to manage it.

4. Progress Tab: The Progress tab displays the evolution of the risk level through a diagram over time. Users can track the risk level and take appropriate actions to mitigate it.

5. Actions Tab: The Actions tab displays all actions planned to address the risk. Users can monitor and manage these actions to effectively mitigate the risk.

6. Objectives Tab: The Objectives tab displays all objectives that have been affected by the risk at least once. This tab allows users to understand the impact of the risk on the project or organization's objectives.

7. Close Window Button: The Risk Form includes a close window button to allow users to close the form after they have finished working on it.

The Risk Form provides a user-friendly interface that enables effective risk management. By providing relevant information and tools to support risk management, the Risk Form helps users to identify, assess, and mitigate risks effectively.

4.5.3. Treatment Actions

The Digital Enterprise Risk Management Tool allows users to monitor and manage all planned treatment actions to address risks for all previous risk management cycles. The tool's monitoring and reporting features enable users to track the progress of treatment

actions, assess their effectiveness, and make data-driven decisions to manage risks effectively.

Users can access a comprehensive view of all treatment actions planned for identified risks, along with the status of each action. In addition, users can track the results of implemented treatment actions.

With these capabilities, users can ensure that their organization's risk management efforts remain on track and effective over time.

SCREEN 16 – Risk Treatment Actions

1. "All" button: Displays all treatment actions for risks across all risk management cycles.
2. "Pending" button: Displays only treatment actions that are currently pending and have not been completed or cancelled.
3. "Closed " button: Displays only completed, cancelled, or closed treatment actions and excludes any actions that are currently pending.
4. Status indicator: This displays the current status of each treatment action, indicating whether it has been completed, cancelled, or is still pending.
5. "Complete Action" button: This button allows users to mark a treatment action as completed and write down the results of the action.
6. "Cancel Action" button: This button allows users to cancel a treatment action and write down a justification for the cancellation.

4.5.4. Objectives

Users can effectively manage the organization's objectives by monitoring, adding, and overseeing the parameters of each objective. With this interface (SCREEN 17), the user can efficiently track and maintain the organization's objectives, ensuring that they are aligned with the overall goals and strategies of the organization.

*SCREEN 17 – Organization's Objectives*

1. Button to add a new objective to the index.

2. Button to appear only active objectives.

3. Button to appear all objectives.

4. Field indicating whether an objective is active or inactive. Inactive objectives do not display during the risk management process and cannot be selected.

5. Field for comments and clarifications.

6. Button to edit objective information such as title, category, date added, and active/inactive status.

7. Button to open form that allows the user to view an overview of the objective's history throughout all the risk management cycles, risks that are affecting the objective, and the risks affecting the objective for each risk management cycle. This button provides valuable insight into how the objective has been affected by risks over time.

4.5.5. Personnel

The Personnel screen is a key feature in the risk management tool that provides a comprehensive overview of all personnel involved in the risk management process. It allows the user to add, monitor, and manage the personnel in their organization who are part of the risk management team and own risks. Additionally, the user can view each person's parameters related to risk management, such as their risks and the risk management cycles in which they participated. This feature enables the user to manage and optimize the personnel's roles and responsibilities in the risk management process.

SCREEN 18 – Organization's Personnel
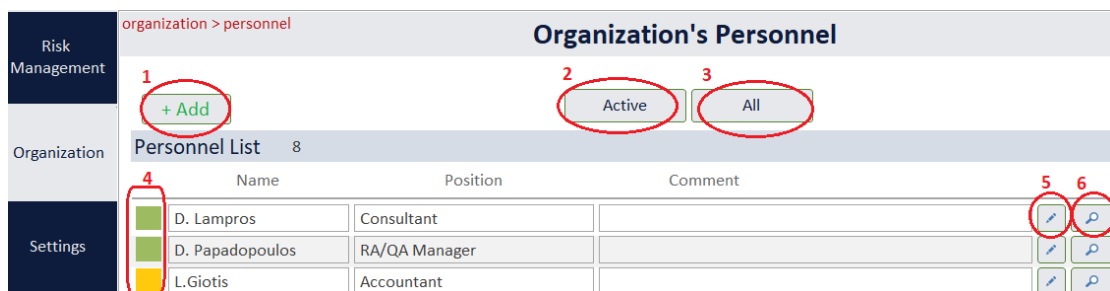
The personnel screen displays a list of all personnel and offers several functionalities, including:

1. button to add a new person,

2. button to display only active persons,

3. button to display all persons,

4. Field that indicates each person's status, whether active or inactive.

5. Button that opens form that allows users to edit a person's information.

6. Button to open form that provides a comprehensive overview of a person's parameters related to risk management, such as their participation in the risk management team and their role historically. Users can also see which risks the person was a risk owner for and in which risk management cycles they were involved. This information is valuable for managing personnel and ensuring efficient risk management processes.

4.6. Additional Features and Setting

4.6.1. Source Data Access

The Digital Enterprise Risk Management Tool provides its users with an accessible and user-friendly interface that enables them to conveniently access all the tables through the setting menu. The tool allows for easy editing of every single data contained in any of the tables, providing users with the flexibility to make necessary changes to the information.

Users can access a panel that contains all the tables in the database, or they can choose to access a panel that solely consists of the libraries of the database. In either case, the tool provides a button that allows users to reach their desired table with ease.

SCREEN 19 -Settings
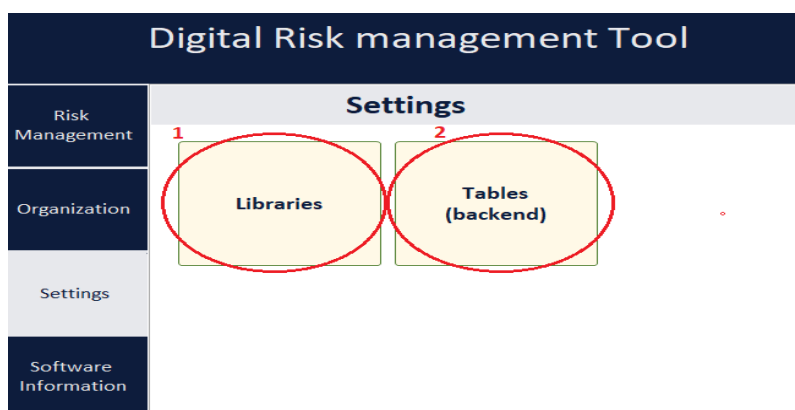
1. Libraries: This option allows users to choose which table to open and review among a list of the libraries with fixed data of the database (tables of § 4.7.1 that are mentioned as "Library", marked with 📖 at the left).
2. Tables: This option allows users to choose which table to open and review among a list of all tables included in the database (all tables in §4.7.1).

4.6.2. Risk Evaluation Parameters

The Digital Enterprise Risk Management Tool provides a unique feature for users to customize and edit risk evaluation criteria based on their specific organizational needs and factors related to risk management. With this powerful option, the tool allows users to completely change the evaluation criteria, including the risk level for every combination of severity and probability, probability levels, and severity levels. This feature enables users to use the tool for different risk management processes beyond enterprise risk management (ERM). The flexibility to adjust the evaluation criteria allows the tool to cater to the needs of various organizations and their unique risk management requirements. Therefore, the tool can be customized to suit the specific risk management needs of any organization, making it a versatile and valuable resource for managing risks.

Risk Evaluation Criteria panel (SCREEN 20) opens through Organization Menu, by clicking on "Evaluation Criteria" button.

SCREEN 20 – Risk Evaluation Criteria

1. Users make any change on Risk Level of each PxS (ProbabilityxSeverity) combination simply by clicking on the corresponding box.
2. For changes on the probability levels user clicks on the pencil next to probability level title. The corresponding table "PROBABILITY" will open.
3. For changes on the severity levels user clicks on the pencil next to severity level title. The corresponding table "SEVERITY" will open.

4.7. Objects' Index

4.7.1. Tables

The tool's database includes several tables that store various types of data related to the risk management process.

📖 COMMUNICATIONMEDIA: This table contains a library of different communication media that can be used during the risk treatment planning phase.

EVALUATIONCRITERIA: This table includes a list of different criteria that can be used for evaluating the risk, based on the combination of probability and severity.

📖 EVALUATIONOPTIONS: This table contains a library of different options that can be used during the risk evaluation process.

📖 EVALUATIONLEVELS: This table includes a library of possible levels or degrees of a risk.

📖 OBJECTIVECLASSES: This table contains a library of objective categories, which are based on their subject or purpose.

OBJECTIVES: This table stores the index of objectives, which can be monitored, managed, and added by the user.

PERSONNEL: This table includes a list of all personnel who are part of the risk management team and can own risks.

PROBABILITY: This table is a library that stores the different levels of probability of risk occurrence.

R_Analysis: This table contains all the data related to every risk and its inclusion in a risk management process cycle. It includes data related to analysis, evaluation, and treatment strategy.

R_Objectives: This table establishes the connection between objectives and risks within a specific risk management cycle run.

R_Treatment: This table records the risk treatment actions and all related parameters within a specific risk management cycle run. Every action is connected to a specific risk of a specific risk management cycle.

RA_Objectives: This table records the objectives determined within a risk assessment, which is part of step 2 of the risk management process cycle.

RISK_ASSESSMENT: This table records all the risk assessments carried out during the risk management process, including basic information about each cycle.

RISKS: This table stores the index of all identified risks.

📖 RISKSOURCE: This table is a library that contains the different categories of risks.

📖 SEVERITY: This table is a library that stores the different levels of severity of consequences of a risk.

TEAMS: This table records the personnel who participate in the risk management team for each risk management cycle and their role.

📖   TREATMENTACTIONS: This table is a library that includes a list of treatment action's categories.

📖   TREATMENTSTRATEGY: This table includes a library of possible options for the treatment strategy of each risk in a specific risk management cycle.

4.7.2. Forms

The risk management tool has a user interface consisting of several forms that allow users to interact with the tool's features. These forms include:

1. fm1RMPInfo: This form is used to conduct step 1 of the risk management process. It allows users to input basic information about the risk management process, such as the process owner, start date, and end date.

2. fm2RMPContext: This form is used to conduct step 2 of the risk management process. It allows users to identify the context in which the risks will be evaluated, including the organization's objectives and the risk evaluation criteria.

3. fm3RMPEvaluation: This form is used to evaluate risks in a risk management process cycle. It allows users to assess the probability and severity of consequences associated with each risk.

4. fm3RMPIdentification: This form is used to identify risks on each objective during a risk management process cycle. It allows users to link risks to specific objectives and to add details about the risks, such as their source and potential consequences.

5. fm3RMPAnalysis: This form is used to analyze identified risks in a risk management process cycle. It allows users to perform a detailed analysis of each risk, including its causes and potential impacts.

6. fm3RMPAssessment: This form is used to conduct step 3 of the risk management process. It allows users to assess the level of risk associated with each identified risk.

7. fm4RMPTreatment: This form is used to conduct step 4 of the risk management process. It allows users to develop and implement treatment strategies for each identified risk.

8. fm4RMPTreatmentPlan: This form is used to determine treatment strategy and set treatment plans for each risk in a specific risk management cycle.

9. mAddObjective: This form is used to add a new objective to the objectives index. Users can input the objective description, category, and other relevant details.

10. fmAddObjectiveCat: This form is used to add a new object category. Users can input the category description and other relevant details.

11. fmAddPerson: This form is used to add a new person to the personnel index. Users can input the person's name, contact information, and other relevant details.

12. fmAddRisk: This form is used to add a new risk to the risk index. Users can input the risk description, likelihood, impact, and other relevant details.

13. fmAddTreatmentAction: This form is used to add a new treatment action to the action plan during step 4 of a risk management cycle. Users can input the action description, responsible person, and other relevant details.

14. fmCancelAction: This form is used to verify treatment action cancellation and justify it. Users can input the reason for cancellation and other relevant details.

15. fmCompleteAction: This form is used to verify treatment action completion and write down the results. Users can input the completion date, results achieved, and other relevant details.

16. fmConfirmCompleteRM: This form is used to verify risk management process cycle completion. Users can input the completion date and other relevant details.

17. fmConfirmDeleteRA: This form is used to verify risk removal from the risk management process. Users can input the reason for removal and other relevant details.

18. fmEditEvaluationCriterion: This form is used to edit an evaluation criterion. Users can modify the criterion description and other relevant details.

19. fmEditObjective: This form is used to edit an objective in the objectives index. Users can modify the objective description, category, and other relevant details.

20. fmEditPerson: This form is used to edit a Person's information. Users can modify a Person's name, job position and his/her status (active/inactive).

21. fmEditRisk: This form is used to edit a risk in the risk index. Users can modify the risk description, likelihood, impact, and other relevant details.

22. fmEditTreatmentAction: This form is used to edit a treatment action in the action plan. Users can modify the action description, responsible person, and other relevant details.

23. fmEvaluationCriteria: This form is used to overview and edit risk evaluation criteria. Users can modify every risk evaluation criterion (Risk levels, probability levels and severity levels).

24. fmMainMenu: The fmMainMenu is the first interface that the user encounters after logging into the risk management tool. It presents a clear and concise overview of the available features and functionalities of the tool. The menu is designed to be user-friendly and easy to navigate, allowing the user to quickly access the different forms and functionalities they require. The fmMainMenu consists of a list of options, each representing a specific feature or functionality of the tool. The options are organized into different categories, making it easier for the user to find the feature or functionality they need. The categories include risk management process features, organization objectives, personnel, risk evaluation criteria, and settings.fmObjectives: This form is used to set organizational objectives during step 2 of the risk management process cycle.

25. fmObjectiveOverview: This form provides an overview of an organization's objectives and parameters related to each objective. This form displays information such as the objective name, description, category and status. It allows the user to edit objectives, view the risks associated with each objective.

26. fmORGMenu: This form is a menu form that allows the user to manage various aspects of the risk management tool. It includes options to manage organization objectives, personnel, and risk evaluation criteria. The form provides an easy-to-use interface to navigate between these different features..

27. fmORGObjectives: This form is used to manage an organization's objectives. It allows the user to add, edit, and remove objectives. The form displays a list of all the objectives, their categories, and their descriptions.fmORGPersonnel: This panel is used to manage organization's personnel.

28. fmORGPersonnel: This form is used to manage personnel information related to the risk management process. It allows the user to add, edit, and delete personnel information, including their name, position, and contact information. This information is used to assign personnel to specific tasks and responsibilities during the risk management process.

29. fmPersonOverview: This form provides an overview of a particular person's information, including their name, position. It also displays the tasks and responsibilities assigned to them during the risk management process.

30. fmRiskOverview: This form is used to manage organization risks. It allows the user to add, edit, and delete risks, including their description, potential impact, and likelihood of occurrence. This information is used to evaluate and assess risks during the risk management process.

31. fmRMMenu: This form is used to manage risk management process features, including risk management process cycles, risks, and treatment actions. It provides access to different forms and panels related to the risk management process.

32. fmRMPrevious: This panel is used to manage previous risk management process cycles, including those that are completed or ongoing. It provides an overview of the risk management process cycles and allows the user to access the details of each cycle.

33. fmRMRisks: This panel is used to manage risks during the risk management process. It displays a list of risks and their related information, including their description, potential impact, likelihood of occurrence, and risk level. It also allows the user to assign risks to specific objectives and to track their progress.

34. fmRMTreatmentActions: This panel is used to manage treatment actions during the risk management process. It displays a list of planned, completed, and cancelled treatment actions, including their description, assigned personnel, and completion status. It also allows the user to edit and delete treatment actions.

35. fmSETTINGS: This menu is used to manage the tool's tables and libraries, including risk evaluation criteria and objective categories. It provides access to different forms and panels related to these features.

36. fmSoftware Info: This panel displays basic software information, including the version, release date, and developer.

37. fmSTLibraries: This panel includes buttons to open any table of the database that is a library with fixed data (tables of § 4.7.1 that are mentioned as "Library", marked with 📖 at the left). The user can add/delete/edit any data of the opened table.

38. fmSTTables: This panel includes buttons to open any table of the database (tables of §4.7.1). The user can add/delete/edit any data of the opened table.

39. fmTeam: This form is used to set up the risk management team during step 2 of the risk management process. It allows the user to assign personnel to specific tasks and responsibilities related to the risk management process.

40. subRiskleveldiagram: This subform is part of the fmRiskOverview and displays the progress of a risk's level over time. It provides a visual representation of the risk's level and allows the user to track the progress of the risk management process.

4.7.3. Reports

1. rpContextObjectives: This report lists the objectives that were set during step 2 of the risk management process cycle.

2. rpContextTeam: This report lists the risk management team that was set during step 2 of the risk management process cycle. It is incorporated in the form fm2RMPContext.

3. rpObjectivesAll: This report lists all active objectives. Users can select and set an objective in the running risk management process cycle during step 2. It is incorporated in the form fmObjectives.

4. rpObjectivesIndex: This report lists all objectives of the organization. There is a button for editing or overviewing each objective. It is incorporated in the form fmORGObjectives.

5. rpObjectivesRA: This report lists the objectives that have been set during a risk management process cycle. It is incorporated in the form fmObjectives.

6. rpObjectivesRisk: This report lists objectives set in a risk management process cycle and indicates for each objective whether the risk identification process is completed or not. By clicking on an objective, the user can identify risks on it.

7. rpPersonnel: This report lists all persons recorded in the personnel index. It contains buttons for overviewing and editing each person listed. It is incorporated in the form fmORGPersonnel.

8. rpRiskAssessmentOverview: This report lists the risks identified during a risk management process cycle. The list includes information about each risk's analysis status, evaluation status, evaluation result, and risk level. It is incorporated in the form fm3RMPAssessment.

9. rpRKActions: This report contains a list of all actions related to a specific risk. It is incorporated into the form fmRiskOverview and is linked with the selected risk in that form.

10. rpRKHistory: This report contains a list of all risk management process cycles related to a specific risk. It is incorporated into the form fmRiskOverview and is linked with the selected risk in that form.

11. rpRKObjectives: This report contains a list of all objectives related to a specific risk. It is incorporated into the form fmRiskOverview and is linked with the selected risk in that form.

12. rpRMActions: This report contains a list of all treatment actions recorded. It is incorporated into the form fmRMTreatmentActions.

13. rpRMAll: This report contains a list of all risk management process cycles conducted. It is incorporated into the form fmRMPrevious.

14. rpRMCommunicationPlan: This report contains a list of all risk management process cycles conducted. It is incorporated into the form fmRMPrevious.

15. rpRisksAll: This report contains a list of all treatment actions recorded within a risk management process cycle. These actions also constitute the communication plan of the risk management process cycle. This report can be accessed through the fm4RMPTreatment or fmRMPrevious forms by clicking the "communicationplan" button.

16. rpTeam: This report contains a list of persons who have been set as risk management team members for a risk management process cycle. It is incorporated into the form fmTeam. By clicking on a person, the user can edit their information and role in the risk management team.

17. rpRMHistoryRisks: This report lists all the risk management process cycles sorted by date, with the most recent one on top. Each cycle includes all the risks that were identified and assessed during that cycle.

18. rpRMHistoryActions: This report lists all the risk management process cycles sorted by date, with the most recent one on top. Each cycle includes all the treatment actions that were recorded during that cycle.

19. rpOBJHistory: This report lists all the risk management process cycles that mention a specific objective sorted by date, with the most recent one on top. Each cycle includes all the risks that were identified on that objective. It is incorporated in the fmObjectiveOverview form.

20. rpOBJRisks: This report lists all the risks that have been identified for an objective. It is incorporated in the fmObjectiveOverview form.

21. rpPRRisksowned: This report lists all the risks that a specific person has owned at least once, along with the last risk management process that happened. It is incorporated in the fmPersonOverview form and is linked with the selected person in that form.

22. rpPRTeams: This report lists all the teams that a specific person has been a member of. It is incorporated in the fmPersonOverview form and is linked with the selected person in that form.

23. rpPRHistory: This report lists all the risk management process cycles that a person owned a risk for, including all the risks that the person was an owner of. It is incorporated in the fmPersonOverview form and is linked with the selected person in that form.

4.7.4. Suggested Data

The Digital Enterprise Risk Management Tool provides prefilled tables and libraries that support risk management processes. Additional to the libraries, The tool includes a suggested risk index, which provides a comprehensive list of potential risks that organizations may face. This index can assist users in identifying risks for the organization. Additionally, the tool includes an organization's objectives index, which allows users to set organizational objectives, facilitating a more targeted and efficient risk management process. These tables provide an additional support to effectively conduct enterprise risk management, enabling users to better understand and manage risks that may impact their organization.

Table 6 - Suggested Risk Index

RISKS	
Category	**Title**
Financial	Taxation
Financial	Price fluctuation
Financial	Consumer demand volatility
Financial	Substitution alternatives
Financial	Cost inflation
Financial	Margins
Financial	Economic downturn
Operational	Corruption
Operational	Earthquake
Operational	Pandemic
Operational	Collision
Operational	Flood
Operational	Theft
Operational	Lack of Communication
Operational	IS breakdown
Operational	Incompetence
Operational	Fire
Strategic	New laws
Strategic	Culture
Strategic	Environmental activism
Strategic	Environmental law
Strategic	Terrorism
Strategic	War
Strategic	Change of regulation

Table 7 -Provided Objectives Index

OBJECTIVES INDEX	
Category	**Title**
CLIENTS	Best value-for-money
CLIENTS	Comply with customer requirements
CLIENTS	Maximize customer satisfaction
DEVELOPMENT	Organization sustainability
DEVELOPMENT	Low risk Investments
DEVELOPMENT	High risk investments
ENVIRONMENTAL	Compliance with environmental laws
ENVIRONMENTAL	Positive Reputation
ENVIRONMENTAL	Certified (ISO 14001)
FINANCIAL	Maximize profits
FINANCIAL	Financial Sustainability
GOVERNMANCE	Compliance with corporate/labor laws
GOVERNMANCE	Establish a Management System
GOVERNMANCE	Certified (ISO 37001)
HEALTH AND SAFETY	(Hope nothing happens)
HEALTH AND SAFETY	Comply with occupational health and safety laws
HEALTH AND SAFETY	Certified (ISO 45001)
HUMAN RESOURCES	Low comptetence/experienced employees
HUMAN RESOURCES	High comptetence/experienced employees
LEGAL	Be as compliant as possible
LEGAL	Avoid fines or litigations
MARKET/COMPETITION	No direct competition
MARKET/COMPETITION	Direct/ Aggressive marketing
PROCESSES	Robust and strict procedures
PROCESSES	Flexible procedures
PRODUCT	Innovate
SOCIAL	Become a popular Brand
SOCIAL	Be acceptable
SOCIAL	Ignore social aspects
SUPPLIERS	Suppliers are critical partners
SUPPLIERS	Suppliers are low importance players

4.8. Entity Relationship Diagram

The relationship diagram represents the various tables and their relationships within the database. This diagram serves as a visual aid to understand the database structure and the connections between the tables. The relationships between the tables are indicated by arrows connecting the primary key of one table to the foreign key of another table. The diagram also indicates the cardinality and optionality of the relationships, allowing for a clear understanding of how the data in the tables are related. The relationship diagram is an essential tool for database design and management, and it facilitates the maintenance of data integrity and consistency.
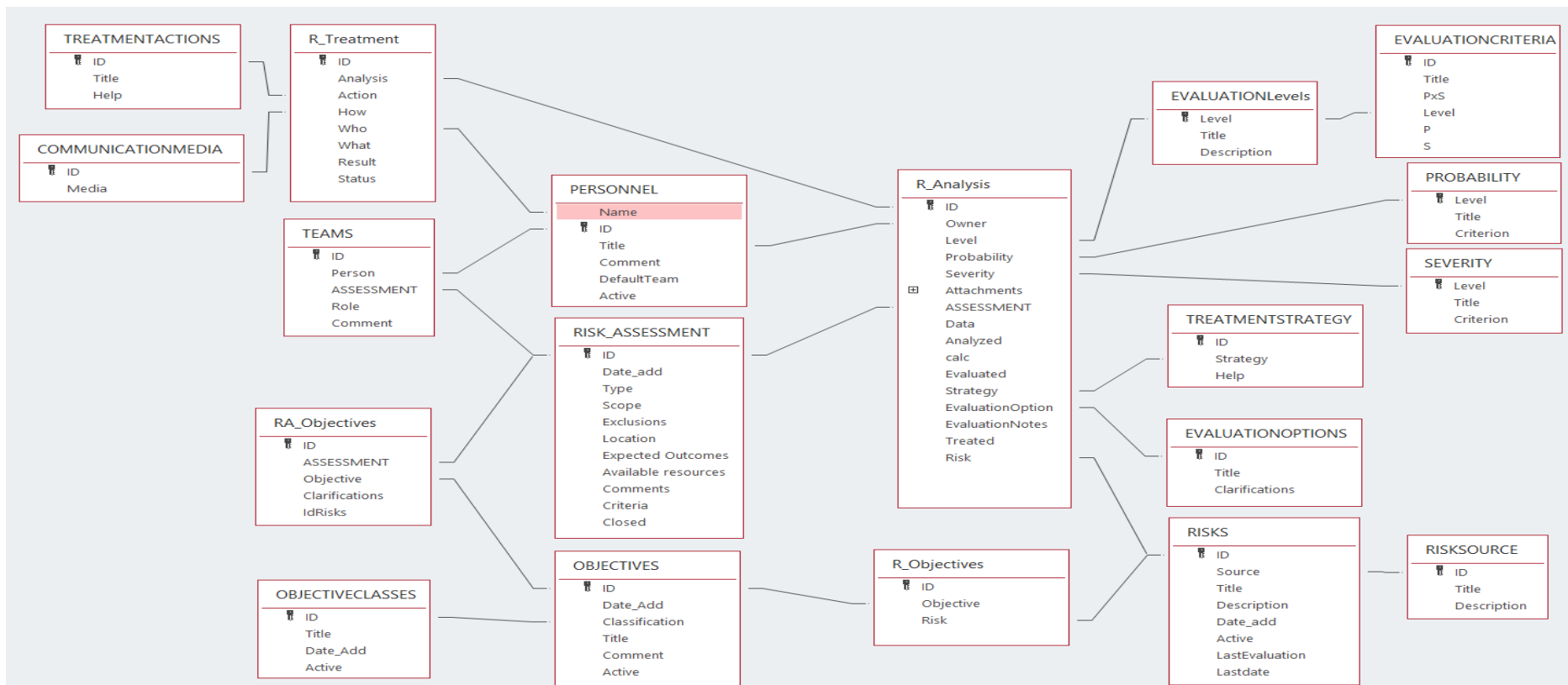
5. Conclusion

The Digital Enterprise Risk Management Tool has been successfully developed to provide a comprehensive and user-friendly solution for managing risk within organizations. The tool was designed with ISO 31000:2018 in mind, and it is based on the requirements set forth in the standard. The tool provides a variety of features and reports that enable risk management teams to identify, assess, and treat risks in a structured and effective manner. The development of this tool represents a contribution to the field of risk management, as it provides a practical and accessible solution for organizations of all sizes and industries.

The Digital Enterprise Risk Management Tool has been specifically designed to provide users with the necessary features and data to support enterprise risk management. It offers a promising solution for organizations looking to enhance their risk management practices and comply with industry standards. It is hoped that this tool will enable organizations to achieve their goals and objectives with greater confidence and success.

By providing a centralized and user-friendly platform for risk identification, assessment, and treatment, the tool enables organizations to better understand and manage their risks, and ultimately make more informed decisions. In addition, the tool's adherence to the ISO 31000:2018 standard ensures that it is grounded in good practices and can be easily integrated into existing risk management frameworks. As such, the Digital Enterprise Risk Management Tool has the potential to become an indispensable tool for organizations of all sizes and industries looking to improve their risk management practices.

Looking forward, there are several areas in which the tool can be further developed and improved. For example, additional features could be added to enhance the tool's reporting capabilities. Furthermore, ongoing updates and maintenance will be necessary to ensure that the tool remains up-to-date with the latest industry standards and best practices.

In conclusion, the Digital Enterprise Risk Management Tool is a valuable asset for any organization looking to manage their risks in a structured and systematic manner. The tool's comprehensive features and user-friendly interface make it easy for organizations to implement and integrate into their existing risk management processes.

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