Ανοικτό Πανεπιστήμιο Κύπρου

Faculty of Economics and Management

Μεταπτυχιακό Πρόγραμμα Σπουδών

Enterprise Risk Management

Μεταπτυχιακή Διατριβή

Assessing the impact of risk factors in public projects: The case of roundabout traffic lights projects

Panagiotis Psaras

Επιβλέπων Καθηγητής

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Η παρούσα μεταπτυχιακή διατριβή υποβλήθηκε προς μερική εκπλήρωση
των απαιτήσεων για απόκτηση μεταπτυχιακού τίτλου σπουδών
Enterprise Risk Management
από τη Σχολή Faculty of Economics and Management
του Ανοικτού Πανεπιστήμιού Κύπρου.

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Abstract

The aim of this “Master’s dissertation” is to assess the impact of risk factors in public projects; the case of roundabout traffic lights projects is taken as a vehicle in this study. A short reference to the definition of project, project types, as well as to the history of public projects in Cyprus and other countries. It is generally accepted that modern societies develop and operate under technological and scientific progress. At the same time, however, they are characterized by a multitude of technological and environmental disasters that have occurred, demonstrating the existence of a large scale of risks in technical projects and the need for their proper management.

The development of the scientific field of Risk Management, was a key point in changing the perceptions that prevailed for years on Project Management and laid the foundations for the development of methods and technologies at all stages of the project life cycle. The difficulty of monitoring and evaluating the risks that threaten a technical project, requires the existence of a model that will include the relationships between the criteria and their effects on alternatives.

According to what resulted by the questionnaires’’ analysis above, it should be said that the 30% of the participants said that when having a project about a roundabout traffic lights project, they take into account the circulation flow of the area in order to make the adequate planning, the 18% take into account the Necessities of pedestrians in that area, the 14% take into account Statistics about car crashes, the 12% the number of cars that will be using the roundabout on daily basis, the 10% take into account international standards and a 4% check new transportation studies in order to be informed about innovations. The rest 12% said that they take into account all of the above.

As a conclusion to the above, the risk, risk analysis, risk assessment and risk management are often used in both the business and public sectors. The risk definition associated with risk management includes the following: Risk is the probability of an event occurring that has a negative impact on the achievement of goals, at the individual or collective level" or "Risk is the positive and / or negative effect of uncertainty that affects the achievement of organizational goals.

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Chapter 1

Introduction

It is generally accepted that modern societies develop and operate under technological and scientific progress. At the same time, however, they are characterized by a multitude of technological and environmental disasters that have occurred, demonstrating the existence of a large scale of risks in technical projects and the need for their proper management.

The development of the scientific field of Risk Management, was a key point in changing the perceptions that prevailed for years on Project Management and laid the foundations for the development of methods and technologies at all stages of the project life cycle. The difficulty of monitoring and evaluating the risks that threaten a technical project, requires the existence of a model that will include the relationships between the criteria and their effects on alternatives.

The risk management is a continuous process that starts from the stage of preparation and submission of the Technical Bulletin of the Project for financing (Cleland, Bidanda, 2015), continues during the tender process and the design phase and implementation of the Project and ends with the completion of the Project and the closing of the contract.

The concept of Contract Management is inextricably linked to risk management. The risks that may arise during the execution and management phase of the contract may be due either to the inability of the Contractor to fulfil his contractual obligations (e.g. unsatisfactory performance, mainly his executives are employed in other contracts, his business interest is focused in another direction or its financial situation deteriorates after the award of the contract), or in the inability of the Contracting Authority to effectively manage the contract (e.g. lack or inadequacy of suitable and specialized staff, delays in the Contractor's payments, lack of management experience similar contracts), or to factors beyond the control of both parties (e.g. conditions of force majeure, significant changes in legislation or at the political level).

Depending on the type of contract, the distribution of risks between the Contracting Authority and the Contractor also differs. For example, in the case of project contracts implemented through a Public-Private Partnership (PPP), the Contractor (Individual) usually assumes the risks associated with the construction, financing, operation, management and ongoing maintenance of the project,

while the Risks that remain in the public sector are, for example, changes in government policy and changes in legislation.

But even in the case of risks that have been "transferred" to the Contractor, the Coordinator (or Engineer in the case of public works) must monitor and ensure that the Contractor has established and implemented procedures to reduce the likelihood of occurrence or limitation. the effects of the occurrence of these risks. The Coordinator (or Engineer) should also work with the Contractor throughout the contract to identify any new risks and determine appropriate actions to address them, following the pre-agreed Risk Management Plan (Cleland, Bidanda, 2015).

Although a relationship based on mutual trust, honesty and communication is desirable, when the Contracting Authority begins to intervene extensively in the Contractor's internal management procedures, the Contracting Authority may end up taking back the risk it had " transfers "to the Contractor. The possibility of re-taking the risk is directly related to the ability of the Contracting Authority, and in particular the Responsible Coordinator (or Engineer), to understand what the Contractor is able to manage and what is not, so that he can reach the right balance. between active involvement (“hands-on”) and neutral attitude (“hands-off”) in contract risk management.

Based on the above, it should be said that the aim of this “Master’s dissertation” is to assess the impact of risk factors in a roundabout traffic lights project. A short reference to the definition of project, project types, as well as to the history of public projects in Cyprus and other countries, will be done. The principles, the international standards, and the organizations of project management will be mentioned as the risk assessment is part of project management. Identification of the risk factors that affect the project, assessment of the critical risk factors through probability impact method will be done. Risk factors related to the technical, management, financial, legal aspects and public complains.

In advance, the questionnaire is being handout to the people who uses or used traffic lights in a roundabout and on people who have relation with the project (engineers, project managers, etc). The questionnaire consisted of two parts. The first one refers to the demographic facts of the respondents (education, working experience, etc.), while the second part included the proposed risk factors based on the probabilities, they will occur during the life cycle of the project.

Chapter 2

Literature Review

2.1 Technical Project Work Management

2.1.1 The Concept of Project Management

The "project" has been defined many times and in different ways by people who have specialized and are active in the field of administration and project management. In order to fully understand the concepts of "project management" and "project risk management", the basic concept of "project" must be fully defined. For this reason, this chapter sets out definitions derived from different organizations (Drymousis, 2007). The manual published by the Institute of Project Management (Project Management, PMI 2017), gives the following definition:

"A project is a temporary effort undertaken to create a unique product, service or result. Over the years there are many human activities that have been described as "works". But there are some key characteristics that can be considered as criteria for whether an activity can be described as a "project".

- ✓ The term temporary refers to the fact that every project has a definite beginning and a definite end
- ✓ The uniqueness of a project indicates that the product or service is always distinctly different from all similar products or services
- ✓ Completion of the project requires resources (time, money, people, materials, machinery, etc.)

Each project requires a team responsible for its smooth completion and a responsible manager, who is able to manage the complexities of the project. According to paragraph 1 of article 1 of Law 2229/94, Government Gazette-138 A'), "project means any new construction or extension or renovation or repair or maintenance and the financially or technically independent operation, as well as any relevant research work, which requires technical knowledge and intervention"

(Karagiannis, 2017). According to article 1 Pr.1,2,3 of law 1418/84, public works are infrastructure projects of the country that cover basic needs of society contribute to the development of productive potential, to the increase of the national product, to the security of the country and generally aim at the improvement of the quality of life of the people (Lavdioti, 2012).

Public works are part of the general framework of the social and economic development of the country and implement choices of democratic planning. From a technical point of view, public works are all works performed by public sector bodies and are connected in any way with the land, subsoil or underwater space, as well as the floating parts of the technical works (Drymousis, 2007).

According to Verzuh (2008), the three variables of each project are cost, timing, and quality. The project management functions consist of 5 parts: (a) selection, (b) definition, (c) planning, (d) control and (e) completion. To these he adds risk management (f) and quality management (g), which are processes aimed at the proper and optimal execution of the project. The present work deals with technical projects related to the construction industry and are divided into public and private technical projects. These are two different categories, which present similarities and differences and lately an effort has been made to take advantage of the positive characteristics of the other and to give more prestige to the project management industry.

2.1.2 The Life of Public Projects

Every project, regardless of whether it is considered small or large, has a beginning and an end. This period is called the life cycle of the work and it is important to know it because all works have similarities. The project has specific phases of development and understanding them allows better control of resources in order for the project management team to achieve its goals. As stated in the PMBOK, each project is unique and involves a certain degree of risk, which is why the companies that undertake the execution of projects usually subdivide it into phases for better administrative control. Collectively, all these phases constitute the life cycle of the project (Karagiannis, 2017).

The project life cycle defines the initial phase, the final phase and the intermediate phases of the project. It fully analyzes the phases of the project. It is important to note that at each stage, the project management team makes decisions to continue the project or modify the original planning. If one examines the whole project, it is very likely that the scheduled plan is very different from the actual one (Activecollab, 2017).

The team that manages the project in this phase is small and does not require special financial openness for the company, as in this phase it is decided whether or not it is worth undertaking the project in question. On the contrary, in the second phase of the project (intermediate phase) the costs increase, and it is obvious that the risk reaches the highest levels. Many people are now the wider project and project risk management team and crucial decisions are made as to whether or not to modify the original plan. In the final phase, there is a vertical drop in costs, as most of the materials (especially we are talking about technical - construction work) have already been purchased while the work is almost completed.

2.2 The Phases of the Project Management in Public Works

In the previous paragraph, reference was made to the life cycle of the project but also briefly to the phases of the project. The basic phases of a project are four (4) (Directorate of Public Procurement of the Republic of Cyprus): (a) project definition, (b) planning, (c) monitoring and control and (d) project completion. The eight-phase life cycle model is often used, of course. These are the initial conception and start-up, the design and development, the implementation or construction, the operation, the delivery, the maintenance, the upgrade and expansion, the dismantling. The following figure shows in more detail the phases of a construction project as they emerge through its completion.

Phase 1: Project definition. This phase includes the initial conception of the idea. In other words, the need or the opportunity that exists for the undertaking of a project is ascertained and the data collection and the definition of the objectives take place. At the same time, the cost-benefit analysis is prepared, and the project management team describes how the project will be implemented and how it is done (Lavdioti, 2012).

- ✓ Initial conception
- ✓ Needs recognition
- ✓ Data collection
- ✓ Goal setting
- ✓ Project definition
- ✓ Feasibility analysis
- ✓ Detailed planning
- ✓ Schedule
- ✓ Purchase of equipment and necessary materials
- ✓ Recruitment of staff and preparations
- ✓ Design Details
- ✓ Technical needs and forecasts
- ✓ Identification of design failures
- ✓ Progress control
- ✓ Plan modifications
- ✓ Execution and monitoring
- ✓ Completion of work
- ✓ Project delivery
- ✓ Operation support
- ✓ Maintenance

Although the construction of the project has not actually started, it is one of the most creative phases for the project manager, as he will have to gather, among other things, specifications, plans, customer requirements and any other information that he deems necessary to start it. implementation of the project. The project manager is therefore the driving force in order to make important decisions that will affect the future of the project (Zacharias, 2008).

Phase 2: Project planning. In this phase, the main activities that should be implemented and monitored are defined in detail. It is the design phase in which the results of the feasibility study

are developed which become the main guide for the creation of the detailed parameters, time plans and plans, based on which the project will be constructed. In addition, the resources, equipment, and materials required for each task / stage are identified and the potential hazards and actions to be taken to mitigate them are identified. Following the above, the quality plan is implemented, ie the quality objectives desired by the client are defined and the acceptance criteria for the deliverables of the project are defined. Roles and responsibilities are defined, and a communication plan is developed and documented. The usefulness of creating a base for project control is very great, so in this phase the detailed work structure (Work Breakdown Structure (WBS) is developed in order to integrate the involved departments and specialties of the project. It is important to devote a lot of time to project planning, as it will make implementation easier and avoid problems and misinterpretations.

Phase 3: Monitoring and control. Here is performed any activity and work defined in the project schedule. In this phase, procedures should be performed in parallel for the monitoring and control of time, resources, costs, risks, quality, changes in communication, etc. If the project contractor undertakes all the activities and actions that must be carried out, then he is responsible for achieving all the results of the project. If, nevertheless, it subcontracts the project or part of the project, it undertakes to monitor and monitor the progress of project implementation. It is very important that the plan is updated and that the current situation is fully reflected with valid data on the progress of the project. Therefore, throughout the construction of the project, meetings should be held with all involved (subcontractors, suppliers, workshops, etc.) in order for the project management team to be sure that the progress of the work does not present problems and follows the agreed.

Phase 4: Completion of the project. At this stage, once everything has been completed effectively, resources are gradually released and audited to evaluate the success of the project and to prepare a report of the project deliverables. In addition to the above, an inspection is performed in order to determine that the implementation of the project has followed the agreed specifications. Depending on the nature of the project, maintenance of the deliverable may be included in this phase, and changes may introduce new requirements (Zacharias, 2008).

2.3 The Project Management

Project management requires absolute dedication, constant effort, and special skills, as the implementation of a project is a very complex process. It was developed as a separate field as a result of the application of the principles of administration and operational research in various applied fields, such as construction, engineering, large military programs, etc. The father of modern project management methods is considered to be Henry Gantt, an American engineer and social scientist who introduced the principles of planning and control to project management (Lavdioti, 2012).

The official definition of project management is the following: "*Project Management is related to the planning, organization, management and control of a company's resources to achieve and meet a relatively short-term goal that has determined. In addition, the project management utilizes the systems approach in the management, using company personnel (functional personnel - vertical hierarchy) for the implementation of a specific project (horizontal hierarchy)*".

However, according to the Project Management BoK (Project Management Institute), the functional definition of project management is "*the application of knowledge, skills, tools and techniques to the activities of a project in order to meet or exceed the needs and expectations of the project owne*r". The goal of the companies and organizations that seek their development is to set the conditions in order to complete projects with complete success. The above conditions are indicatively related to the training of staff, as well as the creation of an internal culture that supports project-based management. Balachanra (1984) has identified the following 10 success factors (Drymousis, 2007):

- ✓ The support from the management
- ✓ The planning of the project, i.e. the conversion of the goal, and the measures
- ✓ Performance in a feasible plan
- ✓ Cooperation with the client

- ✓ Staff issues: If the various people involved in the project do not maintain good relations, the success of the project is questionable, as good cooperation and dedication to the project are essential for success.
- ✓ Technical issues: The technical training of the staff and the fulfillment of the technical specifications of the project
- ✓ Acceptance by the customer
- ✓ The control of the project with a continuous flow of information about the real progress and feedback so that any deviations from the initials
- ✓ Plans to be corrected as soon as they are noticed
- ✓ The communication and good coordination between the participants in each phase of the project
- ✓ Problem solving

The above factors are general lines as each project is unique and its particularities require different handling on a case by case basis.

2.4 The Risk Management Planning

Every project definitely has a project management team which in most cases also undertakes project risk management. Risk management is the systematic process of identifying, analyzing, responding to and monitoring risk. The risk management plan should be constantly updated as the project progresses, ie follow its schedule and analyze the ways and strategies by which it will be able to neutralize them. By defining what a risk management plan is, it can be said that it is the guide with which we will identify the risks, we will analyze them (qualitatively and quantitatively), we will try to deal with them and finally we will monitor them (Karagiannis, 2017).

In order to develop a risk management plan, there must be basic information about the project. Such elements are the experience of the company in the completion of this category, the projects, the general principles and risk management policies that govern the organization, the structural analysis of the project (Work Breakdown Structure), the roles and responsibilities that correspond to those involved, etc. The contents of a plan should include the following (Zacharias, 2008):

- ✓ Method
- ✓ Roles and responsibilities
- ✓ Education
- ✓ Budget
- ✓ Timing
- ✓ Measurement methods and scales
- ✓ Limits
- ✓ Communication
- ✓ Recording

2.5 Risk Identification

The first stage of risk management, i.e. risk identification, is a very critical stage and is sure to affect the project objectives. The above process is an iterative process involving the entire project management team but often involving external stakeholders affected by the project risks. The risks can be organized in directories, in some analysis structure, or be related to specific technical data (Kirittopoulos 2006). There are many different ways to identify risks and each one has its advantages and disadvantages. The following are the ways in which we can identify hazards (Zacharias, 2008):

- ✓ Interviews
- ✓ Group Idea Production
- ✓ Risk Lists
- ✓ Risk Analysis Structure
- ✓ Case Analysis
- ✓ SWOT analysis
- ✓ Document Review
- ✓ Ishikawa Charts
- ✓ Delphi Method
- ✓ Special Groups

The risk identification process requires efficiency and methodology, in order to identify all the risks arising from the project activities. At this stage, of course, it is practically impossible for project managers to identify all the risks and this has the consequence that they cannot take the appropriate measures to deal with any threat. The aim is to be able to increase the success rate of the project as much as possible. Once the hazards have been identified by one of the methods mentioned, each of them will belong to a specific category. Some of the risk categories are the following (Kirittopoulos, Leopoulos, 2016):

- ✓ Technological (system malfunction, wrong database, etc.)
- ✓ Technicians (lack of required materials, incorrect estimation of specifications, etc.)
- ✓ Organizational (Lack of structure of the organization, change of requirements, etc.)
- ✓ Strategies (Defamation, poor allocation of funds, etc.)
- ✓ Financial (Budget reduction, interest rate increase, etc.)
- ✓ Lawyers (Lawsuits, lawsuits, licensing issues, etc.)
- ✓ Environmental (Pollution, Landscape Destruction, etc.)
- ✓ Assessment risks (Poor assessment of schedule, project size, etc.)
- ✓ Human hazards (staff inefficiency, diseases, etc.)
- ✓ Health and safety (Problem conditions, accidents, etc.)
- ✓ Disasters (Storms, monsoons, tsunamis, etc.)

The above risks can be either internal or external and usually different strains of the organization are used for each risk category.

2.6 The Risk Management

According to the model of PMI (2013), *risk management is the process of exploring options and defining actions, so as to enhance opportunities and reduce threats to project objectives*. This includes identifying individuals or groups and assigning them responsibility for the agreed risk response (risk manager). The purpose of the approach is to reduce the risks that may have a negative impact on the project objectives and to maximize the opportunities. At the beginning of this stage, the risk management team has a list of all the risks that were initially identified.

Depending on whether these are opportunities or threats, there is a completely different approach and methods of dealing with them. Trying to match the strategies for dealing with opportunities and threats, the following parallel comparison of the four strategies adapted to the nature of the risk emerges (Kirittopoulos, Leopoulos, 2016).

One of the risk management strategies is risk avoidance. A change in project design can lead to complete risk avoidance at no particular cost. Of course, this does not necessarily mean that the risk does not occur, as risk avoidance can also occur through insurance scenarios (redundancy systems). Of course, if risk is not a threat but an opportunity, the technique used is to exploit, that is, to discover ways to take advantage of opportunities for the benefit of the project objectives.

The second risk management strategy in a project is risk transfer. This category includes methods such as insurance, or clauses. A corresponding strategy regarding opportunities is the sharing of opportunities. Of course, risk aversion is a strategy that cannot happen in all cases, so the most common strategy is mitigation for threats and enhancement for opportunities. The mitigation of risks aims to reduce the likelihood of their occurrence or to reduce the consequence that it can cause in the project and consequently in the organization. The last strategy that can practically not be described as a strategy is risk acceptance. This means practically we cannot do anything to avoid the risk so we try at regular intervals to monitor the evolution of the risk, because its exposure may change (Lavdioti, 2012).

2.7 The Risk Monitoring

This stage is stated as the last stage of risk management, but actually it runs continuously during the life cycle of the project, but it is also the triger to repeat the whole process from the beginning. In addition to monitoring the existing risks, there is a possibility that new risks may appear, the exposure of the old risks may change, the response plan may be revised, and there may no longer be risks that were originally identified. The process of controlling and monitoring the risks is extremely useful for the overall completion of the project, as it provides real-time information about the progress of the project and the risks it faces (Cleland, Bidanda, 2015). The main functions included in the risk monitoring stage are (Cleland, Bidanda, 2015):

- ✓ Monitoring the implementation of risk management actions
- ✓ Risks Monitoring for the appearance of risk triggers
- ✓ Control of risk management plans
- ✓ Identification of new risks
- ✓ Managing new risks that appear
- ✓ Control and monitoring of acceptable risks ("green")
- ✓ Disclosure of risk management data

The reporting of risks must be done professionally and their communication to stakeholders is a very important issue. The way the risks are reported is based, for the most part, on the risk sheets. Risk sheets are created during the risk identification phase and include general risk data, risk analysis data, risk management data, and some observations.

2.8 The Risk Management of Public Projects

In the case of technical works, the risks may appear at any stage of the life cycle of the technical work, i.e. during the preliminary design, design, supervision, construction, receipt or even after the delivery of the project. The risks in a technical project can be (Zacharias, 2008):

- ✓ Natural phenomena (earthquakes, landslides, meteorological phenomena)
- ✓ Accidental events (vandalism, fires, demonstrations - strikes)
- ✓ Incomplete construction plans for the project
- ✓ Incomplete know-how and experience in risk management (ignorance and negligence)
- ✓ Errors and omissions of the executors of the specific project such as
- ✓ Delays in payment orders, failure to implement a project based on schedule and estimated costs)
- ✓ Management failures during project execution (delays from services such as town planning or bureaucratic delays)
- ✓ Construction failures (defective materials, equipment failures, unsuitable construction machinery)

- ✓ Accidents at work (accident at work due to lack of techniques security measures but also security measures)
- ✓ Misunderstanding of the project team (different people with different background and mentality in the execution of a project that fail to find a common horizon of cooperation, foreign workers who do not speak the same language with each other)
- ✓ Incomplete information due to delays, misunderstandings or other problems.
- ✓ Relationships between litigation and competition
- ✓ Non-existent evaluation of the proposals-offers by the developer
- ✓ Design changes at an unsuspecting time

Finally, technical hazards can arise from both internal and external factors. The internal ones include situations that have to do with the supplies of materials, delays and weaknesses of the project administration and the external ones include events that concern natural and accidental disasters but also obstructions of state or financial bodies etc (Kirittopoulos, Leopoulos, 2016).

2.9 The Quantitative Risk Analysis

For the quantitative analysis of the risks of a project, numerical data are used to identify their effects. This method is considered more detailed and accurate because it is based on arithmetic calculations. Of course, this is not entirely accurate as the value of quality risk analysis is just as great, especially when resources are limited. Therefore, quantitative risk analysis does not need to be applied to every project, as it is difficult to apply. However, it is considered necessary in large projects, as if not used, large losses can occur for the company / organization. According to the PMI, quantitative analysis combined with qualitative analysis can bring about the best possible results regarding the risks that may arise in a project / activity (Lavdioti, 2012).

There are many different methods of quantitative analysis. The most important and the most frequently used are the following:

Expected price

The most common method used mainly for predicting results. What creates the need for prediction is that an event may or may not happen. Of particular importance is finding the total expected value of many possible events. The total expected value is defined as the sum of the individual risk reports.

Error trees

This method was first used to analyze the hazards that can cause military missile launches to fail. The steps for developing a decision tree are (a) the definition of the undesirable event, (b) the detailed analysis of the facts, (c) the construction of the structure in the form of a tree, (d) the quantitative analysis by identifying the individual probabilities.

Trees of events

Event logs are used to identify potential problems and the effects that may occur after a problem occurs. The usual steps for creating such a tree are: (a) defining the original event, (b) finding successive events which may arise as chain reactions from the original cause; (c) the development of branching in binary form. Decision trees are mostly used to evaluate alternative scenarios.

Monte Carlo Simulation

The Monte Carlo simulation is the best known and most commonly used method of quantitative risk analysis and is based on the theory of random numbers and its name comes from the name of the well-known casino. This method solves problems that for other methods are particularly difficult to occur. The steps for applying this method are as follows: (a) defining an objective function, (b) determining permissible values / distributions, (c) randomly assigning a value to each of the variables, (d) performing operations and finding a result, (e) repeat steps (c) and (d) up to 10,000 times, (f) calculate probability for each of the results obtained, (g) find the distribution describing the possible result of the objective function and determine the cumulative diagram.

Sensitivity analysis

Sensitivity analysis is also one of the most well-known methods and aims to find the parameters of the project that affect it the most. In other words, the important variables of a problem are identified in order to focus on risk management in them. The following steps are followed in order to apply this method: (a) the initial values of the parameters are determined, (b) they change one by one, keeping the remaining constants, (c) the rate of change of the objective function is recorded, (d) the steps (b) and (c) with different percentages, (e) repeat (d) step, (e) create the rate change rate of the objective function

PERT technique

It is a technique that is difficult for many executives to fully grasp, as it is quite difficult for them to follow and understand statistical processing. The method is based on the characteristics of the distributions that describe the stochastic duration of each activity. The PERT technique is based on the "central limit theorem" of probability theory and essentially determines the distribution of the total duration of a project, based on the duration distributions of the activities of the critical path (Maylor, 2005). If we compare the results obtained for the duration of a project through the method of the critical path (Critical Path Method) with those resulting from the PERT technique, we understand the value of the second (Kirittopoulos, 2006).

2.10 Frameworks and Standards for Risk Management

2.10.1 The ISO 31000: 2009 “Risk Management - Principles and Guidelines”

The International Organization for Standardization (ISO) has issued the International Standard ISO 31000: 2009 "Risk Management - Principles and Guidelines", which provides general principles and guidelines for risk management in a variety of organizations and objects as well as in any public or private carrier. However, it is not targeted at specific industries, and can be applied throughout the life cycle of a project and in a variety of activities, including strategies, decisions, operations, processes, projects, products and services, as well as in any type of risk, or with negative, or with positive consequences. Although this standard provides general principles and

framework, it is not intended to group and simulate risk management for all organizations. Its design and implementation must take into account the different one needs of each organization, its specific objectives, its framework, its structure, its functions, its processes, the projects it undertakes, the services it offers, its assets as well as specific practices that it implements.

It is envisaged that this standard will be used to harmonize future and existing standards. We can mention that it offers a common approach to supporting standards that address specific risks and / or areas but does not replace those standards. ISO 31000: 2009 has been taken as a replacement of the pre-existing standard AS / NZS 4360: 2004 and is not a standard for certification. In order for risk management to be effective throughout its life cycle, the standard sets out the following principles:

a) Risk management creates and protects value. - Risk Management contributes to the proven achievement of objectives and the improvement of performance, for example, in the areas of occupational health and safety, mutual acceptance, legal and regulatory compliance, environmental protection, quality, management project, governance and reputation.

b) Risk management is an integral part of the overall management of the organization - Risk management is an integral part of all organizational processes - Risk management is not an individual process that has clear boundaries from the rest of the work and procedures followed by the organization. Instead, it is part of the management responsibilities and an integral part of all organizational processes, including strategic planning and all project and change management processes.

c) Risk management is part of decision making - Risk management is part of decision making. Risk Management helps decision makers make informed choices, prioritize their actions, and choose between alternatives.

d) Risk management explicitly addresses uncertainty - Risk management explicitly addresses uncertainty. Risk Management calculates the uncertainty, its nature and how it can be addressed.

e) Risk management is systematic, structured and timely - Risk management is systematic, structured and timely. A systematic, structured and timely risk management approach contributes to efficiency and consistent, comparable and reliable results.

f) Risk management is based on the best available information - Risk management is based on the best available information. The input to the risk management process is based on sources of information, such as historical data, experience, data from stakeholders, forecasts and expert judgment. Decision makers, however, must be informed and take into account any limitations of the data or models used, or the possibility of divergence between experts.

g) Risk management is tailored - Risk management is tailored. It is in line with the internal and external context of the organization, as well as with the profile that the organization has in the risks.

h) Risk management takes into account human and cultural factors - Risk management takes human and cultural factors into account. It recognizes the perceptions and intentions of external and internal people who can facilitate or hinder the achievement of the goals of the organization.

i) Risk management is clear and comprehensive - Risk management is transparent and inclusive. Appropriate and timely involvement of stakeholders and in particular decision makers at all levels of the organization, ensures that risk management remains relevant and topical. This involvement also allows stakeholders to be properly represented and have a good say in setting risk assessment criteria.

j) Risk management is dynamic, iterative and responsive to change - Risk management is dynamic, iterative and responsive to change. Risk Management constantly receives stimuli and reacts to changes. As internal and external events occur, the environment and knowledge change, followed by monitoring and risk management. New dangers appear, others change shape and others disappear.

k) Risk management facilitates the continuous improvement of the organization - Risk management facilitates continual improvement of the organization. Organizations need to develop and implement strategies to improve their risk management maturity alongside all their other aspects.

The International Standard ISO 31000: 2009, can help each organization to achieve its goals, to improve the process of identifying both opportunities and threats, as well as to use efficiently the resources at its disposal to deal with risks. Provides the principles and general framework for risk management, as shown in the following figure.

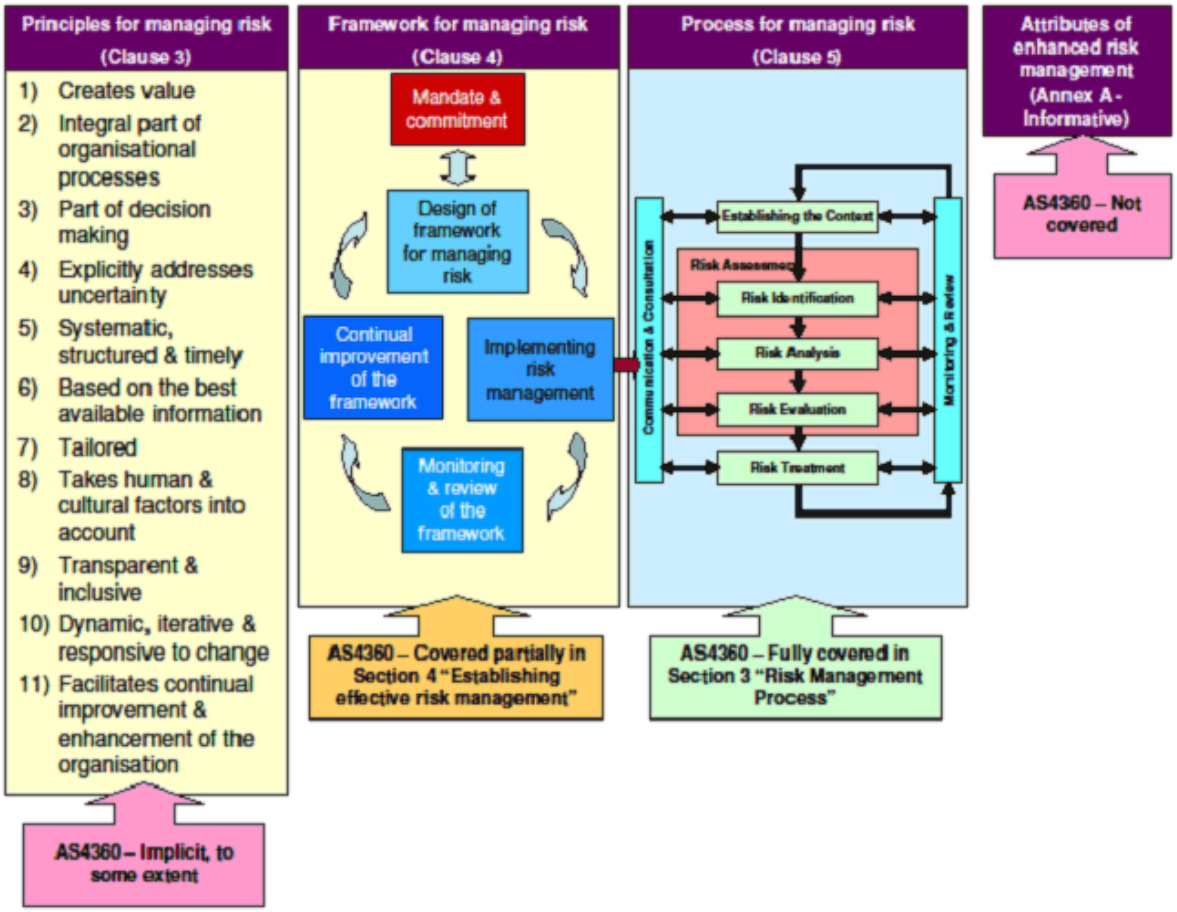

Figure No.1: Principles, framework and process of risk management according to ISO 31000: 2009 (www.iso.org).

The success of risk management depends on the effectiveness of the process framework, which lays the groundwork and the regulations that will apply it at all levels of the organization. This framework actually helps in risk management through the implementation of project management at various levels of the organization and within specific contexts. Ensures that the information resulting from the risk management process is adequately disclosed and used as a basis for decision-making at all levels of the organization. The components of the risk management framework are as follows:

a) Design of the action framework

b) Implementation of the risk management process

c) Monitoring and feedback

d) Continuous evolution of the framework

It is worth noting that this framework is not intended to describe a management system, but to help the organization implement risk management throughout its management. This is why every organization should adopt and implement the risk management framework, based on its own individual needs. The process followed for the effective risk management in an organization, follows the following course:

A) Communication and Consultation

B) Defining the framework

C) Risk assessment

- ✓ Recognition
- ✓ Analysis
- ✓ Assessment

D) Monitoring and review

Along with the issuance of the ISO 31000: 2009 standard, the International Organization ISO, also issued the standard ISO / IEC 31010: 2009 "Risk Management - Risk assessment techniques", which emphasizes the assessment, in the procedures and finally in the selection of the techniques used for the evaluation. In addition, it issued the ISO / IEC 73: 2009 guide, "Risk management - Vocabulary", which presents definitions related to risk management. The ISO also designed ISO 21500: 2012 "Guidance on project management", which provides guidance on the processes and concepts that are important for project management. The design of this standard was done in the context of compliance with other standards, including ISO 31000: 2009.

2.10.2 The AN / NZS «Risk Management»

The New Zealand and Australian Standard AN / NZS 4360 was developed in 1995 and revised in 1999 and 2004, as provided for every 5 years. It provides a general framework on risk management and can be applied to a wide range of tasks, decisions, operations as well as to any public or private organization, group or individual activity. Through this general approach, it provides organizations with the basic principles and guidelines, the broader framework and the methodology for risk management. The design and implementation of the framework that it presents, is influenced by the various needs of each organization, its specific goals, its products and services, as well as procedures and practices that it uses.

The process he proposes can be applied at all levels of the organization, and at all stages of the life cycle of a project. These are seven steps, which are in a dynamic relationship with each other, as shown in the image below:

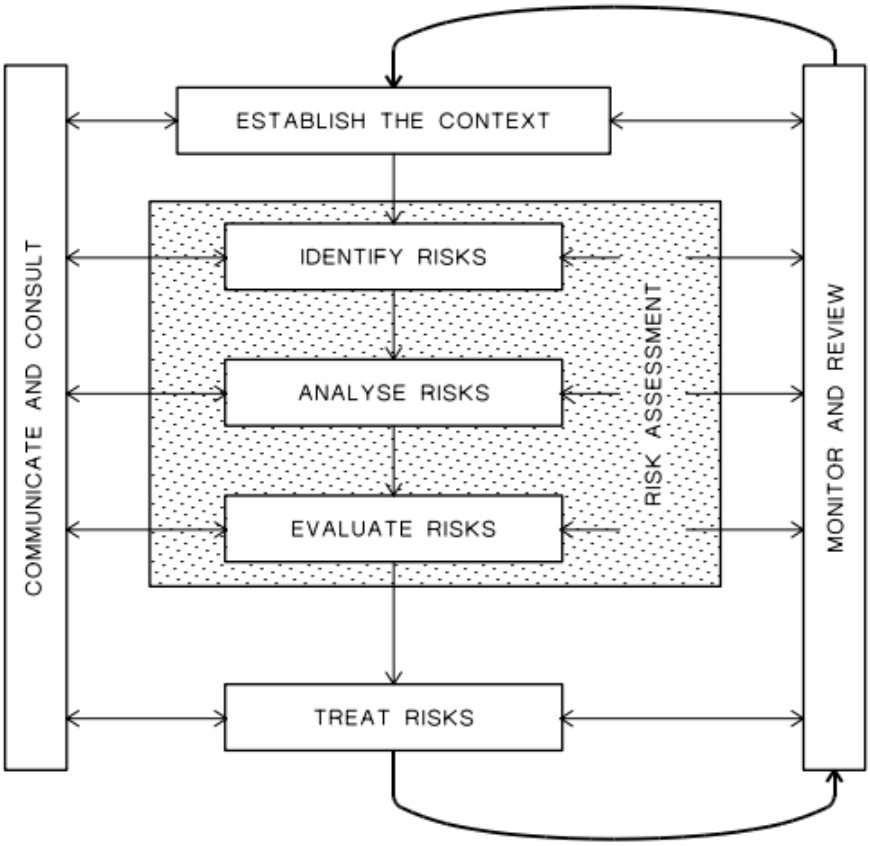

Figure No.2: Overview of the risk management process - AS / NZS

a) Communication and consultation
b) Introduction of content
c) Risk identification
d) Risk analysis
e) Risk assessment
f) Treatment of risks
g) Monitoring and feedback

The revised standard of 2004 presents some changes compared to the previous one, in the following points:

• Emphasis on the importance of integrating risk management into the overall culture of the organization and the procedures it follows.

• Emphasis on managing both potential gains and potential losses.

• Move and extend illustrative examples in an updated manual.

Australia and New Zealand have published a series of manuals on how the risk management process can be applied to a wide range of fields and disciplines. In 2009, the ISO 31000 |: 2009 standard was jointly adopted by these two countries, following the establishment of a joint committee "Committee OB-007", and the AS / NZS ISO 31000: 2009 standard was issued, which essentially replaces the previous one. (Standards Australia / Standards New Zealand, 2004). However, in order for ISO 31000: 2009 to be applicable in Australia and New Zealand, it had to be slightly adapted to the data of the two countries. The aim of this new model, through its eleven principles, is to assist organizations in effectively managing risks, regardless of their source or type.

2.10.3 The PMI - Project Management Institute - "Guide to the Project Management Body of Knowledge - PMBOK 2013 - 5TH edition"

The Project Management Institute is a non-profit organization based in the United States of America, founded in 1969, with the goal of disseminating and developing the principles and techniques of Project Management. This was followed by the relevant certification on Project Management, and the PMBOK Management Standard (1987, 1996, 2000, 2004). The main areas of action of PMI are the creation of Standards through which guidelines are given for an effective and comprehensive project management, as well as the continuous research on this subject. It is worth noting that the PMBOK driver has been certified as ANSI Standard (Cleland, Bidanda, 2015).

As the PMI has recognized Risk Management as one of the most important elements that influence the development and results of a project, a relevant special interest group (Risk Specific Interest Group) has been established within the organization. Through this group, a standard has been developed regarding the required procedures, which has been widely accepted due to the penetration of the organization in a very large number of companies worldwide. In Greece, PMI Greece was founded in June 2006 as a non-governmental, non-profit, scientific association after 3

years of efforts. Its initial members amounted to 473 members from more than 270 organizations and daily gains ground among professionals in the field.

The goal of PMI Greece is its continuous and catalytic contribution as the leading authority in promoting the best practices of project management in the Greek business community, in the public and in the private sector, while at the same time to spread and make more widely understood the necessity of project management in all sectors of the Greek economy. In Project Management type, describes the Risk Management process, in the light of risk identification, analysis, response and monitoring and control fee. The goals of PMI risk management are to increase the likelihood of occurrence and consequences of opportunities, while reducing the negative consequences and occurrence of adverse events.

2.10.4 Conclusions for the Risks Management Standards and Certification Frameworks

The International Organization for Standardization (ISO) has issued the International Standard ISO 31000: 2009 "Risk Management - Principles and Guidelines", which provides general principles and guidelines for risk management in a variety of organizations and objects as well as in any public or private carrier. However, it is not targeted at specific industries, and can be applied throughout the life cycle of a project and in a variety of activities, including strategies, decisions, operations, processes, projects, products and services, as well as in any type of risk, or with negative, or with positive consequences.

In advance, the New Zealand and Australian Standard AN / NZS 4360 was developed in 1995 and revised in 1999 and 2004, as provided for every 5 years. It provides a general framework on risk management and can be applied to a wide range of tasks, decisions, operations as well as to any public or private organization, group or individual activity. Through this general approach, it provides organizations with the basic principles and guidelines, the broader framework and the methodology for risk management. The design and implementation of the framework that it presents, is influenced by the various needs of each organization, its specific goals, its products and services, as well as procedures and practices that it uses.

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2.11 Risks in Technical Projects

According to Banaitiene & Banaitis (2012), technical projects can be very complex and characterized by high uncertainty. Risks and uncertainty can greatly damage a technical project and can occur at any stage of its life cycle. Each technical project is unique, complex and dynamic and includes many processes. Everyone involved has different motivations, experiences and expectations and this causes problems even for the most experienced and competent project managers. According to ISO: 31000 concerning risk management, there are some basic principles for managing these risks and they relate to the standard and they are (Cleland, Bidanda, 2015):

- ✓ To create value
- ✓ To be an integral part of organizational processes
- ✓ Be taken into account when making decisions
- ✓ Emphasize assumptions and uncertainty
- ✓ Be systematic and structured
- ✓ Be based on the best available information
- ✓ Take into account the human factor
- ✓ Be a transparent and inclusive process
- ✓ Be a dynamic, repetitive process that responds to changes
- ✓ To include the element of continuous improvement

According to research scholars, risks may arise during the preliminary design, design, supervision, construction, receipt or even after the operation of the project. The risks can be:

- ✓ Natural phenomena (earthquakes, landslides, climatic conditions)
- ✓ Accidents that cause damage (fires, terrorist acts)
- ✓ Negligence, mistakes and / or omissions of project implementers (delays payments, failure to meet schedule, inability to complete within budget)
- ✓ Management failures during the project life cycle (e.g. town planning requirements, bureaucratic delays by auditors' institutions such as town planning, poor estimate of construction costs due inability to predict geotechnical problems, etc.)
- ✓ Construction and technological failures (e.g. supply of defective ones materials, equipment failures)
- ✓ Accidents at work
- ✓ Supervision and control (arbitration, case law)

The main risks and causes of failure of a project that she identifies during the study of the literature are the following:

- ✓ Risk due to incomplete construction plans is an indicator of the evaluation of the capabilities of the project builders
- ✓ Danger of lack of know-how in project risk management: ignorance or negligence in locating is one of the most obvious and significant risks. Risk of project team misunderstanding: Diverse people with different background and mentality must match goals and operating methods for the success of the project.
- ✓ Lack of incentives for project risk management: A must have cooperation between team members.
- ✓ Interruptions in the flow of information: Delays often occur, misunderstandings or problems in the supply chain.
- ✓ Foreign workers: Problems not adapting quickly, or problems complicate the smooth running of the project.
- ✓ Dispute relations.

- ✓ Competition based on the lowest bid.
- ✓ Excessive use of subcontracting.
- ✓ Poor planning and inaccurate cost, time and resource forecasts (KPMG, 2010).
- ✓ Non-existent evaluation of the submitted proposals - tenders by the project owner (KPMG, 2010).
- ✓ Design changes at an unsuspecting time (KPMG, 2010).
- ✓ Unsuitable construction machinery - vehicles (KPMG, 2010).

Risks, therefore, arise from internal causes, such as incomplete building plans, delays in the receipt of supplies, lack of cash, lack of a technician and safety doctor or from external causes, such as natural disasters, bad weather, strike blockade of roads with access to the project, obstructions of state supervisors or financial institutions, etc. The objective objectives of the risk management process are:

- ✓ Strengthening the capacity of the company
- ✓ The consistent application of risk management procedures in his project's organization / company
- ✓ Strengthen the management of the company's projects and get better results in project planning, cost and performance by reducing threats and seizing opportunities (Cooper et al, 2005)

According to Verzuh (2008), in order for project management to be effective, the following issues need to be properly addressed:

- ✓ Project team: The employees in a project play a very important role both in terms of their correct choice and in terms of their proper distribution
- ✓ Estimates: Costs and timing must be calculated as accurately as possible. But because each project has its own terms and conditions many times this assessment is made from scratch (ad hoc).
- ✓ Power: The correct application of the organization chart and the hierarchy contributes in minimizing the risk.

✓ Checks: Needed regular financial audit, most of the time in fact even more regular even than the usual accounting practices.

The factors that compose the success of a technical project are many and the role of supervision is crucial for it. Many times, the financial data are the ones that are given the most attention and importance, however, they are not necessarily the most important reason for the failure of a project. A very important factor is the project team which is examined in the next section.

2.12 The Team of a Technical Project - Roles, Responsibilities and Obligations

According to Graham M. Winch (2010) there are some key characteristics of the construction industry that are related to the four categories of participants in technical projects. These categories are customers, project engineers, manufacturers and specialist suppliers. These participants present a different approach at each stage of the project. More specifically, during the project award process, the manufacturers are usually judged by the lowest price (bidding process) and not the quality. Manufacturers give lower than the actual bids in order to undertake the work with the result that the project is not as expected or even needs a lot of processing during the execution of the project.

During the process of updating and specializing in the project, customers do not give details of their needs and desires and do not emphasize the functionality of the project. Engineers do not pay attention to the needs of users and do not innovate and do not direct the weaknesses of the project. During the design phase, customers are unable to "see" the project completed, and manufacturers are reluctant to use test builds or engage specialized suppliers through collaboration.

When it comes to project management, clients lack project control skills, tend to downplay risks, and rely on contracts and agreements to solve problems. Manufacturers are delaying the completion of the supply chain and do not have a clear picture of the actual cost centers and processes by which a project is actually executed. Builders often lack management skills and place less emphasis on contracts and less on project execution processes. They delay suppliers' payments and create problems with cash flow.

This industry creates an innate climate of endemic crisis that is recycled and perpetuated. Suppliers are mainly based on crisis management and less on effective planning. They also rely on the execution of contracts instead of finding a solution and commit additional resources that should be allocated between the various departments. According to Steven Tadelis (2012), the supplier must receive from the buyer drawings and clarifications that describe the project before taking it on. Thus, the buyer should judge in advance the amount of money he will invest in the design of the project before assigning it. Completing the design is very difficult, as there is a lot of uncertainty about the future and a lot of unpredictable variables. The more complex a project is, the more expensive its design will be.

According to research by Akintoye and MacLeod (1997), developers and project managers believe that the most important sources of risk are financial, irresponsible and non-compliance with participants' contracts, unavailability of labor and misinformation or lack of information about the design of the project. Less important are construction sources (insufficient productivity, accidents, safety), contractor-subcontracting relationships, political and social risks (eg inflation), environmental risks and IT development.

A recent global KPMG survey (2010) found that technical companies try to address the various risks through training and education of their employees, a thorough risk analysis from the early stages of projects with an emphasis on bidding and design stage as well as trying to create process models. Also, several technical companies establish a stricter risk management framework, conduct regular reviews and hire professionals specializing in risk management. The same research points out that project outsourcing through one-off project delivery contracts is an outdated tactic, especially in America.

2.13 Literature Review and Research Analysis on Risk Management in Technical Projects

During the search and study of this topic, several researches were found in the context of dissertations or in level of company research, mainly in terms of the causes of cost overruns since the main factor of failure or distance from the success of a project is the financial part. According

to various researches and studies in the last twenty years, the reasons that lead to cost overruns are the following (Morris, 1990, Wachs, 1987, Kahneman and Lovallo, 2003, Lee, 2008):

- ✓ Cost increases
- ✓ Delays in the implementation phase of the project
- ✓ Poor project design without actual or contingent support
- ✓ Poor project implementation and adaptation to new conditions
- ✓ Insufficient funding
- ✓ Bureaucracy
- ✓ Lack of coordination between parties
- ✓ Inflation
- ✓ Cost estimation over-optimism due to lack of information sources, insufficient use of resources, strategic behavior
- ✓ Tendency to avoid risk
- ✓ Changes in scope
- ✓ Do not use the profit management system
- ✓ Uncertainty
- ✓ Inadequate organizational structure
- ✓ Political reasons, such as inside information, manipulation of forecasts

Of course, the financial part is a serious selection criterion, however the financial capacity, the technical skill and the previous experiences of the supplier play a big role. As part of her dissertation, Tsopouridou (2011) conducted a research on the management of technical project risks in Greece, which showed that the most important risks for large technical companies are focused on accidents at work with less emphasis on financial risks and non-compliance for the smaller technical companies, they focus on non-compliance with the schedule due to financial entanglements, time-consuming bureaucratic procedures, delays in receiving materials and constant changes in plans, installation accidents, natural disasters and theft cases and d.

Internal parameters that need attention in order not to end up in danger are liquidity and cash flows, staff recruitment, supply chain management, possible acquisitions or mergers, information systems

used by the company, research and development, intellectual capital (Tzachristas, 2013). External parameters are financial risks (interest rate risk, foreign exchange risk, credit risk), strategic risks (customer relationships, competition), industrial change, operational risks (external risk, process risk, behavioral risk, culture, interdependencies, composition), accident risks (environment, natural events, procurement).

Cost estimates usually fall short and this increases the risk of a project. Managing construction projects is difficult, as there is often misinformation about costs, and this leads to cost overruns that even threaten the viability of the projects (Cantarelli et al. 2010). In Greece, for example, the state's liabilities to contractors in the construction sector reach 23 billion euros due to defaults (Tzachristas, 2013).

Chapter 3

Methodology Research

3.1 The Aim of the Research

The aim of this "Master's dissertation" is to assess the impact of risk factors in a roundabout traffic lights project. A short reference to the definition of project, project types, as well as to the history of public projects in Cyprus and other countries. The principles, the international standards, and the organizations of project management will be mentioned as the risk assessment is part of project management. Identification of the risk factors that affect the project, assessment of the critical risk factors through probability impact method will be done. Risk factors related to the technical, management, financial, legal aspects and public complains.

3.2 Research Questions

The research questions for the specific case, are mentioned as follows

- ✓ Which are the risk factors in public project?
- ✓ What factors do the managers take into account in order to make the adequate planning in public projects and in roundabouts?
- ✓ Are the drivers aware of the Purpose of Roundabouts?

3.3 Methodology Research for the Dissertation

As to the methodology of the specific dissertation, it could be said that this mentioned to the qualitative research analysis upon use of literature review on the topic examined. Therefore, the research process is concerned to the four (4) basic steps which will be used in order to achieve the goals of the essay, in order to identify the objectives and the problems of the study, to collect the qualitative data, to analyze the data as also to present the results.

Following the review of the literature, this is a discussion section in which the researcher will examine the usefulness of qualitative research approaches in studying this topic; as well as areas which need further research, such as to assess the impact of risk factors in a roundabout traffic lights project. A short reference to the definition of project, project types, as well as to the history of public projects in Cyprus and other countries.

Therefore, the aim of the dissertation, is to assess the impact of risk factors in a roundabout traffic lights project. A short reference to the definition of project, project types, as well as to the history of public projects in Cyprus and other countries. There will be a strong highlighting of the research's objectives and results. Suggestions will be noted on how to improve or change the current status in Cyprus and globally as well.

3.4 Data collection

About the data collection in specific dissertation, particular emphasis was placed on the reliability of the literature review sources collected mainly by Public Services of the Republic of Cyprus and recognized organizations at the local level that deal with topics related to those of the exhibition. In addition, priority has been given to surveys and sources that have been published and are valid for up to 10 years. As to the primary collection of data, this was made upon use of questionnaires. There were distributed 40 questionnaires to the respondents, where all of them were answered by such people. The time frame was as from 1st February 2022 to 31st Market 2022.

3.5 Procedure

The data collected were analyzed and interpreted using the theories and models included in the theoretical framework of the report. Finally, conclusions and recommendations are also mentioned from the Cyprus National Reports and challenges have also been identified for further future research by the relevant bodies.

3.6 Sample of the Research

The number of the 50 respondents in the survey, is concerned to the 80% of the participants who were male and the rest 20% were female. The mean age of the participants was almost 46 years old with Standard Deviation 9,7 years. The youngest participant was 32 years old and the oldest

65 years old. The 82% of the participants had a university degree, the 12% has a Master/PhD degree and the rest 6% a college degree. In advance, the 40% of the participants were in a relationship, the 36% were married, the 16% were single and the rest 8% were divorced. Also, the 42% of the participants had a working experience in public projects from 6-10 years, the 22% from 11-15 years, the 14% over 20 years, the 12% from 16-20 years and the rest 10% from 1-5 years. Finally, the 40% of the participants were project managers, the 36% were engineers, the 18% were designers and the rest 6% were safety experts.

Chapter 4

Results Analysis

4.1 SPSS Questionnaires' Analysis

Part A

Demographical characteristics

Gender

The 80% of the participants were male and the rest 20% were female.

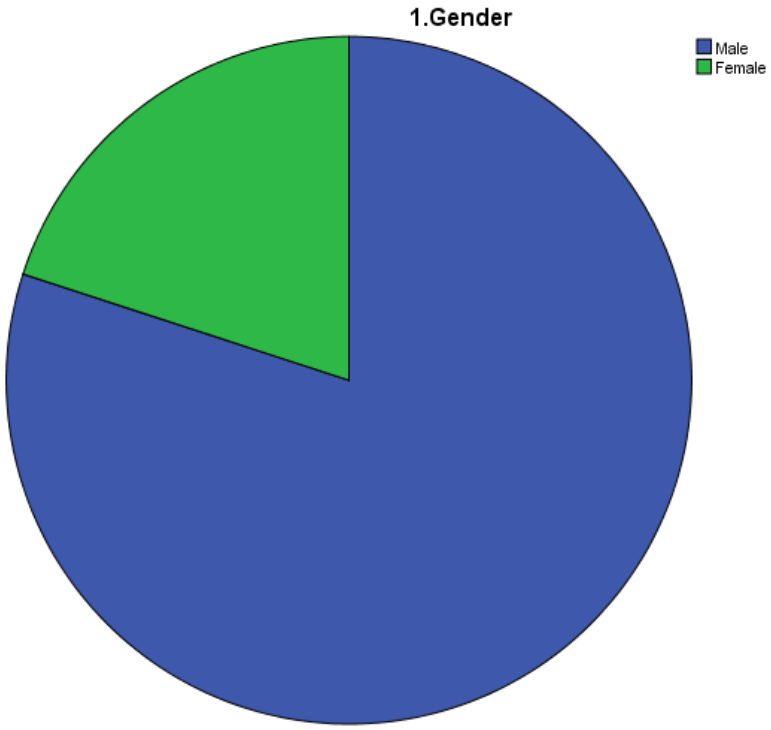


Figure No.1 – Gender

Age

The mean age of the participants was almost 46 years old with Standard Deviation 9,7 years. The youngest participant was 32 years old and the oldest 65 years old.

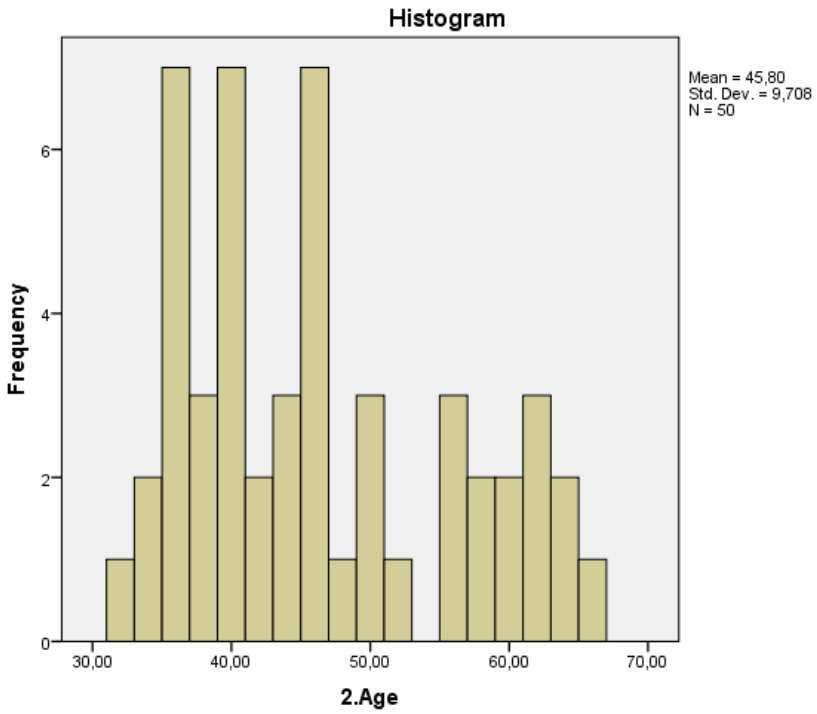


Figure No.2 – Age

Educational level

The 82% of the participants had a university degree, the 12% has a Master/PhD degree and the rest 6% a college degree.

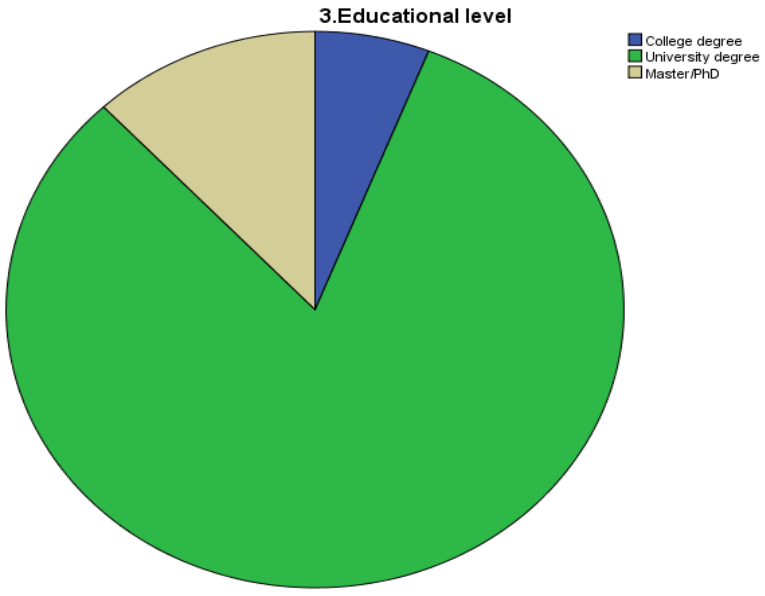


Figure No.3 – Educational level

Family Status

The 40% of the participants were in a relationship, the 36% were married, the 16% were single and the rest 8% were divorced.

4.Family status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	8	16,0	16,0	16,0
	In a relationship	20	40,0	40,0	56,0
	Married	18	36,0	36,0	92,0
	Divorced	4	8,0	8,0	100,0
	Total	50	100,0	100,0	

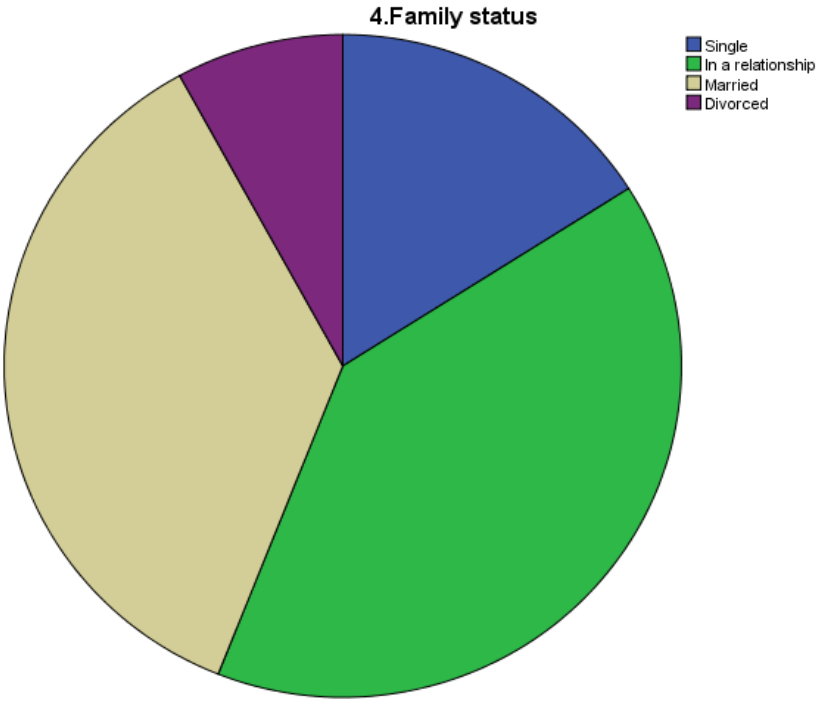


Figure No.4 – Family Status

Working experience

The 42% of the participants had a working experience in public projects from 6-10 years, the 22% from 11-15 years, the 14% over 20 years, the 12% from 16-20 years and the rest 10% from 1-5 years.

Figure No.5 – Working Experience

Specialty

The 40% of the participants were project managers, the 36% were engineers, the 18% were designers and the rest 6% were safety experts.

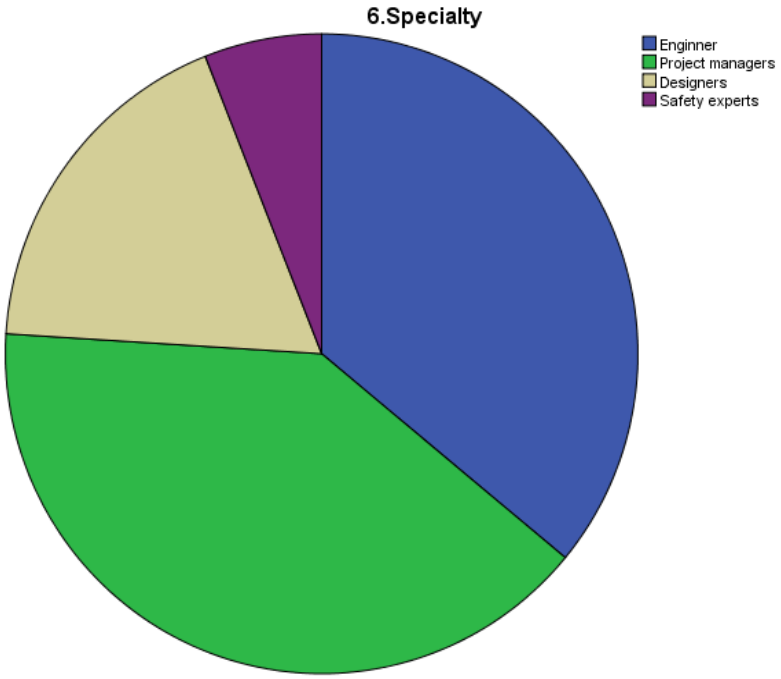


Figure No.6 – Specialty

Part B

Question - what factors do you take into account in order to make the adequate planning

The 30% of the participants said that when having a project about a roundabout traffic lights project, they take into account the circulation flow of the area in order to make the adequate planning, the 18% take into account the Necessities of pedestrians in that area, the 14% take into account Statistics about car crashes, the 12% the number of cars that will be using the roundabout on daily basis, the 10% take into account international standards and a 4% check new transportation studies in order to be informed about innovations. The rest 12% said that they take into account all of the above.

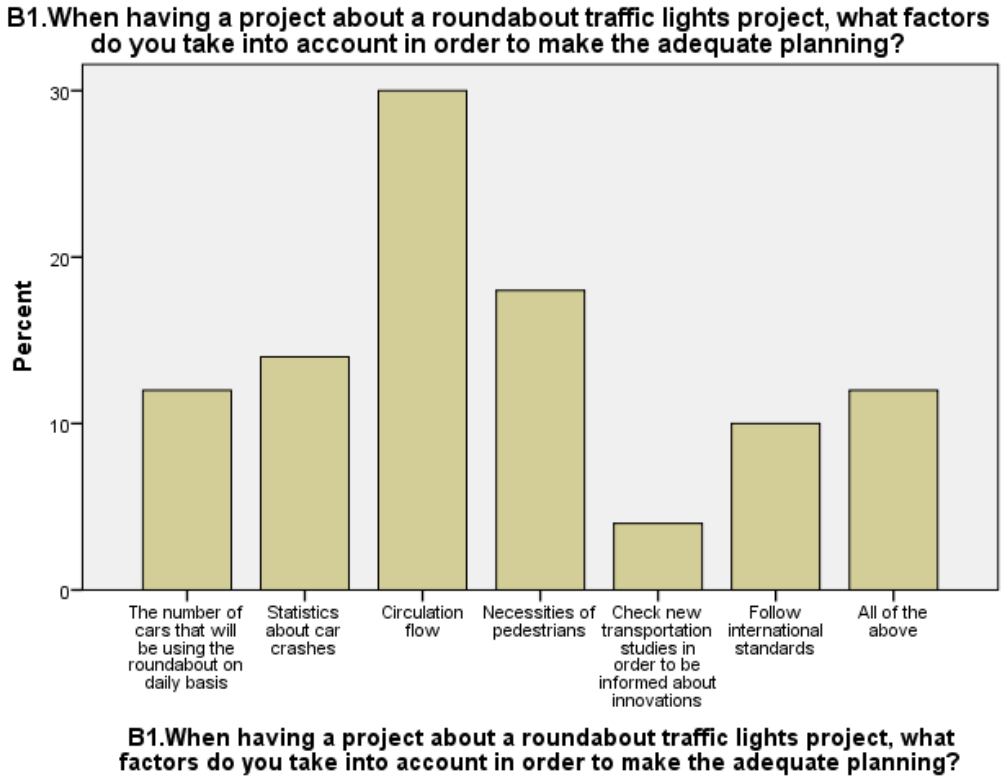


Figure No.7

Question B2 - Factors Considered to be Important for Normal Circulation in a Roundabout

The majority of the participants consider most important proper traffic lights and general lighting (for night hours) in order to have normal circulation flow in a roundabout, the 18% proper signage as well as the Width of lane/lanes, the 16% the island diameter, the 14% the Curvature/geometry and the rest 12% the Width of entry approach.

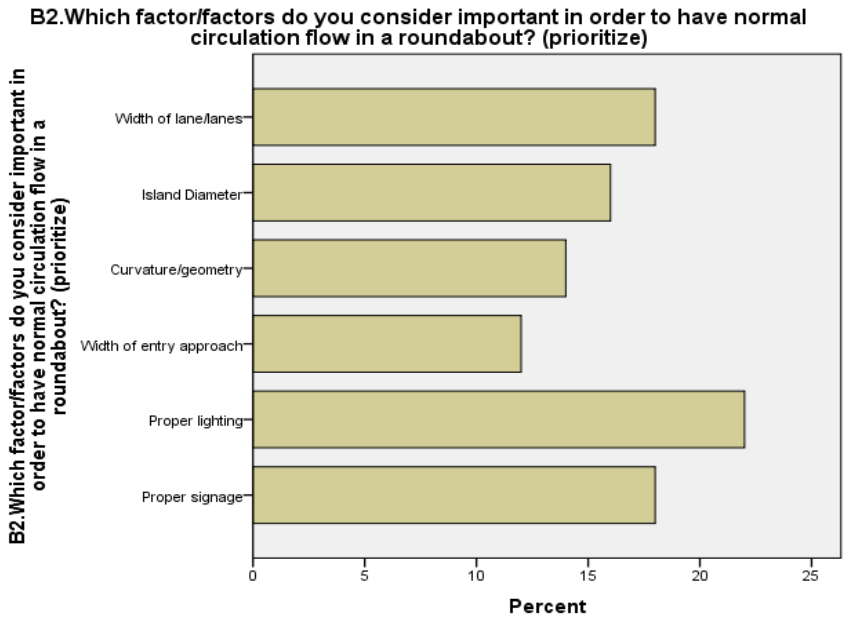


Figure No.8

Question B3 – Agree or Disagree about the Lack of Mechanism to Allow the Pedestrians to Walk

The 70% of the participants disagreed a lot with the opinion that one of the risks of roundabouts is the lack of mechanism to allow pedestrian to cross, the 20% disagreed, whereas the 6% agreed and the rest 4% neither agreed nor disagreed.

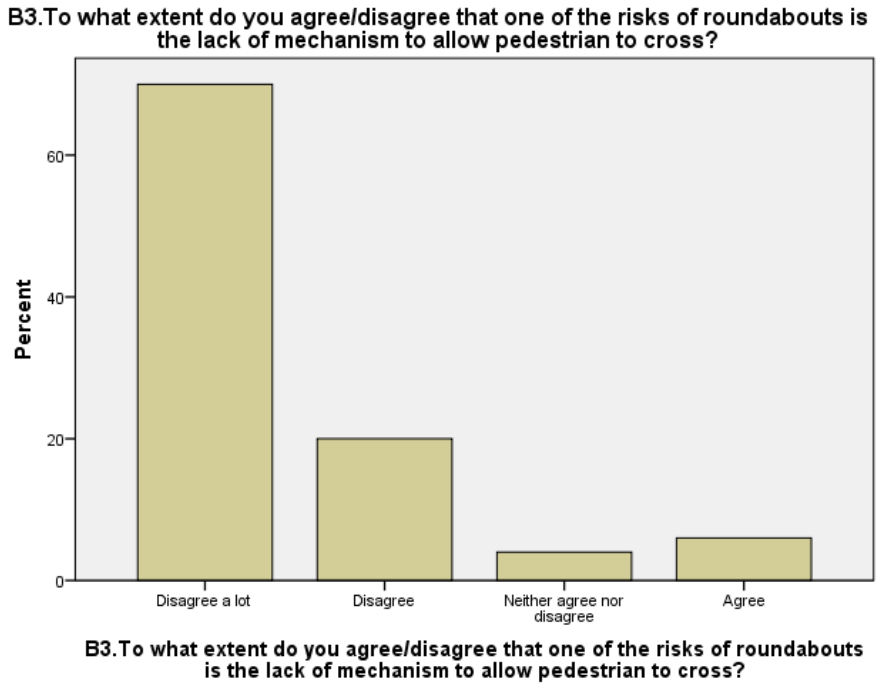


Figure No.9

Question B4 - Agree or Disagree about the Risks of Roundabout with Bicycles

The 40% of the participants agreed with the opinion that one of the risks of roundabouts is when bicycles have to co-exist with vehicles, the 34% neither agreed nor disagreed and the 20% agreed a lot.

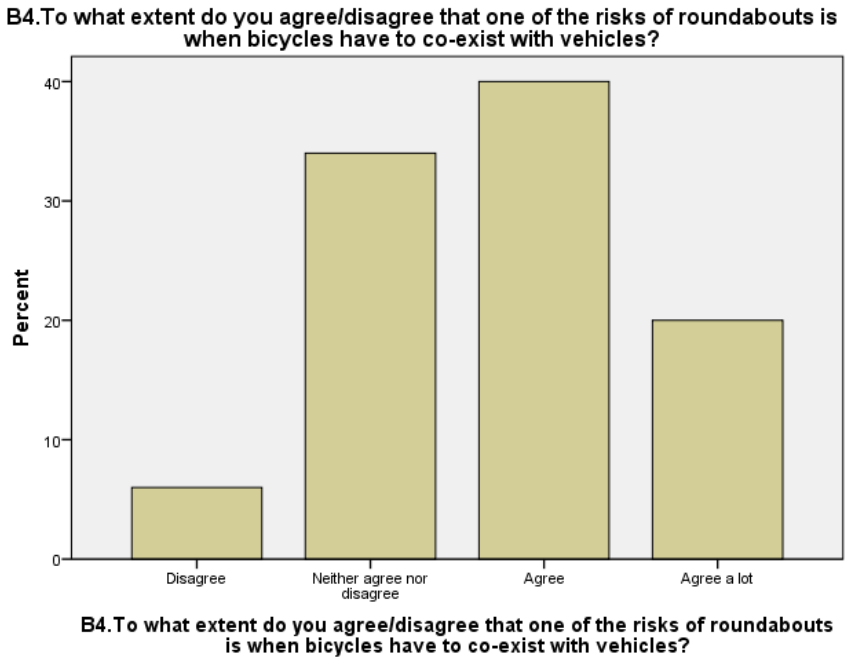


Figure No.10

Question B5 - Agree or Disagree about the Risks of Roundabout to the Means of Transport

The 38% of the participants neither agreed nor disagreed with the opinion that one of the risks of roundabouts is when means of transport (e.g.buses), which are considered heavy vehicles, have to co-exist with vehicles, the 36% disagreed and a 14% disagreed a lot.

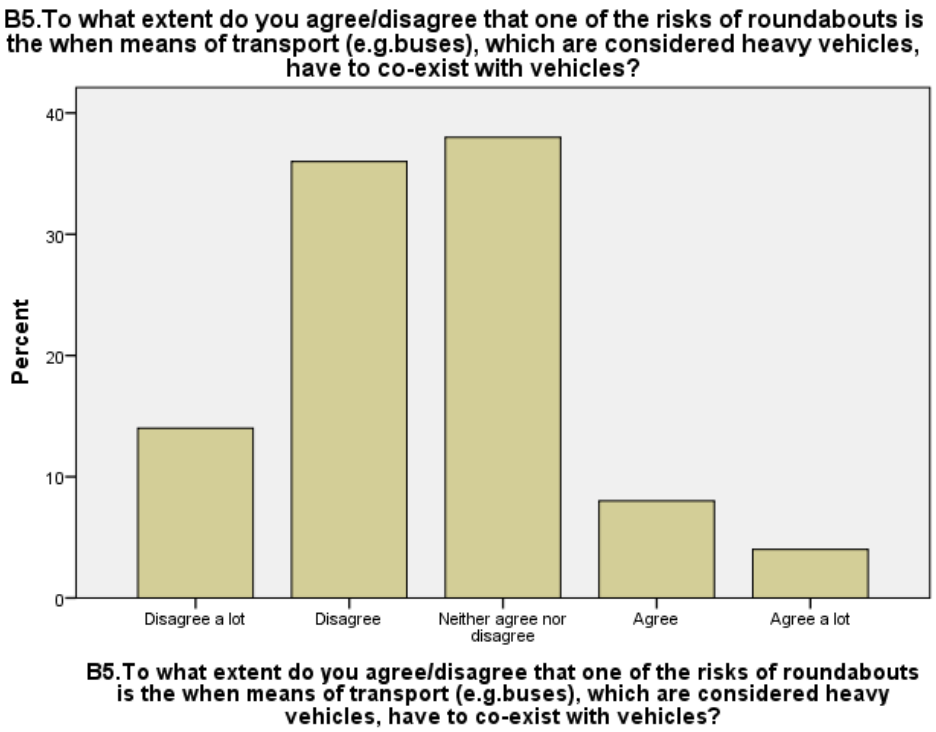


Figure No.11

Question B6 - Agree or Disagree about the Risks of Roundabout to the Lack of Knowledge from Drivers so as to the Right Choice of Lane

The 38% of the participants agreed with the opinion that one of the risks of roundabouts is the lack of knowledge on behalf of the drivers concerning the right choice of lane when exiting the roundabouts, the 32% agreed a lot and the 26% neither agreed nor disagreed.

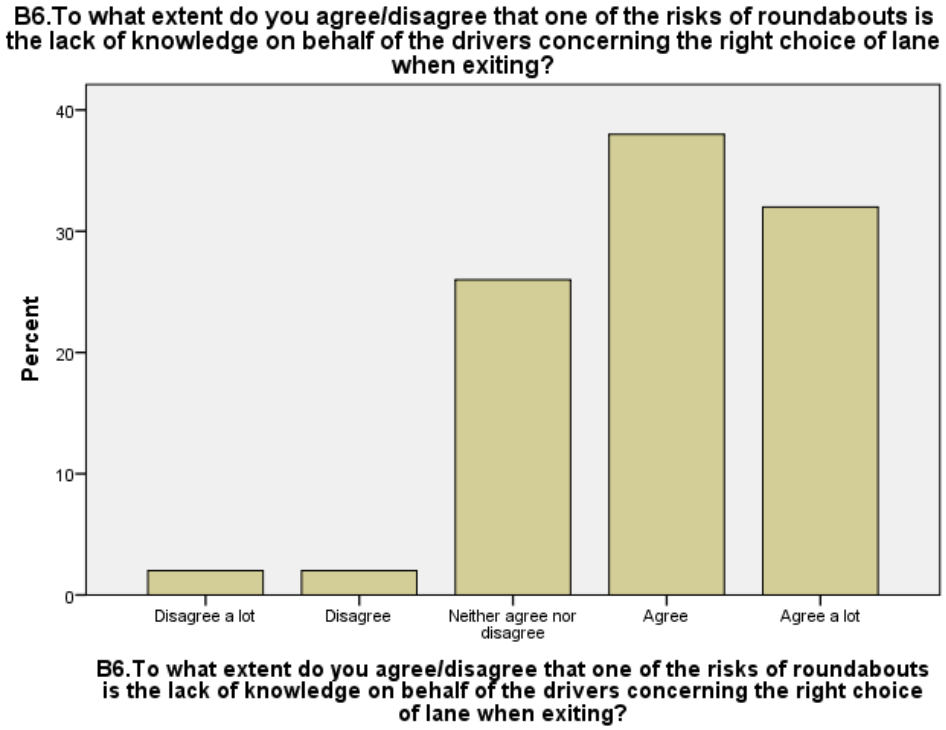


Figure No.12

Question B7 - Agree or Disagree about the Risks of Roundabout to Special Technical Challenges

The 38% of the participants disagreed with the opinion that one of the risks of roundabouts is special technical challenges that they may encounter during the process, on the contrary, a 28% agreed with the above opinion and the 26% neither agreed nor disagreed.

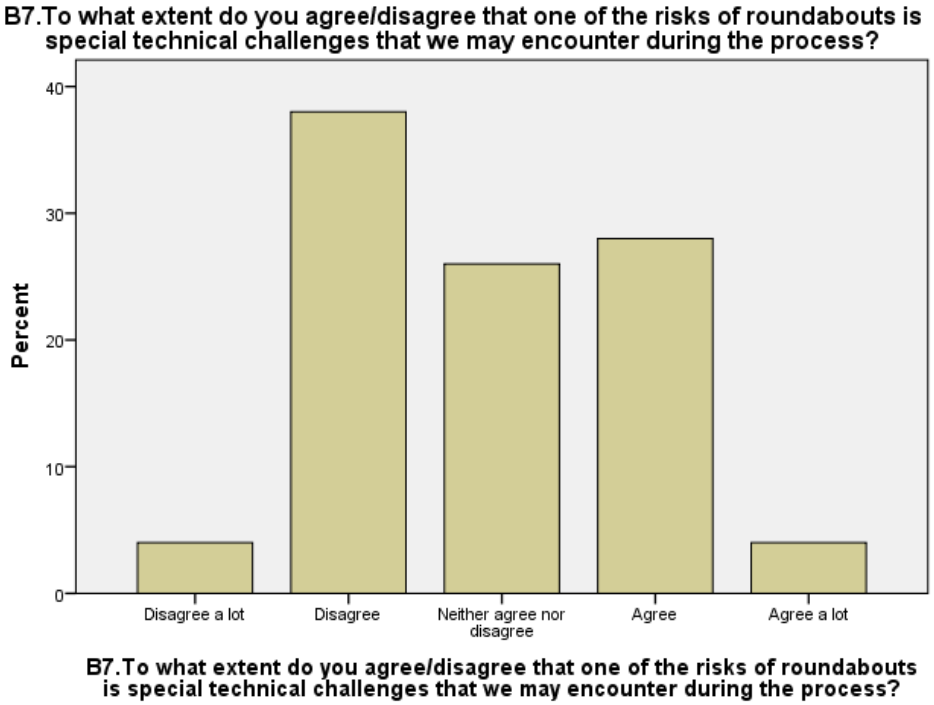


Figure No.13

Question B8 - Agree or Disagree about the Risks of Roundabout to the Maintenance of all Public Projects in Cyprus

The 56% of the participants agreed with the opinion that proper maintenance of all public projects in Cyprus is a challenge and the rest 44% agreed a lot as well.

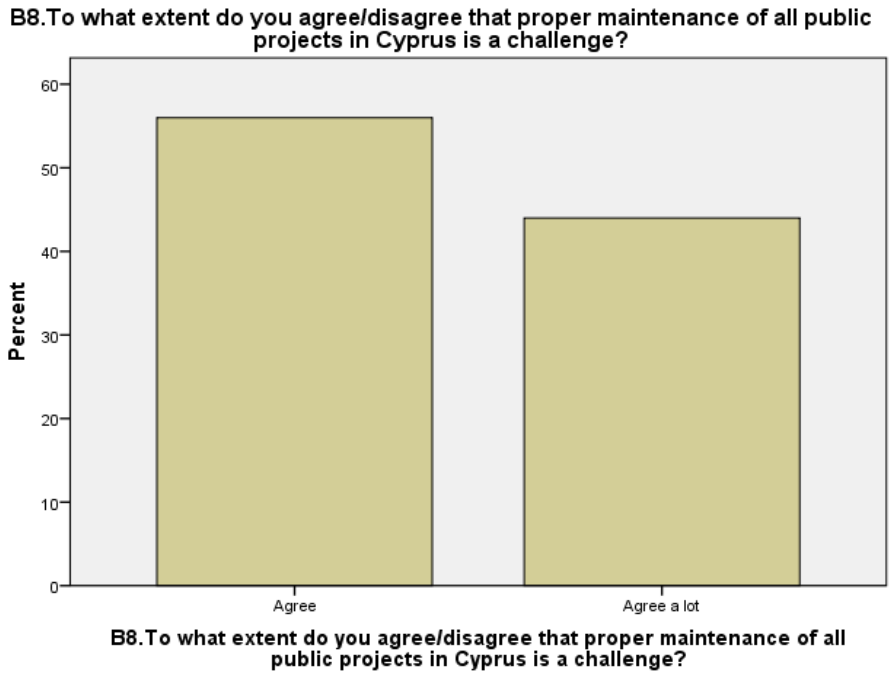


Figure No.14

Question B9 – Are the Drivers Aware of the Purpose of Roundabouts?

The 74% of the participants believe that Cypriots drivers are aware of the purpose of roundabouts whereas the rest 26% gave a negative answer.

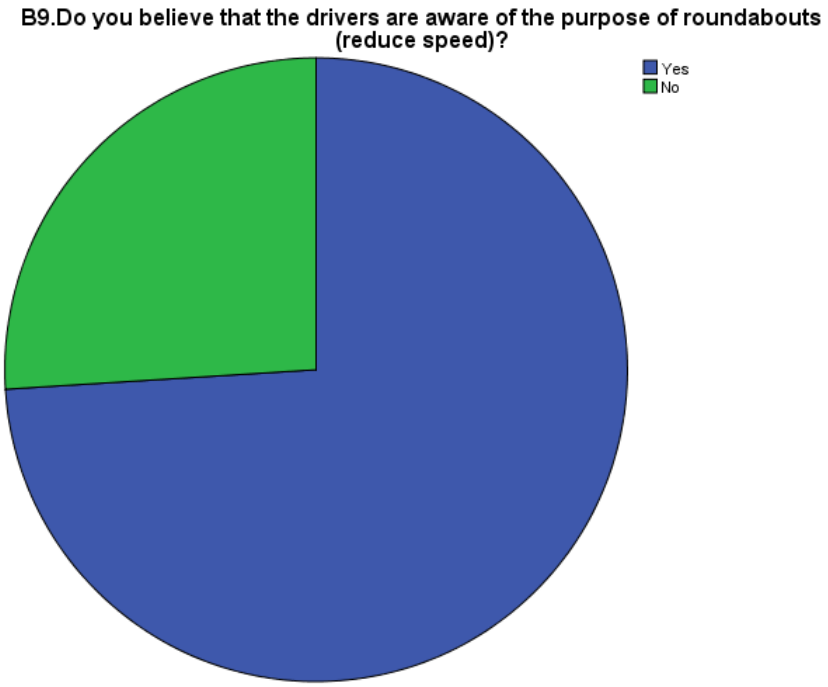


Figure No.15

Question B10 - Agree or Disagree with Complaints About Inappropriate Signaling

The 38% of the participants neither agreed nor disagreed with the opinion that the Public Works Department has put, in many cases, incorrect signage that do not comply with the Cyprus Highway Code, a 22% disagreed and a 16% disagreed a lot with the above complain.

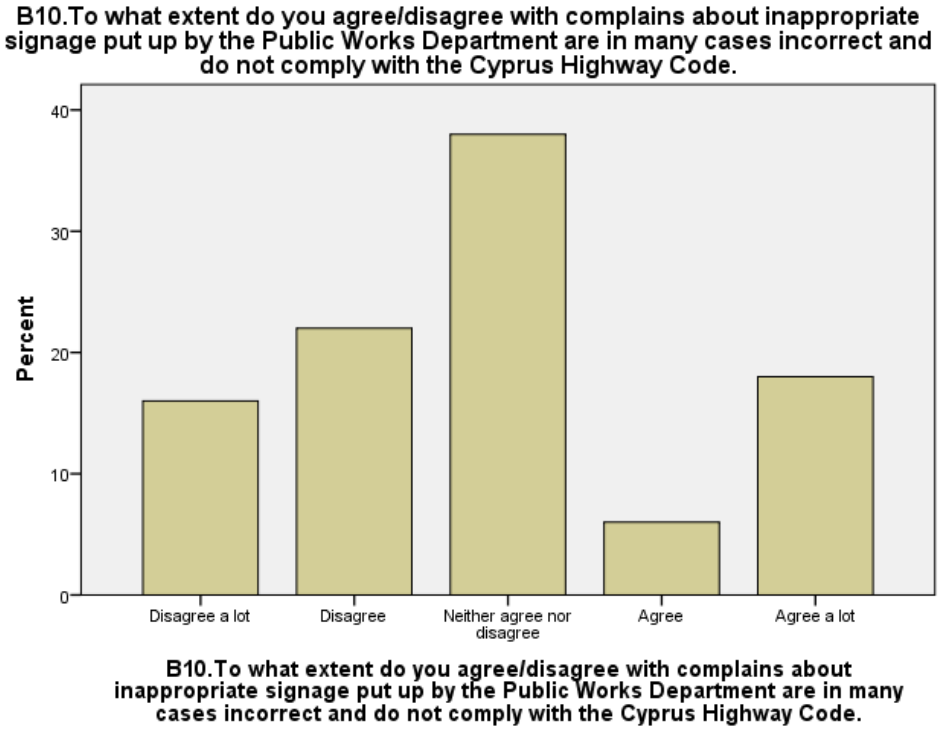


Figure No.16

Question B11 Agree or Disagree about the Installation of a Smart Traffic Lights

The 32% of the participants neither agreed nor disagreed with the opinion that the installation of ‘smart’ traffic lights will reduce the "lost" time of the drivers, a 24% disagreed whereas the 18% agreed and another same percent agreed a lot with the above opinion.

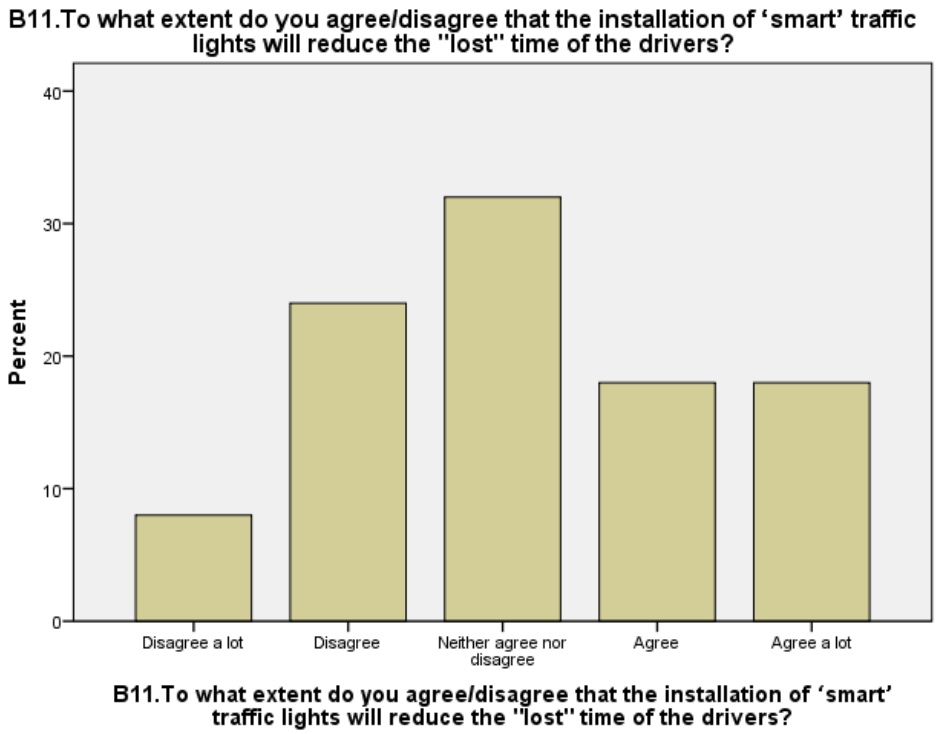


Figure No.17

Question B12 Agree or Disagree about the Fact that the Proper Lighting is Important in Order to Reduce Accidents?

The 46% of the participants agreed a lot with the opinion that proper lighting is important in order to reduce accidents during the night, a 26% neither agreed nor disagreed whereas a 12% agreed and another same percent disagreed with the above opinion.

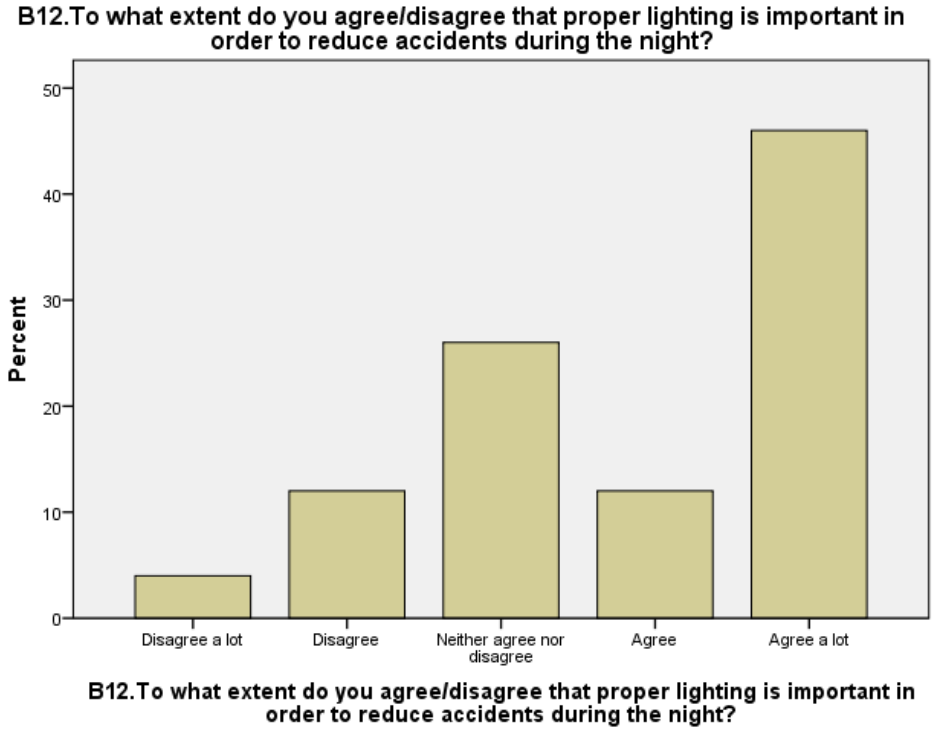


Figure No.19

Question B13 – Evaluation of the Cypriot Drivers' behavior

The 30% of the percent consider the driving behavior of Cypriot drivers moderate, the 20% very satisfactory, another 20% satisfactory and another same percent a little satisfactory.

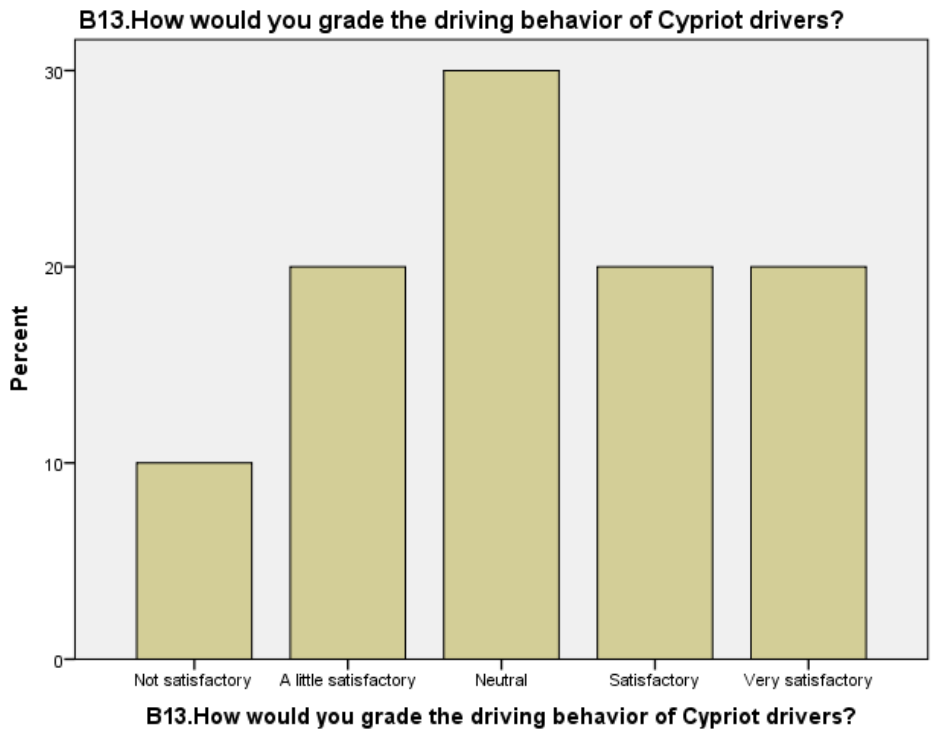
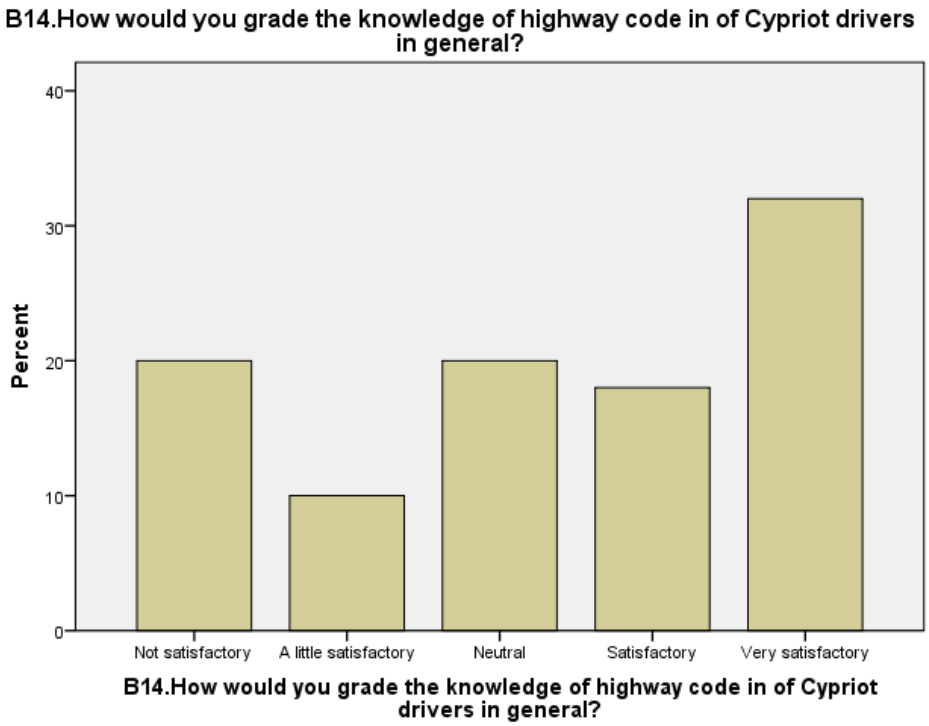


Figure No.20

Question B14 - Evaluation of the Cypriot Drivers' Knowledge About Highway Code

The 32% of the percent consider the knowledge of Highway Code in of Cypriot drivers in general very satisfactory, a 20% not satisfactory and another same percent moderate.


B14.How would you grade the knowledge of highway code in of Cypriot drivers in general?
Percent
40
30
20
10
0
Not satisfactory
A little satisfactory
Neutral
Satisfactory
Very satisfactory
B14.How would you grade the knowledge of highway code in of Cypriot drivers in general?

Chapter 5

Discussion

According to what resulted by the questionnaires'' analysis above, it should be said that the 30% of the participants said that when having a project about a roundabout traffic lights project, they take into account the circulation flow of the area in order to make the adequate planning, the 18% take into account the Necessities of pedestrians in that area, the 14% take into account Statistics about car crashes, the 12% the number of cars that will be using the roundabout on daily basis, the 10% take into account international standards and a 4% check new transportation studies in order to be informed about innovations. The rest 12% said that they take into account all of the above.

The majority of the participants consider most important proper traffic lights and general lighting (for night hours) in order to have normal circulation flow in a roundabout, the 18% proper signage as well as the Width of lane/lanes, the 16% the island diameter, the 14% the Curvature/geometry and the rest 12% the Width of entry approach as also the 70% of the participants disagreed a lot with the opinion that one of the risks of roundabouts is the lack of mechanism to allow pedestrian to cross, the 20% disagreed, whereas the 6% agreed and the rest 4% neither agreed nor disagreed.

In advance, the 40% of the participants agreed with the opinion that one of the risks of roundabouts is when bicycles have to co-exist with vehicles, the 34% neither agreed nor disagreed and the 20% agreed a lot, the 38% of the participants neither agreed nor disagreed with the opinion that one of the risks of roundabouts is when means of transport (e.g. buses), which are considered heavy vehicles, have to co-exist with vehicles, the 36% disagreed and a 14% disagreed a lot, the 38% of the participants agreed with the opinion that one of the risks of roundabouts is the lack of knowledge on behalf of the drivers concerning the right choice of lane when exiting the roundabouts, the 32% agreed a lot and the 26% neither agreed nor disagreed and the 38% of the participants disagreed with the opinion that one of the risks of roundabouts is special technical challenges that they may encounter during the process, on the contrary, a 28% agreed with the above opinion and the 26% neither agreed nor disagreed.

Moreover, the 56% of the participants agreed with the opinion that proper maintenance of all public projects in Cyprus is a challenge and the rest 44% agreed a lot as well, the 74% of the participants believe that Cypriots drivers are aware of the purpose of roundabouts whereas the rest 26% gave a negative answer and the 38% of the participants neither agreed nor disagreed with the opinion that the Public Works Department has put, in many cases, incorrect signage that do not comply with the Cyprus Highway Code, a 22% disagreed and a 16% disagreed a lot with the above complain.

Finally, the 32% of the participants neither agreed nor disagreed with the opinion that the installation of ‘smart’ traffic lights will reduce the "lost" time of the drivers, a 24% disagreed whereas the 18% agreed and another same percent agreed a lot with the above opinion. The 46% of the participants agreed a lot with the opinion that proper lighting is important in order to reduce accidents during the night, a 26% neither agreed nor disagreed whereas a 12% agreed and another same percent disagreed with the above opinion, the 30% of the percent consider the driving behavior of Cypriot drivers moderate, the 20% very satisfactory, another 20% satisfactory and another same percent a little satisfactory and the 32% of the percent consider the knowledge of Highway Code in of Cypriot drivers in general very satisfactory, a 20% not satisfactory and another same percent moderate.

According to the literature review analysis, the risks that need to be anticipated and possibly addressed during all phases of a project vary and are analyzed into categories that have been studied in terms of their degree and criticality. Then, an attempt was made to identify the situation in our country and whether risk management is integrated into the design of a project. In order to confirm or reject the findings of the study, the case of execution of a public and a private project by the same company in Cyprus was studied.

From the discussion with the executives of the company that carried out both the examined projects, some key elements emerged which one must pay attention to from the beginning in order not to face problems in the execution of both a public and a private project. According to the company's experience in a public project, one must proceed to a thorough study of the project contract immediately after its signing in order to find any errors or omissions and to clarify - identify. Legal knowledge is necessary to find these shortcomings. These are then presented to the

service for approval. In this way an extra cash flow can be achieved from the contingencies, while at the same time the frictions with the service during the project are reduced.
Another crucial element is that project management must have a very good schedule from the beginning, so that there are no deviations in either time or budget. Unnecessary delays must be reduced from the outset and, in the event of such delays, be due to unbalanced and unavoidable factors. The work needs to flow, to eliminate the "dead" times between the work groups. It is also necessary for the crews to coordinate with each other in time so that when they finish their work, they start their own work without unnecessary delays. So, time management and specifically proper time management is a criterion for success in the execution of a public project.

Regarding a private project, the company in the discussion pointed out two important elements for its proper execution. First, it is important to present to the client alternatives for each task group in order to be able to choose based on their financial budget. This tactic, in addition to reducing the risk, also offers more variety to the customer and leads him to choose the company over a competitor. Secondly, it is necessary to make an agreement from the beginning on how to finance the project so that there are no misunderstandings in its course.

Based on the study for the elaboration of the diploma and the conclusions that emerged from the study of the two cases of projects made by the same company, it appears that the differences between public and private projects are many and obvious. Risks are not always common although in cases such as external risks the management should be the same. The changes in the jurisprudence certainly try to correct any problems due to the different treatment of the two categories but there is still much to be done. In addition, time must be given to implement what is provided and for the two categories of projects to converge in practice.

- ✓ Employer or project owner: the public or other legal entity of the public sector on whose behalf the contract is drawn up or the project is constructed.
- ✓ Project developer: the competent Authority or service responsible for the production of the project
- ✓ Contractor or contractor: the construction company to which the construction of the project has been contracted

✓ Contract: the written agreement between the employer or the construction company of the project and the contractor for the construction of the project, as well as all relevant issues, plans and specifications

✓ Managing service or supervisory service: the technical service of the project construction body that is responsible for monitoring, controlling and managing the construction of the project.

✓ Chief Authority or Supervisory Authority or Service or body of the construction body that supervises its construction and in particular decides on any change in the terms of the contract or other elements thereof as defined by this law and the PD / s issued with his authorization.

✓ Technical Council: the collective body of the construction body of the project which gives an opinion on the issues defined by this law and the pd / s issued with its authorization.

Chapter 6

Conclusion

There are various definitions in the world literature and jurisprudence regarding the concept of project and project management in the construction industry. The criteria for characterizing a project as public are the functional criterion, i.e. by the nature of the construction, and the organic criterion, ie by the parties to the contract1. Project management deals with questions such as "why", "how", "what", "who", "when" and "how much does it cost" a project in all its stages, from the design stage to the destruction or abandonment of.

According to Pantouvakis (2003), in the construction sector the project management concerns the completion of technical sheets, the possible integration of the project for financing, the management of the studies, the selection of the implementation methods, the necessary time and cost estimates, the quality program, the safety and health plan, risk management and any other organizational or control action required for the design, implementation and operation of the project throughout its "useful" life.

During the study for the elaboration of this diploma it was necessary to understand the concepts of project and project management. For this reason, at this point, definitions of the specific concepts are given in order to then deepen the subject. The PMI (Project Management Institute) defines a project as "a temporary effort made to produce a unique product, service or result" (PMI PMBOK, 2013). This is the process in which knowledge, skills, tools and techniques are applied during the execution of the project work in order to develop its requirements. According to Verzuh (2008), the three variables of each project are cost, timing and quality. He developed a blueprint that describes the management functions of a project and which consists of 5 parts: (a) selection, (b) definition, (c) design, (d) control and (e) completion. To these he adds management (f) and quality management (g), which are processes aimed at the proper and optimal execution of the project.

As a conclusion to the above, the risk, risk analysis, risk assessment and risk management are often used in both the business and public sectors. The risk definition associated with risk management includes the following: Risk is the probability of an event occurring that has a negative impact on the achievement of goals, at the individual or collective level" or "Risk is the positive and / or negative effect of uncertainty that affects the achievement of organizational goals.

Also, in a more general context, risk is a type of event, activity or inability to perform an activity, which is likely to occur in the future, which will have a generally negative but, in some cases, positive effect on the achievement of the organization's goal. In addition, risk is defined as the probability of occurrence of all elements and events that may adversely affect the operation of a financial institution (this is the definition commonly found in risk management regulations).

Therefore, risk management to reduce and minimize exposure to exposure is essential for any business. Despite this need, many companies rarely implement detailed risk assessment and management strategies. This is due to the fact that participation in risk assessment and management requires a certain budget and human resources, which is limited to companies and especially to small ones that have limited capital to invest in this process. The decision of these companies on how and what to invest depends on their current activities and financial situation. Businesses often shift the project-based risk management process. It is not certain, however, whether a well-implemented risk management plan or an already tailored project risk management can help businesses reduce risk losses or, on the contrary, negatively burden their budgets.

Risk identification and management is an integral part of the sound management and governance framework of both the private and public sectors. Those in charge of governance (auditors) are expected to act in the best interests of the key stakeholders and also express the assessment and response to the risks of each business entity. This risk response includes those directly related to strategies, programs and business activities, as well as compliance with the laws and economic regulations of each country system. Stakeholders expect those responsible for organization and management to manage strategic and environmental risks and to set up controls to address similar risks. In addition, managers and managers at all levels of public bodies are expected to manage strategic, environmental and operational risks. That is, risk management is not an individual

responsibility but governs all levels of organizations. In other words, the responsibility for dealing with risks lies at all levels of an organization.

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