MITIGATION OF PROJECT RISK THROUGH COMMUNICATION TRAINING: A SERIOUS GAMES PROPOSAL

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Dissertation submitted for the degree of

M. Sc. (Operational Research)

in the

SCHOOL OF INFORMATION TECHNOLOGY

in the

FACULTY OF ECONOMIC SCIENCES AND IT

at the

NORTH-WEST UNIVERSITY
VAAL TRIANGLE CAMPUS

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May 2014

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ABSTRACT

Keywords: enterprise-wide projects; project risk management; risk mitigation; critical success factors; project stakeholders; communication preferences; behavioural preferences

Complex projects often fail even when formal project management systems are in place. Project management processes and methodologies are well defined and described in academic and business literature. There is however less published research on the socio-cultural factors that are critical for project success. This study investigated whether project stakeholders view communication as one of the critical success factors for project success. Critical project success factors were identified from a literature study and ranked by 34 project stakeholders. The data was analysed using the Instant Priorities method and Analytical Hierarchical Process. A workshop on the use of communication within projects was observed. The results were translated into a project success factor model that explains the importance of communication in project success. Furthermore, a serious games based training tool is proposed. The aim of the training will be for participants to understand the communication preferences of themselves and the people they interact with in large projects. The proposed tool will require the participant to map typical stakeholder behavioural preferences. The well-known Marston DISC behavioural model is used as basis for understanding the behavioural preferences of different stakeholder groups. This research project supports the view that communication training across stakeholder groups should be used as a project risk mitigation tool. An increased understanding of the communication preferences of project stakeholders has the potential to shape a project culture that will stimulate teamwork combined with high levels of personal motivation as well as have the capacity to quickly identify and address project risks.

ACKNOWLEDGEMENTS

I would like to express my gratitude and thanks to the following people for their valuable contributions:

- My supervisor Prof. Hermien Zaaiman for her most valuable advice, insight and leadership. It has truly been a pleasure learning and working with her
- My loving family for their support, love and purpose in my life
- Pastor Colin Chetty for his wisdom, understanding and knowledge
- The examiners who offered up their time to examine this study
- MMI Holdings (Centurion) for their participation and hospitality in hosting the Risk Mitigation Workshop
- The Serious Games Institute of South Africa (SGI-SA) for their participation and valuable ideas during the game design workshop
- All the people who so willingly responded to the research

Soli deo Gloria

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION, PROBLEM STATEMENT AND RESEARCH OBJECTIVES

1.1 INTRODUCTION AND PROBLEM STATEMENT

Companies that operate in hypercompetitive technological environments are increasingly reliant on large capital projects to support and expand their business. Projects have become more complex as the "need to integrate information technologies, physical technologies, disparate subcontractor entities, cultures, languages, time zones, politics, and the interests of multiple and increasingly powerful stakeholders" have increased. Such projects are characterised by complexity, uniqueness, assumptions, constraints and stakeholder expectations (Gray & Larson, 2000:4-5). These factors contribute to the success and failure rates of projects.

One can define two dimensions to carrying out projects. The first dimension is the technical or hard side of the project management process. This technical dimension consists of the formal, directed, purely logical parts of the process as defined by the typical deliverables of formal project management methodologies. The second dimension is the socio-cultural or soft side of project management. This dimension focuses on creating a temporary project-based social system within a larger organisational environment, for example: how people work together, relationships and politics, project ownership, intangible objectives and influencing project stakeholders (Gray & Larson, 2011:15-16).

The hard and soft sides of a project can be seen as the 'science' and the 'art' of a project, respectively. For a project to be successful, both dimensions must be adequately managed. However, some project managers become overly focused on the planning and technical dimension of projects (Gray & Larson, 2011:16). The people aspects are often ignored and misjudged, leaving project stakeholders disappointed. Since people are responsible for the planning and execution of projects, it is important to attempt to understand the behavioural preferences of people to optimise the success of your project (Kocken, 2000:1).

Marston's DISC behavioural style model (Marston, 1928) will be used to evaluate and explain the behavioural preferences of different project stakeholder groups. For example, some people are dominant and want to be in control, while others are influencers. There are 'steady' people who do not like change and need security, while conscientious people are

concerned with the rules and regulations. Some people are quiet and reserved and some boisterous.

In this study, the critical success factors for projects were identified and ranked. The resultant ranking and literature on the subject of project success were translated into a project success factor model that explains the importance of communication in project success. The premise is that an increased understanding of the communication preferences of project stakeholders has the potential to shape a project culture that will stimulate teamwork and high levels of personal motivation as well as have the capacity to quickly identify and resolve threatening problems (Gray & Larson, 2011:15-16).

Lastly, a serious games based training tool was proposed based on observation of a workshop on the use of communication in project risk mitigation, literature study in serious games and a game design workshop. The aim of the training is for participants to understand their own communication preferences in conjunction with the communication preferences of typical project stakeholders and individual team members. The proposed tool requires the participants to map project team members to behavioural styles.

1.2 OBJECTIVES OF THE STUDY

The researcher investigated the idea that communication training will strengthen the behaviour of project stakeholders in the workplace. Based on the literature study described in Chapter 2, the researcher postulated that training based on serious gaming principles will enable project stakeholders to understand and more optimally manage the risks associated with human behaviour and miscommunication in a project environment.

The following objectives were formulated for the study:

1.2.1 Primary objective

The primary objective of this research project was to investigate the use of a serious games based intervention to mitigate the risks of inadequate communication within a project environment.

1.2.2 Secondary objectives

In order to achieve the primary objective, the following secondary objectives were formulated for the study:

- Investigate the validity of the perception that communication plays an important role in determining project success using a questionnaire and comparative analysis tool
- Evaluate the use of a workshop based communication training intervention based on the Marston DISC behavioural style model
- Translate the intervention into a proposed serious game to train project stakeholders on key principles of effective project communication and as such contribute to the mitigation of the risks of inadequate communication in projects

1.3 RESEARCH METHODOLOGY

1.3.1 Literature review

Available literature on project management, definitions of project success, critical success factors in projects, behavioural preferences according to the DISC model and serious games were studied to gain an overview of the problem area. The available literature was sourced from online academic databases, academic journals, articles, relevant books and the Internet.

1.3.2 Empirical study

Empirical research were conducted in the form of questionnaires and two workshops, the first where the researcher observed a workshop on communication within projects and the second a game design workshop. The workshops were presented in a participatory and facilitated fashion.

The workshop on communication within projects provided an immersive learning experience on the challenges that project stakeholders face to successfully deliver their. The workshop as a qualitative research method combined with the quantitative questionnaire method led to a mixed research design.

The game design workshop was presented in a participatory and facilitated fashion. The researcher presented the background and findings of the study. Afterwards a discussion took

place between the researcher and the participants which led to a concept for the proposed game.

The target population for this study comprised of project stakeholders within the chemical and financial sector. Specific project stakeholder roles in the study were defined as project sponsor, project user, project manager and project team member.

A sample of 34 representative participants completed the questionnaire. Non-probability sampling using the technique of snowballing was used. The questionnaire was sent to key stakeholders who further spread the questionnaires to other participants. It was also administered to the participants of the project risk mitigation workshop.

The structured questionnaire consisted of three sections. The aim of the questionnaire was to investigate the perception of project teams and other stakeholders that communication plays an important role in determining project success. The questionnaire was accompanied by a cover letter explaining the purpose of the study and requesting the participants to follow the given instructions.

The first section contained demographic information pertaining to the participants. The researcher was interested in the participants' project stakeholder role, the sector they work in, typical project team size and experience as a stakeholder.

In the second section, a comparative analysis tool was used to identify the most important critical success factors in projects. The data were analysed using the decision making techniques of Instant Priorities and Analytical Hierarchical Process.

Project stakeholders belonging to a large financial services group in South Africa attended workshops on the use of communication in project risk mitigation. Based on the result of the comparative analysis tool obtained from the questionnaires and observation of the workshops, a serious games based training tool is proposed.

1.4 CHAPTER CLASSIFICATION

Chapter 1: Nature and scope of the study

This chapter encompasses the introduction and background to the research study. The problem statement, research objectives and research methodology were discussed.

Chapter 2: Literature review

Literature on the following topics is reviewed in Chapter 2:

- Project management
- Definitions of project success
- Critical success factors in projects
- Behavioural preferences according to the DISC model
- Serious games

Chapter 3: Findings and conclusions

The findings from a questionnaire determining success factors are presented and the results are analysed, interpreted and evaluated.

A workshop-based intervention to improve communication in projects using the DISC model is discussed. The findings are presented and the results are analysed, interpreted and evaluated.

On the basis of the findings in this chapter a project success model is proposed.

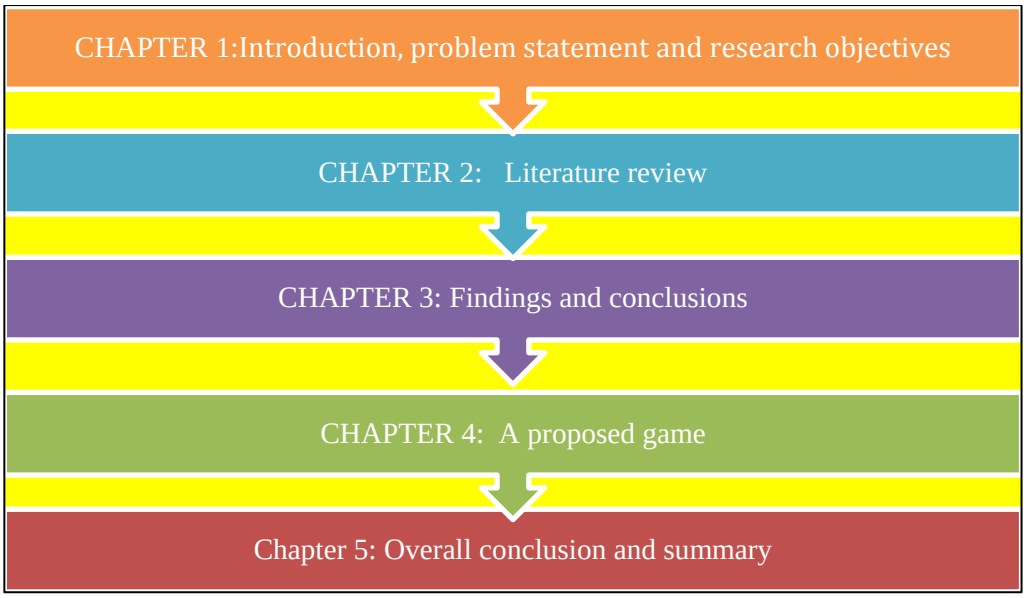
Chapter 4: A proposed game

A serious game is proposed.

Chapter 5: Overall conclusion and summary

This chapter provides a summary of the conclusions drawn from the research study. The main findings per secondary objective are given. Recommendations and suggestions for future research are provided.

Figure 1 Chapter classification



CHAPTER 2: LITERATURE REVIEW

2.1 PROJECT MANAGEMENT

2.1.1 Defining a project

Changes that companies face in today's complex business environment are developed and managed as projects. The Project Management Institute (PMI) states that a project is a temporary endeavour undertaken to create a unique product, service, or result (PMBOK, 2008). According to Kerzner (2009:2) a project can be characterised as follows:

- A well-defined objective to be completed within certain specifications
- Defined start and end dates
- Funding limits
- Multifunctional (i.e., money, people, equipment)

2.1.2 Project management defined

Project management is defined as the initiation, planning, execution and controlling of knowledge, skills, tools and techniques to meet project objectives and requirements. Project management involves process groups and knowledge areas as listed below (PMBOK, 2013).

Project management processes:

- Initiating
- Planning
- Executing
- Monitoring
- Controlling
- Closure

Project management knowledge areas:

- Scope Management
- Time Management
- Cost Management

- Quality Management
- Human Resource Management
- Change and Communications Management,
- Risk Management,
- Procurement Management
- Integration Management
- Stakeholder Management

2.1.3 Project Stakeholders

Definition of a stakeholder

A stakeholder can be defined as any group or individual, internal or external to the organisation, who may influence and in turn be influenced by a particular project's outcome (Venter & Bricknell, 2011:252). Stakeholders invest in the outcome of the project by contributing time, skills, knowledge or funding (Kara, 2011:9).

For the purpose of this study the following four typical project stakeholder groups were identified:

- Project managers
- Business managers, project sponsors and business owners
- Project users
- Project team members

These stakeholders have different needs and expectations that must be fulfilled for the project to be deemed successful. It is therefore important to understand how to manage the expectations of each stakeholder to be able to successfully deliver on projects (Barron & Sewchurran, 2008:59).

The Project Manager

The project manager is responsible for planning, scheduling and controlling all project activities. In this role, the project manager acts as the link between the different project stakeholders to satisfy their needs on the project. The project manager's role should therefore include the identification and management of stakeholder expectations. This requires that the

project manager establish a common understanding of the business problem and solution between the project stakeholders (Barron & Sewchurran, 2008:58).

Optimal execution of this role requires sustainable working relationships with other project stakeholders. To be able to do this, the project manager must be a strong communicator, have excellent management skills, be innovative, be knowledgeable about technology, have created an established rapport with the project team and client organisation, be able to lead his/her team and be able to work well under pressure (Barron & Sewchurran, 2008:58).

Business Managers, Project Sponsors and Business Owners

The project sponsor is the most senior stakeholder, as s/he takes ownership of the business problem and is accountable for ensuring a successful project outcome. The project sponsor has the power to influence decisions and should be responsible for obtaining stakeholder and employee buy-in to ensure that the project is successful. In this role, s/he will identify and liaise with other project stakeholders who may be impacted by the project and who may therefore assist or hinder the project. The project sponsor is also accountable for the use of external stakeholders such as vendors and consultants on the project. Like the project manager, the project sponsor must coordinate communication and encourage open relationships with the project stakeholders while acknowledging and addressing their concerns and interests (Barron & Sewchurran, 2008:58-59).

Project User

In this study, the project user is defined as the main user and beneficiary of the project deliverables. The user has ultimate say on whether the project was successful and can be an individual, a group of people with a common objective, an organisation or a group of organisations.

Project Team Member

The project team member is the person who reports directly or indirectly to the project manager and who is responsible to perform the tasks required to achieve the deliverables within the project constraints. The team members have to inform the project manager of project risks and issues that require resolution by other stakeholders. It is important that team members understand the needs and expectations of the other project stakeholders to be able to tailor successful delivery of the project (Kerzner, 2009:17; 174-175).

2.2 DEFINITIONS OF PROJECT SUCCESS

2.2.1 Project success

A project is considered successful when it is completed on time and budget delivering the initially specified features and functions. However, literature argues that under this standard definition of project success, very few projects, especially projects requiring innovation, accomplish what was set out to do. Very few projects are ever completed without trade-offs on time, cost or quality or scope changes on the initially agreed-on deliverables (Eveleens & Verhoef, 2010:30).

Kerzner (2009:3) defines successful project management as meeting project objectives within time and within cost with minimum or mutually agreed upon scope changes, at the desired technology and performance level while utilising the assigned resources effectively and efficiently. A project is considered a success when it is accepted by the customer.

The traditional constraints under which the project manager operates are known as the triple constraint or the project management triangle as seen in the Figure 2. According to Kara (2011:3) trade-offs in scope, quality, cost and schedule occur during the project management processes. Trade-offs allows the project manager to deliver an optimal solution to the project clients under the project constraints.

Figure 2 The project management triangle (PMBOK, 2004)

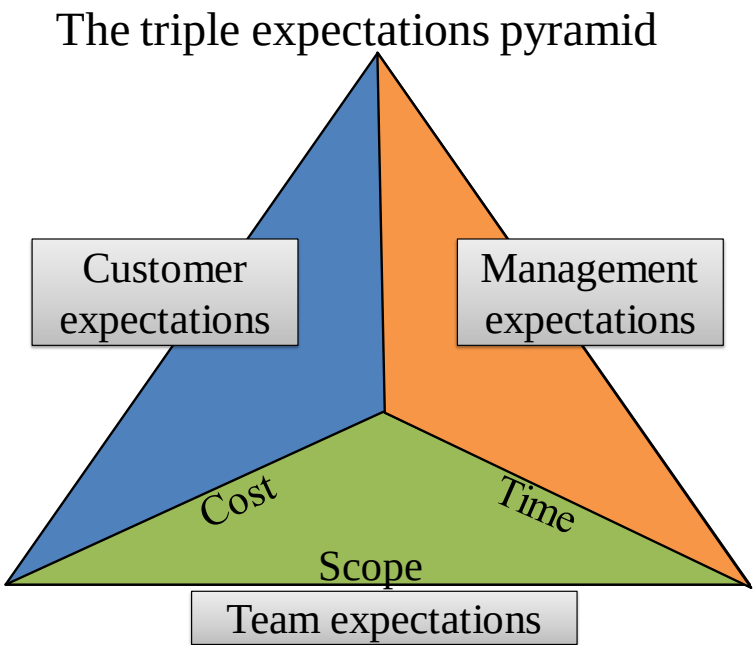
The triple constraint states that successful project management requires meeting time, scope and cost and satisfying the project clients, i.e. the project's sponsor, business owners and

users. Deliverable quality depends on meeting cost, scope and time goals as optimally as possible. Scope refers to the activities or tasks that need to be completed to produce the expected end result. Time refers to the amount of time available to complete the project and the cost constraint refers to the amount budgeted for the project. Increased scope usually means increased time and cost, a restricted budget could mean reduced scope and more time and a tight time constraint could mean greater costs and/or decreased scope (Kara, 2011:7).

A modified approach to constraints requires project management to identify requirements, address the needs, concerns and expectations of the stakeholders and optimally balance the following competing constraints: scope, quality, schedule, budget, resources and risk (PMBOK, 2008:6).

Russel (2011:17) suggests a triple expectations pyramid that successfully balances the expectations of the stakeholders and the technical constraints.

Figure 3 The triple expectations pyramid (Russel, 2011:87)



As seen in the Figure 3, each face of the pyramid introduces the expectations of the customer, management and the team to the definition and evaluation of project success. These expectations have corresponding impact on the traditional project success factors of budget (cost), time and scope. Success can thus be ascribed to meeting the expectations of the stakeholders as well as managing the resultant technical constraints on the project.

2.2.2 Project failure

Projects are classified as failures when expectations are not met. Reasons for project failure identified in Kerzner (2009:63) and Barron & Sewchurran (2008:58) are:

- Technical factors
  - Ineffective detailed planning
  - Lack of proper project skills (scheduling, estimation, cost control)
- Data factors
  - Undefined, incomplete, and changing business requirements
- User factors
  - Lack of user involvement
  - Unrealistic expectations
- Organisational factors
  - Lack of resources required by the project
  - Lack of executive support and commitment
  - Lack of employee commitment
  - Poor morale and motivation
  - Conflicting priorities between executives, line managers and project managers
  - Lack of stakeholder expectation management

2.3 CRITICAL SUCCESS FACTORS FOR PROJECTS

A literature study on project success factors was done and 10 key project success factors were identified.

2.3.1 Planning

Planning leading to a project plan defines how a project will be executed and is used as a basis for the monitoring and controlling of the project. A typical project plan is geared towards addressing the hard technical project dimension of scope, quality, time, costs, resources and risks. More complete project plans include the soft aspects of projects in a formal change management and communication plan. It is essential that the project plan is based on realistic assumptions and is aligned to the specific requirements of a project. However, planning well is only the start of project success (Russel, 2011:133-134).

2.3.2 Expectations

Each stakeholder group's expectations of the project should be identified and constantly assessed throughout the life of the project to optimise project success. Communication is a crucial tool to facilitate stakeholder expectation management. As mentioned in Barron & Sewchurran (2008:59) Preble proposes an iterative approach to stakeholder expectation management based on stakeholder management theory. This approach includes the following steps:

- Identify stakeholders and their expectations
- Assess these expectations against the business objectives
- Prioritise expectations according to project constraints
- Communicate prioritised expectations to all stakeholders
- Decide on the approach to be taken to meet these expectations
- Monitor and control the expectations throughout the project

Stakeholder expectations are influenced by their perception of the project objectives and how the implemented solution will fulfil these objectives. Therefore, stakeholder assessment of project outcome will be determined by how well they believe their expectations have been met. Each stakeholder must consciously and explicitly define his/her expectations to allow the project manager to understand their view of project success. Expectations may change and must be monitored and managed through the life of the project.

2.3.3 Clear business case, scope and requirements

Effective project management includes clearly defined project objectives and goals, as well as agreement between the project stakeholders on how these goals and objectives will be achieved (Barron & Sewchurran, 2008:57-58). The goal of the project scope document is to describe the customer’s needs, rather than how the team will accomplish its goals. The scope document should include the project objectives, deliverables, milestones, specifications, limits and exclusions (Fraser, 2011:93). Agreement and understanding of the project business case, scope and requirements will determine both project delivery and the ultimate stakeholder assessment of project success.

2.3.4 Project scope, timeline and team size

In this study the critical success factor of project scope, timeline and team size refers to the impact of the size of the project on project success.

By definition, a project has a start and an end date. The project timeline is determined by and also determines stakeholder expectations and assessment of the ultimate success of a project (Fraser, 2011:95).

Project team members need to be able to communicate with each other. A fundamental principle of systems thinking is that elements of the system relate to one another in greater complexity as the number of elements increases. The size of the team determines the number of relationships in a project team. Two team members will have a single relationship, three members have three relationships and four have six relationships, etc. The larger the project team, the more relationships the project manager has to manage and control (Radford, 2011:309-310).

2.3.5 Project implementation team

The implementation team is responsible for conducting the project activities. The implementation team includes the technology specialists responsible for implementing the project solution. Other stakeholder groups should interact with the implementation team to ensure that requirements are correctly implemented (Anon, 1997:7). The capability of the project implementation team to fulfil their role will impact project delivery.

2.3.6 Stakeholder ownership, understanding and involvement

Executive support and ownership is an important factor for project success as they control resources and information that impact the achievement of project objectives. Visible executive support sets the example for the rest of the organization and encourages employee participation and buy-in across the organization. It is critical for business resources to be involved in the project to ensure that they feel part of the change and that their contribution is seen as valuable to the process (Barron & Sewchurran, 2008:58).

2.3.7 Project management method

A formal project management methodology describes a system of interrelated phases, procedures, activities and tasks that define the project process from start to end. Best practice advice is that companies should adopt a single project management methodology to increase their project management maturity. Maintaining and supporting a single methodology should lower cost, reduce resource requirements, minimise paperwork and eliminate duplicated efforts (Kerzner, 2009:75-76).

2.3.8 Risk management

Project risk is defined as an uncertain and unfavourable event, which if it should occur, negatively affect the deliverables or objectives of a project. Risk may be quantified as the probability that such an event may occur multiplied by its expected impact. Project risk management may be defined as the process concerned with identifying, analysing and responding to uncertainty in projects. In order to successfully manage project risk, the project team must consist of appropriately experienced members who are able to implement the project risk management process (De Villiers, 1999:24).

2.3.9 Vendors, subcontractors or consultants

Few firms have sufficient in-house resources or a comprehensive enough knowledge or skills base to implement a complex enterprise-wide project. Such projects therefore rely on external support obtained from vendors, subcontractors or consultants. Consequently, coordination between the external consultants and the client is critical for project success. This requires facilitating communication and mutual understanding through project management activities for successful implementation.

External consultants are often informally blamed for project failure in large projects and we were interested in where their contribution to project success would be ranked by project stakeholders.

2.3.10 Communication

On-going communication across the organisation throughout the project is essential for project success. Communication involves educating all project stakeholders about the benefits and impact of the project on the organisation as well as communicating the progress of the project (Brown & Hyer, 2010:8). Project communication includes soliciting issues and risks associated with the project from all stakeholders, as well as resolving conflict within the team. Effective communication to the right stakeholders at the right time ensures that the project will be less susceptible to budget, schedule, and resource issues (Barron & Sewchurran, 2008:58).

Communication unlocks the power of all the skills described in the literature to manage projects. Communication on projects is much broader and deeper than simply informing stakeholders about the status of the project. It is the foundation of effective relationship building and creating trust between stakeholders (McGregor, 2011:302).

Table 1 categorises the critical project success factors as relating mainly to either hard (H) (technical) or soft (S) (behavioural) dimensions of projects.

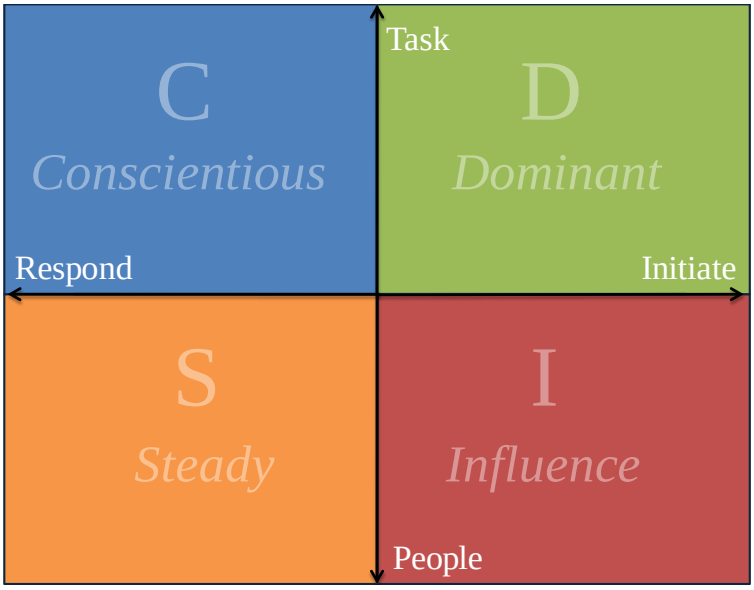
Table 1 Critical success factors

Critical project success factor	Dimension of project management	
	Hard (H) (technical)	Soft (S) (behavioural)
Planning	X	
Expectations		X
Clear business case, scope and requirements	X	
Project scope, timeline and team size	X	
Project implementation team		X
Stakeholder ownership, understanding and involvement		X
Project management method	X	
Risk management	X	
Vendors/subcontractors/ consultants		X
Communication		X

2.4 BEHAVIOURAL PREFERENCES ACCORDING TO THE DISC MODEL

The theoretical model by Marston introduced in his book Emotions of Normal People (Marston, 1928) is widely known as the DISC model in the public domain. How people felt, behaved and interacted with people around them interested Marston. According to the DISC model, every individual's behavioural preference can be described as a combination of four behavioural dimensions. The four primary dimensions are depicted in Figure 4.

Figure 4 DISC model (Manager Tools, 2006a:1)



Persons who fall in the dominant quadrant are strong-willed, strong-minded people who like to accept challenges, take action and get immediate results. They are comfortable in a leadership role, are problem solvers, can make tough decisions. They are not afraid to confront issues and stay focused on their goals. Other may perceive them as intimidating, insensitive, abrupt, impatient, intolerant and unapproachable (Reid & Reid, 2003:96).

Influencers are people who like to share ideas with others in an energising and entertaining fashion. They are sociable and inspiring to be around. Influencers are not focused and tend to be weak at organising or finishing tasks. This means that tasks may fall through the cracks and projects don't get finished (Reid & Reid, 2003:96).

Steady behaviours are linked with helpful people who like to work behind the scenes, performing in consistent and predictable ways and being good listeners. They are good team

players, easy to get along with, empathetic and methodological. Others may see them as indecisive, indirect, resistant to change and worn down by others' problems (Reid & Reid, 2003:96).

Conscientious people are concerned with quality, checking and re-checking for accuracy, like to plan ahead and prefer approaching problems in a systematic fashion. They are thorough, rule bound, diplomatic and fair. People may perceive them as unapproachable and hard to please and they may delay decisions by being too thorough (Reid & Reid, 2003:96).

The DISC model makes it possible for people to subjectively identify their own behavioural preferences. This provides a non-judgemental way to address behavioural issues in project teams. Individuals can discover their own behavioural strengths, value the strengths of others, adapt their behaviour to suit personal and situational needs to manage others more effectively, foster teamwork, improve their communication skills, reduce conflict and stress and mitigate the risk of miscommunication (Reid & Reid, 2003:96).

Communicating with different behavioural styles

According to Manager Tools (2006b:2) communication can be enhanced effectively when individuals are able to recognise another individual's behavioural preference and modify their communication style accordingly. When one communicates in a way that makes more sense to the receiver, communication is more likely to be effective. The different behavioural preferences can be recognised by verbal, vocal and visual clues. Verbal clues are what one says, vocal clues are how one says it and visual clues are the things that one does while communicating. The following tables give an overview of each behavioural preference.

Table 2 D – Dominant (Manager Tools, 2006c:1)

How can you identify a D	
How they talk:	**What they do:**
Ask 'what' questions	Impatient and time conscious
Talk more than listen	Good eye contact
Fast speech with short sentences	Direct, forceful
Get right to the issue, may be pushy, even rude and has an authorative tone	Result orientated with a history of achievement
What D's want from others:	
D's like others to be direct, straight forward and open to their need for result	
You should try to:	**Be ready for:**
Communicate briefly. Get to the point and stick to the topic	Blunt demanding approach
Respect their need for autonomy	Lack of empathy and sympathy
Be clear about rules	Little social interaction
Let them take the lead	
Show competence and independence	

How to manage your D's			
You can help them learn:		**They might want from you/ your organization:**	
Socialising	Ask more questions	Flexibility	Results
Be more approachable and socialise	Relaxing and pacing themselves	Direct and concise answers	Power and authority to make changes
Empathy and listening	Complementing others	Prestige or a promotion	A challenge

Table 3 I – Influencer (Manager Tools, 2006c:1)

How can you identify an I	
How they talk:	**How they do:**
Ask 'who' questions	Animated and laugh out loud
Go off on tangents	Lots of facial expressions
Prone to making small talk	Spontaneity
Use stories, anecdotes and exaggeration	Short attention span
Express their feelings and share personal emotions	Warm, may approach you closely
Fast speech	Stylish dress
What Influencer's want from others	
I's like others to be friendly, emotionally honest and recognized for their contributions.	
You should try to:	**Be ready for:**
Approach them informally and keep the conversation light	Attempt to influence or pursue you
Be relaxed, social and humorous	A need for the spotlight or attention
Let them tell you how they feel	Over-selling ideas
Provide written details	Over-estimating self and others
Give public recognition	Vulnerability to feeling rejected

How to manage your I's			
You can help them learn:		**They might want from you/ your organization:**	
Objectivity	Analysing data	Visible awards	Casual relationship
Prioritise and organise	Emphasis on clear results	Public recognition and visible awards	Approval, popularity and friendliness
Sense of urgency		Freedom from details	

Table 4 S – Steady (Manager Tools, 2006c:2)

How can you identify a S	
How they talk:	**What they do:**
Ask 'how' questions	Consult others
Make small talk and use first names	Patient, tolerant
Lower volume and warmth in voice	Service orientated
Listens more than talks	Embarrassed by recognition
Reserved with opinions	Casual relaxed walk and subdued clothing
Slow steady delivery	Friendly, functional workplace
What S's want from others	
S's like others to be relaxed, agreeable, cooperative and to show appreciation	
You should try to:	**Be ready for:**
Provide a secure environment	Friendly approach to others
Be logical and systematic	Difficulty prioritizing
Tell about change early and go slowly into change	Resistance to change
Show how they are important and appreciate sincerely	Difficulty with deadlines
How to manage your S's	
You can help them learn:	**They might want from you/ your organization:**
Self-affirmation	Shortcut method
Openness to change	Effective presentation skills
How to make their accomplishments known	Believing their successes are worthwhile
Status quo	Security
Private appreciation and sincerity	Time to adjust to changes
Standard procedures	Listening and happy calm relationships

Table 5 C – Conscientious (Manager Tools, 2006c:2)

How can you identify C's	
How they talk:	**What they do:**
Ask 'why' questions	Focus on task and process
Listen more than talk	Meticulous, orderly, precise and accurate
Not a lot of reaction	Time conscious
Slow speech and lower volume	Diplomatic
Precise detailed speech	"Sterile" at work
Prefer talking not writing	Want to be right
What C's want from others:	
C's like others to minimize socializing, they value accuracy and attention to detail	
You should try to:	**Be ready for:**
Give clear expectations, value high standards and honor precedents	Discomfort with ambiguity
Show loyalty and dependability	Resistance to vague information
Be precise and focused	Desire to double check
Be tactful and reserved	Little need to be with others

How to manage your C's			
You can help them learn:		**They might want from you/ your organization:**	
Tolerance to conflict	Tolerance of ambiguity	Clear expectations	No sudden changes
To ask for support	Acceptance of their limits	Attention to their objectives and a chance to show their expertise	References and verifications
Group participation skills	Acceptance of others ideas	Business like environment	Limited exposure and personal autonomy

2.5 SERIOUS GAMES

2.5.1 Introduction to serious games

Clark Abt was the first to introduce the term serious games in the 1960's with the use of war-games and simulations to train management. In these war-based dramatic scenarios, mathematical analysis and interactive play were combined. He defined serious games as to: "have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining." (Abt, 1970:9).

Since then many definitions for serious games arose, one being: "there is no one single definition of the term 'serious games', although it is widely accepted that they are games 'with a purpose'. In other words, they move beyond entertainment per se to deliver engaging interactive media to support learning in its broadest sense." (Stone, 2008:9).

Serious games have the capability to model not only hard skills, such as the understanding of how a complex system works, but also soft skills such as creativity, social communication and collaboration. Games provoke active learner involvement through exploration, competition, experimentation and co-operation (Riedel & Hauge, 2011:7).

2.5.2 Game writing and design

The following paragraphs give the applicable background and definitions to the terms used in Chapter 4 where a serious game is proposed.

Story structure and approach

Content in games are created by stories which is presented by a sequence of events. Stories can be structured from free-flowing stories to linear paths with many hybrids in between. Game writing is an iterative process, constantly in motion and revision. Ideas build on ideas, levels and even core gameplay. Gameplay is the play-pattern in which the player will interact with the game (Dille & Zuur Platten, 2007:15-16).

A story has a beginning, middle and end through which the story progresses. This is called the story arc. Most story arcs begin with a frustration the character tries to solve (Aldrich, 2009:254).

In a very linear game the writer has control. The writer thinks out every possibility for the player and the player has no choice as to what to do in the story. Goals are present by the writer and success or failure of the game is dependent on whether the player is able to accomplish it. The story drives the player through the game, whereas with a non-linear story set pieces are created that when added together it builds toward a larger unfolding narrative (Dille & Zuur Platten, 2007:19).

In contrast to very linear games, free-flowing games, consequential stories and role-playing games are less controlled by the writer.

A free-flowing game has an open-world design in which the player's adventure is whatever he does in the world. There are no obvious breaks in the story.

A consequential story balances free-flow and structure. The world remembers things and there are consequences for the player's actions.

In a role-playing game (RPG) the writer tries to build the character up to better deal with the world of the game. The journey of the character becomes the story. The writer needs to anticipate many different kinds of alternatives depending on who the character is and how the Nonplayer Character will relate to them.

The abovementioned games lead to a lot of situations where the writer will have to write endless alternatives and generic exchanges with Nonplayer Characters. In practice these games have linear components so that the player can experience varied gameplay (Dille & Zuur Platten, 2007:19).

Branching stories

Branching allows the player to make a series of decisions through a series of multiple choices to progress through the story. Specifically, players would start with a briefing and then advance to a first multiple decision point, or branch. Based on the decision or action they

make, they will see a scene that provides some feedback, advances the story and then sets up another decision. Players continue making decisions, moves along some of the available branches until they ultimately win or lose. Player's receive an action review (Aldrich, 2009:15).

The branching story's basic input, a multiple-choice interface, typically focuses on the actions of the player's character, which often involve choosing specific statements to direct other people (Aldrich, 2009:15).

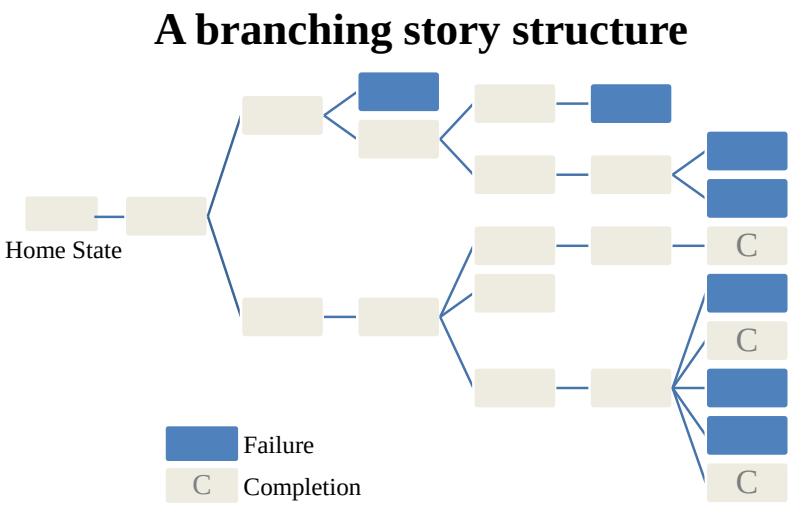
Branching stories can be visualised by a tree with branches. The trunk of the tree is the spine of the story and the events within the narrative reach outward in a number of directions at specific decision points, or branches along the journey (Dille & Zuur Platten, 2007:20).

Limited branching stories tend to revolve around a series of binary objectives. Depending on the outcome, or the choice that the player takes, the game will branch to the appropriate story thread (Dille & Zuur Platten, 2007:20).

Similar to limited branching, a critical path has one success path, and allows the player to deviate from it in very small ways. Nothing of consequence in the game or story happens outside of a predetermined path that winds its way through the experience (Dille & Zuur Platten, 2007:21).

Branching stories can be presented in text, full-motion video, or pictures with or without sound creating a cinematic quality (Aldrich, 2009:17).

Figure 5 A branching story structure (Aldrich, 2009:16)



Cut-scenes

Narrative cut-scenes give the player information into the narrative, creating a fully realised experience for the player. The most common types of cut scenes:

- *Setups* – Narratives used to set up the challenges the player will face in a particular level. Setups are usually at the beginning of the level or shorter ones in-game. These cut scenes needn't be anything more than voice-overs.
- *Payoffs* – Payoffs reaffirms the player's accomplishments. These are the most visual sequences (like when the bridge blows up as the player jumps to safety).
- *Autopsy* – These narratives are used to show the player where he made a mistake.
- *Advancement* – Similar to payoffs, but on a larger scale. Advancement cut-scenes establish new worlds, or characters, or skills that the player has earned by progressing forward through the game.
- *Character journeys* – Character journeys are cut-scenes that show how the character is evolving, becoming wiser, or getting more powerful or even weaker. The player creates a journey for his character.
- *Impart information* – This is a creative way of telling the player what he needs to accomplish. Cut-scenes can also inform the player that something important has changed within the game that he will be forced to deal with.

- Establish rules and expectations – Narratives that sets the tone in the beginning of the game establishes the player's expectations and helps the player understand the rules of the game. (Dille & Zuur Platten, 2007:22-23)

World

The world of a story is not just the location, but the reality in which the story takes place (Dille & Zuur Platten, 2007:31). The world of the game:

- Tends to reflect the intended market of the game.
- Determines its inhabitants.
- Is a setting. The game can be set in the past present or future. (Dille & Zuur Platten, 2007:62)

Characters

Player Character – The Player Character is the character that the player controls as he/she plays the game. This will either be the role that the player is playing during the experience, or the character that the player is controlling (depending on the point of view that the game utilises). Some games allow you to either choose or generate your own character, while other games have well-defined Player Characters. Player Characters are the vehicles by which the players overcome obstacles, conquer fears and reach their eventual goal (Dille & Zuur Platten, 2007:65-66).

Nonplayer Characters – Nonplayer Characters are the other characters that populate the worlds of the game. Each of these characters has a relationship to the Player Character. The relationship is an ally, an enemy or a neutral character. The player cannot control the Nonplayer Characters, but can influence their actions by the choices he makes during gameplay (Dille & Zuur Platten, 2007:66).

Player-directed Characters – The Player-directed Character(s) can be given orders by the player. These characters function as a subset of the Player Character. Issuing the right commands to them as the player moves through the game is often essential to the success of the Player Character. The player however never takes direct control over these characters (Dille & Zuur Platten, 2007:67).

Drivers of the game

Rewards (advancement, winning) and punishments (obstacles, losing) are compulsory to gameplay. This drives the player through the experience.

Rewards come in the form of resources, power ups, information, keys, points, skills, collectables, difficulty level unlockables, game saves, new alliances and allies, reveal hidden areas or characters, upgrades or add-ons.

Punishments arrive in the forms of hindered progress or capability, taking time or resources away and new enemies.

The characters are defined by the choices they make. The choices need to be anticipated and manipulated by both the game design and narrative (Dille & Zuur Platten, 2007:71-73).

Creating an Executive Summary

Dille and Zuur Platten (2007:101-104) prompts aspiring game writers and designers to write an Executive Summary of a creative game idea. An Executive Summary or One-Sheet is up front in the High-Level Design Document. Creating an Executive Summary explains the core gameplay experience that the game writer or designer is creating. The suggested elements of the Executive Summary are as follows:

- *Title* – The title of the game should tie into the main theme, action, character or genre of the game.
- *Genre* – Some common genres are First-Person Shooter (FPS), Third-person Action, Role-playing Game (RPG), Simulation, Survival-Horror and Sports.
- *Version* – A version number to keep track of the document. A date has a shelf life, thus its best to not put a date.
- *The Big Idea* – A brief synopsis of the game's content (story, character, worlds) and gameplay.
- *Category* – A list of a few games similar to your title. Here one is to mention whether the game is Single Player, Multiplayer (local, network, wireless or Internet), or Cooperative. If it is single player, put a brief description of the missions or levels with a possible storyline that progresses as the player advances through the game.
- *Platforms* – A list of the target platforms for the game.

- *Play Mechanic* – This is the core gameplay and control of the game. The play mechanic describes how the player interacts with the gaming experience, and how and why it will be compelling and fun for him to do so.
- *Target audience* – Description of who is expected to play this game and why.
- *Key Features* – A list of a few unique selling points.

This format will be used in Chapter 4 when a serious game is proposed.

CHAPTER 3: FINDINGS AND CONCLUSIONS

This chapter summarises the results obtained from the questionnaire and the workshop intervention.

3.1 QUESTIONNAIRE

The questionnaire was used to test the researcher's premise that communication is important for projects to be successful. The questionnaire can be found in Appendix A.

3.1.1 Section 1: Background information

The objectives of the questions in this section were to determine:

- The role of the respondent within a project environment
- The sectors in which the respondents execute projects
- The size of the organisation measured by the number of employees
- The number of members in a typical project team
- The monetary value of the projects executed by the respondents
- The experience levels of the project managers measured in years of experience

Tables 6 to 11 summarise the responses obtained from the questionnaire. The individual values are rounded and may not total 100%.

Table 6 Project stakeholder role

As a Project Stakeholder, what role do you play in projects?	***Frequency***	***Percentage***
Project Sponsor	9	26%
Project User	5	15%
Project Manager	10	29%
Project Team Member	9	26%
Not completed	1	3%

Table 7 Sector

Sector(s):	***Frequency***	***Percentage***
Aerospace & defense	1	3%
Banking and financial services	14	41%
Chemicals	2	6%
Education	1	3%
Energy & utilities	2	6%
Engineering & construction	2	6%
Entertainment & media	1	3%
Healthcare, pharmaceuticals	1	3%
Insurance	7	21%
Technology	1	3%
Not completed	2	6%

Table 8 Number of employees in your company

Number of employees in your company:	***Frequency***	***Percentage***
<10	3	9%
10 – 100	4	12%
100 – 1000	7	21%
>1000	11	32%
Not completed	9	26%

Table 9 Typical project team size

Typical project team size:	***Frequency***	***Percentage***
<5	4	12%
5 – 10	14	41%
10 – 20	7	21%
>20	6	18%
Not completed	3	9%

Table 10 Average monetary value of projects undertaken by you

What is the average monetary value of projects undertaken by you?	***Frequency***	***Percentage***
Less than R500 000	3	9%
R 500 000 – 1 000 000	4	12%
R 1 000 000 – 10 000 000	9	26%
R 10 000 000 – 100 000 000	4	12%
Over R 100 000 000	3	9%
Not completed	11	32%

Table 11 Years' experience

How many years experience:	*Frequency*	*Percentage*
Less than 5 years	5	15%
6 – 10 years	7	21%
11 -15 years	10	29%
16 – 20 years	6	18%
20 years and more	5	15%
Not completed	1	3%

The results from table 6 to 11 indicate a good spread of stakeholder roles, organisation size, project values and project management experience. The sectors most represented were financial, chemical, energy and engineering and construction.

3.1.2 Section 2: Determining the most important critical success factors in projects

Project management theory relating to this study is described in Chapter 2. A pairwise comparison matrix containing the 10 critical success factors were constructed as shown in Figure 6. Thirty-four stakeholders from different stakeholder groups were requested to compare each factor against its corresponding factor in each column. If the factor in the row was a more important contributor than that of the column, the participant had to enter a "1" in the corresponding white block. If the factor in the row was a less important contributor than that of the column, the participant had to enter a "0" in the corresponding white block.

Figure 6 Pairwise comparative matrix

Pairwise comparative matrix												
Determinants of Project Success	Planning	Expectations	Clear business case, scope and require-ments	Project scope, timeline and team size	Project implemen-tation team	Stakeholder ownership, understand-ing and involvement	Project manage-ment method	Risk manage-ment	Vendors/ sub contractors/ consultants	Communi-cation	Total	Ranking (Top = 1)
Planning		0	0	0	0	0	0	0	1	0	1	9
Expectations	1		0	0	0	0	1	0	0	0	2	8
Clear business case, scope and requirements	1	1		1	1	0	1	1	1	0	7	3
Project scope, timeline and team size	1	1	0		0	1	0	0	0	0	3	7
Project implementation team	1	1	0	1		0	1	1	1	1	7	3
Stakeholder ownership, understanding and involvement	1	1	1	0	1		1	1	1	1	8	2
Project management method	1	0	0	1	0	0		0	1	0	3	7
Risk management	1	1	0	1	0	0	1		1	0	5	5
Vendors/subcontractors / consultants	0	1	0	1	0	0	0	0		0	2	8
Communication	1	1	1	1	0	0	1	1	1		7	3
Total	8	7	2	6	2	1	6	4	7	2	45	

The Instant Priorities method described by Senge *et al* (1994) was used to obtain the rankings of the most important critical success factors. This was done to obtain an overall ranking per stakeholder group rankings as well as a separate senior level ranking. For the senior level ranking the users and the stakeholders with less than 5 years' experience were excluded.

Furthermore, the Analytical Hierarchy Process technique was used to confirm the ranking obtained from the Instant Priorities Method.

Instant Priorities Method

The results of each individual case were summed per row to obtain a ranking. After obtaining all the individual rankings, a sum of the rankings was obtained, resulting in an overall ranking of the success factors. Every individual ranking therefore carried the same weight. Table 12 gives the overall result.

Table 12 Instant Priorities – Overall ranking of critical project success factors (1 = most important, 10 = least important)

Critical success factor	Ranking (1=most important)
Planning (H)	5
Expectations (S)	6.5
Clear business case, scope and requirements (H)	2
Project scope, timeline and team size (H)	6.5
Project implementation team (S)	8
Stakeholder ownership, understanding and involvement (S)	1
Project management method (H)	10
Risk management (H)	3
Vendors/subcontractors/ consultants (S)	9
Communication (S)	4

By doing the same for the different stakeholder groups the following rankings were obtained:

Table 13 Instant Priorities – Stakeholder groups' ranking of critical success factors

Critical success factor	Ranking (1=Most important)			
	Sponsor	User	Manager	Team Member
Planning (H)	4	6	3	4.5
Expectations (S)	5	6	7	6
Clear business case, scope and requirements (H)	2	4	1	3
Project scope, timeline and team size (H)	6.5	8	6	4.5
Project implementation team (S)	6.5	6	8	7
Stakeholder ownership, understanding and involvement (S)	1	2	4	2
Project management method (H)	10	9	9	10
Risk management (H)	8	3	2	1
Vendors/subcontractors/ consultants (S)	9	10	10	9
Communication (S)	3	1	5	8

In addition, the following senior level ranking was obtained by excluding users and stakeholders with less than 5 years' experience:

Table 14 Instant Priorities – Senior level ranking

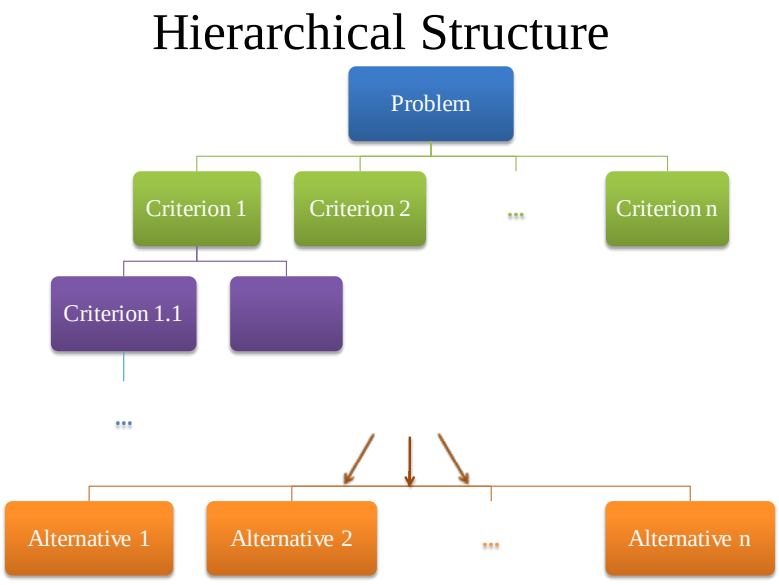
Critical Project Success Factor	Ranking (1 = most important)			
	Overall	Excluding users	Excluding less than 5 years experience	Excluding users and less than 5 years experience
Planning (H)	5	4	5	5
Expectations (S)	6.5	7	6	7
Clear business case, scope and requirements (H)	2	1	2	2
Project scope, timeline and team size (H)	6.5	6	7	6
Project implementation team (S)	8	8	8	8
Stakeholder ownership, understanding and involvement (S)	1	2	1	1
Project management method (H)	10	10	10	10
Risk management (H)	3	3	3	3
Vendors/subcontractors/ consultants (S)	9	9	9	9
Communication (S)	4	5	4	4

Analytical Hierarchy Process

The Analytical Hierarchy Process (AHP) is a systems analysis technique for solving decision problems. AHP is applied in decision making when there are multiple objectives or criteria to consider. T. L. Saaty developed the AHP in the 1970's.

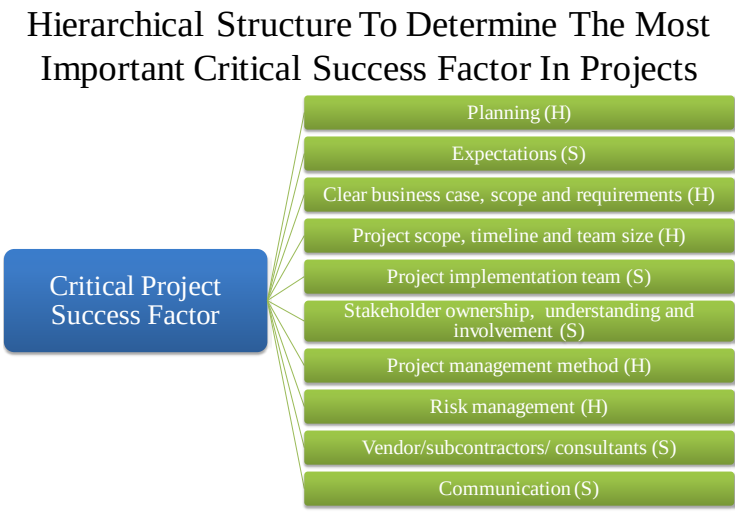
Ratio scales are derived from paired comparisons. These comparisons may be taken from actual measurements or from a fundamental scale which reflects the relative strength of preferences and feelings. When modelling a problem with the AHP one needs a hierarchical or network structure to represent that problem and pairwise comparisons to establish relations within the structure (Saaty, 1987:161). An example of such a hierarchy of criteria and alternatives are shown in Figure 7.

Figure 7 Hierarchical structure



The hierarchical tree for this study is shown in Figure 8.

Figure 8 Hierarchical structure to determine the most important critical success factor in projects



The objective is to determine a ranking of the critical project success factors. The relative importance of the criteria was determined using pairwise comparisons by either entering a 1 or a 0, as described previously.

Adding over the pairwise matrices obtained from the 34 participants resulted in the following collective matrix.

Figure 9 AHP – Resulting matrix

Resulting matrix										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	34	15	13	23	20	11	26	17	25	14
2	19	34	14	16	20	11	22	13	17	13
3	21	20	34	30	22	15	29	19	25	20
4	11	18	4	34	18	17	23	14	24	16
5	14	14	12	16	34	6	27	12	23	13
6	23	23	19	17	28	34	27	19	25	21
7	8	12	5	11	7	7	34	9	17	10
8	17	21	15	20	22	15	25	34	25	17
9	9	17	9	10	11	9	17	9	34	10
10	20	21	14	18	21	13	24	17	24	34

Each cell in the matrix in Figure 9 was divided by n=34 to obtain a matrix of weights, giving matrix A below.

Figure 10 AHP – Matrix A

1	0.44	0.38	0.68	0.59	0.32	0.76	0.5	0.74	0.41
0.56	1	0.41	0.47	0.59	0.32	0.65	0.38	0.5	0.38
0.62	0.59	1	0.88	0.65	0.44	0.85	0.56	0.74	0.59
0.32	0.53	0.12	1	0.53	0.5	0.68	0.41	0.71	0.47
0.41	0.41	0.35	0.47	1	0.18	0.79	0.35	0.68	0.38
0.68	0.68	0.56	0.5	0.82	1	0.79	0.56	0.74	0.62
0.24	0.35	0.15	0.32	0.21	0.21	1	0.26	0.5	0.29
0.5	0.62	0.44	0.59	0.65	0.44	0.74	1	0.74	0.5
0.26	0.5	0.26	0.29	0.32	0.26	0.5	0.26	1	0.29
0.59	0.62	0.41	0.53	0.62	0.38	0.71	0.5	0.71	1

The algorithm used for obtaining a ranking of the critical project success factors is taken from Saaty (1987:170).

There is an infinite number of ways to derive the vector of priorities from the matrix (a_{ij}). However the general concern with AHP is consistency. This leads to the eigenvector solution of the AHP. If a_{ij} represents the importance of alternative *i* over *j* and a_{jk} represents the importance of alternative *j* over *k* then a_{ik}, the importance of alternative *i* over *k*, must equal $a_{ij}a_{jk}$for the judgements to be consistent. If we do not have a convenient scale as in some measuring devices, we cannot give the precise w_i/w_j, but only an estimate. The problem becomes $A'w' = \lambda_{max}w'$, where $\lambda_{max}$is the largest or principal eigenvalue of $A' = \{a'_{ij}\}$ the perturbed value of $A = \{a_{ij}\}$with $a'_{ji} = \frac{1}{a'_{ij}}$ forced.

The solution is obtained by raising the matrix to a sufficiently large power then summing over the rows and normalising to obtain the priority vector $w = \{w_1, \dots, w_n\}$. The process is stopped when the difference between components of the priority vector obtained at the k^{th} power and at the $(k+1)^{th}$ power is less than some predetermined small value.

An approximation of the priorities is obtained by normalising the elements in each column of the judgment matrix and then averaging over each row.

Steps followed to solve for the eigenvector (using SAS IML):

1) Raise the matrix to powers that are successively squared each time.
2) The row sums are then calculated and normalised.
3) Stop process when the eigenvector solution does not change from the previous iteration.

First iteration:

Table 15 Eigenvector solution – first iteration

Iteration 1: Matrix A squared										Sum	Eigenvector (Sum/Total)
1.0000	0.4412	0.3824	0.6765	0.5882	0.3235	0.7647	0.5000	0.7353	0.4118	5.8235	0.1059
0.5588	1.0000	0.4118	0.4706	0.5882	0.3235	0.6471	0.3824	0.5000	0.3824	5.2647	0.0957
0.6176	0.5882	1.0000	0.8824	0.6471	0.4412	0.8529	0.5588	0.7353	0.5882	6.9118	0.1257
0.3235	0.5294	0.1176	1.0000	0.5294	0.5000	0.6765	0.4118	0.7059	0.4706	5.2647	0.0957
0.4118	0.4118	0.3529	0.4706	1.0000	0.1765	0.7941	0.3529	0.6765	0.3824	5.0294	0.0914
0.6765	0.6765	0.5588	0.5000	0.8235	1.0000	0.7941	0.5588	0.7353	0.6176	6.9412	0.1262
0.2353	0.3529	0.1471	0.3235	0.2059	0.2059	1.0000	0.2647	0.5000	0.2941	3.5294	0.0642
0.5000	0.6176	0.4412	0.5882	0.6471	0.4412	0.7353	1.0000	0.7353	0.5000	6.2059	0.1128
0.2647	0.5000	0.2647	0.2941	0.3235	0.2647	0.5000	0.2647	1.0000	0.2941	3.9706	0.0722
0.5882	0.6176	0.4118	0.5294	0.6176	0.3824	0.7059	0.5000	0.7059	1.0000	6.0588	0.1102
									Totals	55	1

Second iteration:

Table 16 Eigenvector solution – second iteration

Iteration 2: Previous matrix squared										Sum	Eigenvector (Sum/Total)
3.0294	3.1272	2.1116	3.3123	3.2811	2.1306	4.3486	2.6522	4.1263	2.6514	30.7708	0.1058
2.6860	3.1497	2.0346	2.9048	3.0657	1.9291	3.9161	2.3512	3.5562	2.4118	28.0052	0.0963
3.4351	3.8581	2.8659	4.1168	3.9723	2.6696	5.2137	3.2042	4.8564	3.3374	37.5294	0.1290
2.4005	2.9637	1.7050	2.9888	2.9732	2.1090	3.8486	2.3209	3.6998	2.4697	27.4792	0.0944
2.3106	2.6540	1.7958	2.6791	2.9542	1.6548	3.7967	2.1393	3.5095	2.2388	25.7327	0.0884
3.6012	3.9585	2.8166	3.7855	4.2137	2.9204	5.2266	3.2370	4.8711	3.3806	38.0112	0.1306
1.5251	1.8867	1.1254	1.7604	1.7085	1.2266	2.7318	1.4645	2.3789	1.5441	17.3521	0.0596
3.0346	3.5277	2.3806	3.4386	3.6099	2.3841	4.6116	3.0891	4.3694	2.9308	33.3763	0.1147
1.8028	2.2621	1.4446	1.9939	2.0978	1.4299	2.8201	1.6635	2.9126	1.7491	20.1765	0.0693
3.0631	3.4412	2.3080	3.3227	3.5035	2.2630	4.4853	2.7837	4.2491	3.1073	32.5268	0.1118
									Totals	290.9602	1

Computing the difference of previous computed eigenvector to this one:

Table 17 Eigenvector solution – first iteration absolute difference

Absolute Difference
0.0001
0.0005
0.0033
0.0013
0.0030
0.0044
0.0045
0.0019
0.0028
0.0016

There is not much difference to four decimal places and the process will stop when the eigenvectors are the same to four decimal places.

Third iteration:

Table 18 Eigenvector solution – third iteration

Iteration 3: Previous matrix squared										Sum	Eigenvector (Sum/Total)
78.2766	90.4471	59.6405	88.3790	91.3824	60.3194	120.4099	72.5636	113.2425	75.2942	849.9552	0.1056
71.4957	82.5778	54.5112	80.7027	83.4607	55.0155	109.9115	66.2213	103.2635	68.7192	775.8791	0.0964
95.9408	110.8716	73.2025	108.4035	112.0607	73.9953	147.5508	88.9615	138.7175	92.3683	1042.0724	0.1294
69.8763	80.8332	53.2623	78.8000	81.6585	53.8995	107.4764	64.7579	101.0573	67.2605	758.8818	0.0943
64.9801	75.1967	49.5623	73.4176	75.9312	50.0504	100.1559	60.2559	94.1481	62.5723	706.2706	0.0877
97.4884	112.4910	74.4051	109.9571	113.8257	75.0576	149.7839	90.3047	140.7645	93.7328	1057.8107	0.1314
43.7735	50.6761	33.3704	49.3660	51.0625	33.7540	67.4121	40.5789	63.3400	42.1386	475.4721	0.0591
85.2885	98.5614	65.0889	96.2630	99.6257	65.7158	131.1342	79.1146	123.2800	82.0562	926.1283	0.1150
51.2403	59.2698	39.1225	57.7859	59.8004	39.4622	78.7768	47.4562	74.0966	49.2712	556.2818	0.0691
83.1373	96.0123	63.3996	93.7914	97.0442	63.9860	127.7568	77.0284	120.1100	79.9949	902.2609	0.1121
									Totals	**8051.0128**	**1**

Fourth iteration:

Table 19 Eigenvector solution – fourth iteration

Iteration 4: Previous matrix squared										Sum	Eigenvector (Sum/Total)
59831.775	69157.152	45634.287	67523.564	69863.251	46094.92	92025.345	55452.734	86509.816	57565.389	649658.233	0.1056
54619.616	63132.632	41658.913	61641.366	63777.223	42079.437	84008.71	50622.058	78973.657	52550.674	593064.286	0.0964
73363.479	84797.887	55955.052	82794.872	85663.711	56519.866	112838.02	67994.067	106075.08	70584.53	796586.564	0.1294
53423.719	61750.315	40746.801	60291.72	62380.807	41158.08	82169.317	49513.674	77244.497	51400.06	580078.99	0.0943
49710.788	57458.729	37914.909	56101.451	58045.356	38297.623	76458.593	46072.491	71876.051	47827.781	539763.772	0.0877
74473.23	86080.615	56801.466	84047.323	86959.53	57374.84	114544.92	69022.612	107679.69	71652.259	808636.485	0.1314
33469.962	38686.574	25527.872	37772.755	39081.568	25785.541	51479.066	31020.316	48393.664	32202.134	363419.452	0.0591
65200.818	75363.002	49729.311	73582.862	76132.487	50231.281	100283.3	60428.833	94272.833	62731.067	707955.794	0.1150
39161.51	45265.21	29868.871	44196.011	45727.379	30170.366	60233.065	36295.309	56622.999	37678.098	425218.818	0.0691
63519.443	73419.571	48446.902	71685.331	74169.205	48935.934	97697.234	58870.513	91841.763	61113.381	689699.277	0.1121
									Totals	6154081.671	1

Computing the difference of previous computed eigenvector to this one:

Table 20 Eigenvector solution – last iteration absolute difference

Absolute Difference
0.0000
0.0000
0.0000
0.0000
0.0000
0.0000
0.0000
0.0000
0.0000
0.0000

The eigenvector does not change after the fourth iteration, giving a relative ranking of the criterion. The eigenvector with the highest value is the most important factor.

Table 21 AHP – Overall ranking of critical project success factors (1 = most important, 10 = least important)

Critical Project Success Factor	Eigenvector	Rank (1 = most important)
Planning (H)	0.1056	5
Expectations (S)	0.0964	6
Clear business case, scope and requirements (H)	0.1294	2
Project scope, timeline and team size (H)	0.0943	7
Project implementation team (S)	0.0877	8
Stakeholder ownership, understanding and involvement (S)	0.1314	1
Project management method (H)	0.0591	10
Risk management (H)	0.1150	3
Vendors/subcontractors/ consultants (S)	0.0691	9
Communication (S)	0.1121	4

3.1.3 Interpretation of the results

The overall result obtained from the Instant Priorities method and the Analytical Hierarchy Process supports the research premise that communication plays an important role in project management. The ranking of the factors for success can be used as an initial priority list for project management. This result deserves further research to refine the proposed factors and obtain a statistically validated ranking of relative importance for the success using a larger sample of project stakeholders.

The first four factors in the ranking consist of a mix of 'Hard' and 'Soft' skills. Communication ranked fourth in the list of ten critical success factors. Communication can be viewed as glue that holds the project together as the application of the other key success factors is dependent on effective communication.

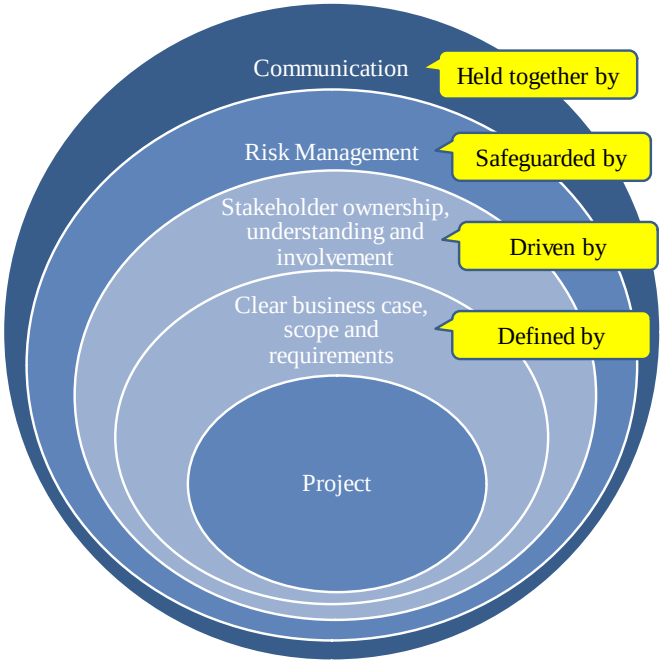
The factors that were ranked lower (5-10) refer to project success factors that may be more easily managed when the requirements of the first four factors are satisfied. An interesting result is that the respondents did not attribute high responsibility for project success to external stakeholders such as vendors, subcontractors and consultants. Project success is therefore mainly seen as the responsibility of internal stakeholders.

Based on these results, one can describe a project's probability for success as a qualitative function of the top four factors as follows shown in Figure 11.

A successful project is:

- Defined by a clear business case, scope and requirements (Ranking: 2 - Hard)
- Driven by stakeholder ownership, understanding and involvement (Ranking: 1 - Soft)
- Safeguarded by risk management (Ranking: 3 -Hard)
- Held together by communication (Ranking: 4 - Soft)

Figure 11 Priority determinants for project success



Furthermore, an interesting result was obtained from the rankings per stakeholder group. The following table highlights how the different stakeholder groups perceive communication and also shows two outliers.

Table 22 Ranking per stakeholder group – drawing a conclusion

Critical success factor	Ranking (1=Most important)			
	Sponsor	User	Manager	Team Member
Planning (H)	4	6	3	4.5
Expectations (S)	5	6	7	6
Clear business case, scope and requirements (H)	2	4	1	3
Project scope, timeline and team size (H)	6.5	8	6	4.5
Project implementation team (S)	6.5	6	8	7
Stakeholder ownership, understanding and involvement (S)	1	2	4	2
Project management method (H)	10	9	9	10
Risk management (H)	8	3	2	1
Vendors/subcontractors/ consultants (S)	9	10	10	9
Communication (S)	3	1	5	8

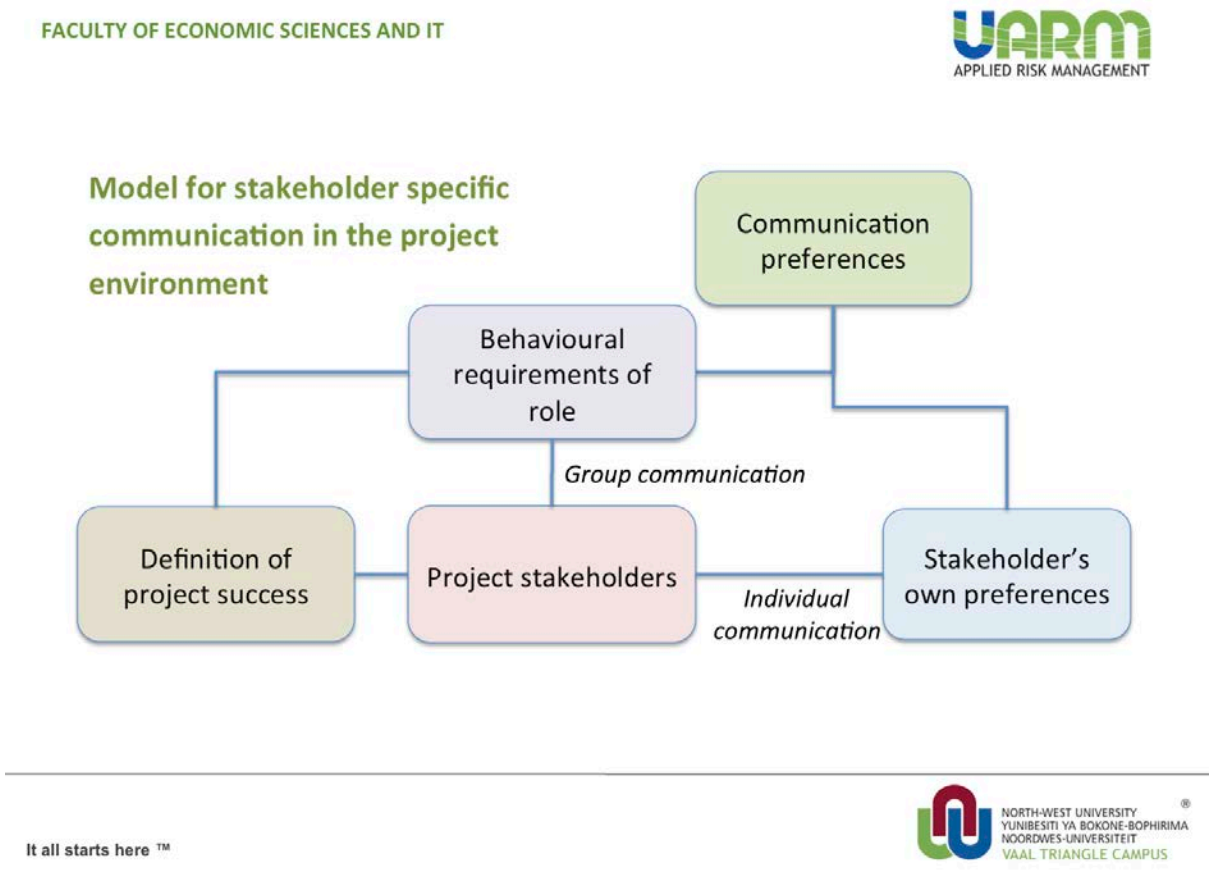
As expected, stakeholder ownership, understanding and involvement are top priority for project sponsors. Risk management lies in the 8th position for project sponsors. This could be a red light if the project sponsor doesn't value the importance of risk management in projects. However, since the ranking can be seen as priority list, it may not be on the top of things to do for the project sponsor since he has appointed a project manager who should take responsibility for project risk management through contingency plans for potential project risks and issues. Communication was the most important factor for project success for the users of the project's deliverables. Interestingly, communication is not valued as critical by the project team members. This can be ascribed to the 'cubicle syndrome' where the team members do not communicate often outside the project team, either because of company policy restrictions or because they are only focused on the task they are responsible for. The top critical factor for success for project managers is clear business case, scope and requirements. This makes sense in the context of the project manager's role to understand and deliver what the project stakeholders require.

3.2 WORKSHOP INTERVENTION

The UARM Project Risk Mitigation through Communication and Change management workshop is based on the premise that communication must be adjusted according to project

stakeholder needs. Different stakeholder groups have different definitions of project success and need to be communicated to according to the requirements of their role. The UARM model for stakeholder-based communication in the project environment is depicted in Figure 12.

Figure 12 UARM project stakeholder communication model



During the workshop, the participants:

- Explored the DISC behavioural style model
- Explored the application of the DISC model to communication in a project environment
- Translated the information obtained into proposed dashboards suitable for different groups of project stakeholders

Based on observation during the workshop held at a large financial services group in South Africa, project stakeholders typically have the following behavioural preferences, as shown in Table 23.

Table 23 Typical DISC styles per stakeholder group

Project Stakeholder	Narrow focus
Project sponsor	D
Project user	S
Project manager	C
Project team member	S, C

Mapping Stakeholder Groups' Typical DISC Style to the Communication Preferences of Each Style

1) *Dominant project sponsor*
   - Be direct, straight forward and open to their need for result
   - Communicate briefly and get to the point
   - Stick to the topic
   - Show competence and independence
   - Be clear about the rules
   - Respect their need for autonomy

2) *Steady project user*
   - Be agreeable and cooperative
   - Be logical and systematic
   - Inform about change early and go into change slowly
   - Show appreciation
   - Provide a secure and relaxed environment

3) *Conscientious project manager*
   - Give clear expectations
   - Show loyalty and dependability
   - Honour precedents
   - Be tactful and reserved
   - Value high standards
   - Give attention to detail and accuracy
   - Be precise and focused

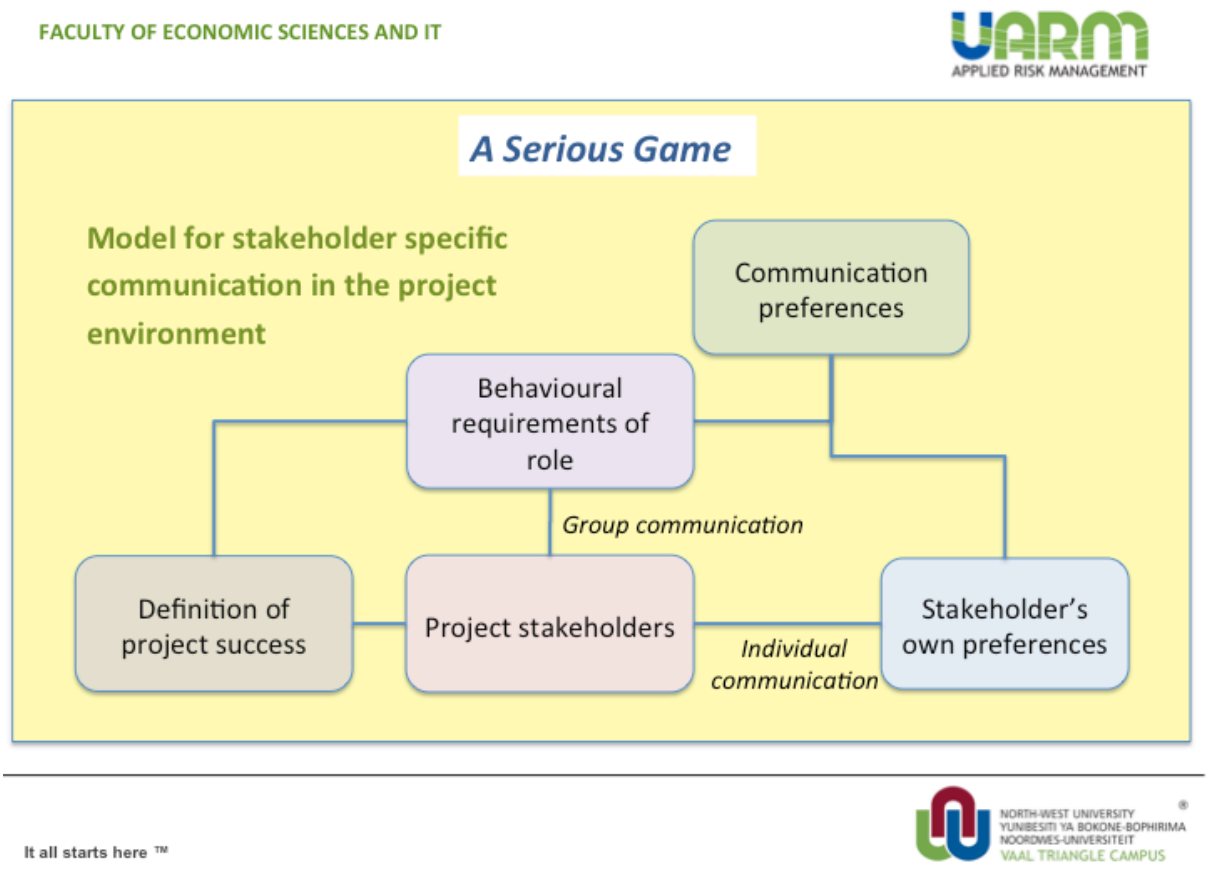
4) *Steady and conscientious project team member*
   - Be agreeable and cooperative
   - Be logical and systematic
   - Give clear expectations
   - Value high standards
   - Give attention to detail and accuracy
   - Be precise and focused

3.3 CONCLUSION

Based on the basis of the research findings, the development of a serious games based training tool on project communication is proposed. The premise that communication plays a significant role in the success of projects, combined with the knowledge of one's own behavioural preferences and the people you interact with in large projects allows for a potentially powerful project risk mitigation tool.

The first step in the proposed training tool is that stakeholders will map their typical stakeholder behavioural preferences. Different stakeholders need different information and also measure project success differently. Considering the different stakeholder groups' listed critical success factors together with their DISC communication preference a serious game can be proposed which can be used throughout the company or program. This model for stakeholder based communication for project success is depicted in Figure 13.

Figure 13 Project stakeholder based communication training – a serious game



CHAPTER 4: A PROPOSED GAME

A game design workshop was held with members of the Serious Games Institute of South Africa (SGI-SA). The researcher presented the background and findings of the preceding chapters. Afterwards a discussion took place between the researcher and the participants which led to a concept for the following proposed game.

4.1 EXECUTIVE SUMMARY

Title

Procom (Project communication)

Genre

RPG (Role-playing game)

Category

Procom is an exciting and challenging serious game that brings a number of unique gameplay elements to conversational communication between stakeholders. This Single Player game allows the player to lead a project that is at a critical junction to success by making smart decisions and communicating them smartly.

Platform

Tablet or mobile application

Concept

Procom is a serious game in which the project manager faces real-time challenges. The entire game happens in and around an office building. Group communication will take place in project management meetings. The meetings cover the project management hierarchy from project steering committee through to implementation team meetings and meetings with project users. One-on-one communication and electronic mail will take place in your office and informal communication in the communal areas of the office building will be included in the game.

Project success is the measure of success in the game. In order to make your project a success, you will have to have meaningful conversations with the project stakeholders. You, the project manager, are one of the project stakeholders, along with the project sponsor, project team member and project user. The conversations will be pre-scripted with different options you can choose from. The option you choose will indicate how well you observed your audience or speaker. A project success meter will indicate whether you correctly observed the behaviours and speech and to what extent you focused on the person and his/ her behaviour (Soft skills) and to what extent you focused on the mechanics of the project (Hard skills). Every conversation style or reply you choose will have an effect on the outcome of the project. The options that you will be able to choose from will combine both hard and soft skills.

The challenge is to know which DISC behavioural type you are, how to adapt to the role you are fulfilling and how to take the other persons behavioural preferences into account in your decision making. Cut-scenes will give feedback as to how well the player is playing the game.

The story of the game unfolds as you make your way through the levels that follow the project lifecycle curve. The narrative will be filled with problems and solutions, and by the time the story ends, you will better understand yourself and the people you interact with.

Low morale and despair lurk around the corner, scope creep and time waits for no player . . . even the audit committee is at your heels.

You are the only one who can save the project. Face the challenges of communication and find a way to integrate the soft skills and hard skills.

Overview

The Player's Character will be the newly appointed project manager who comes in at a critical point of an IT project internally known as 'The Disaster'. Low morale, an unhappy owner, inexperienced subcontractors, scope changes and government audits are but a few of its challenges. During a project steering committee (Steerco) meeting, the player will have to observe the behaviours, way of speech and body language of the other stakeholders in order to decide on the best communication option that will lead to preferred actions be taken to

solve the problems on the project. Each conversation will have an effect on the project which will eventually determine whether the project is a success or failure.

Through the course of a project, the Player's Character must overcome a number of obstacles and challenges that real-time projects face in a business environment. The player must map his/ her own behavioural preferences according to the DISC model before play starts. A summary of the four preferences will be given cinematically before the player chooses his/ her style.

The game will consist of conversation trees that eventually branches out to a critical success or fail of a project. Not all the project stakeholders will be present at the first meeting in the project management meeting where the game starts. They will come into play as the Player's Character progresses through the levels. Throughout the gameplay experience, players will constantly confront their own behavioural preferences as they develop strategies to adapt their own preferences to fit into their stakeholder role and also determine how they are triggering the behaviours of the other stakeholders, ultimately improving the way they communicate the actions that needs to be taken.

Play mechanic

Players will control their character as he/she moves through the various locations that comprise the worlds of *Procom*. The Player's Character can walk, write, type, use items, and interact with other characters through talking and showing his/her body language. Most interaction happens through the characters perception, or first-person. However the player will also have the option to view the interaction in a highly cinematic third-person perspective.

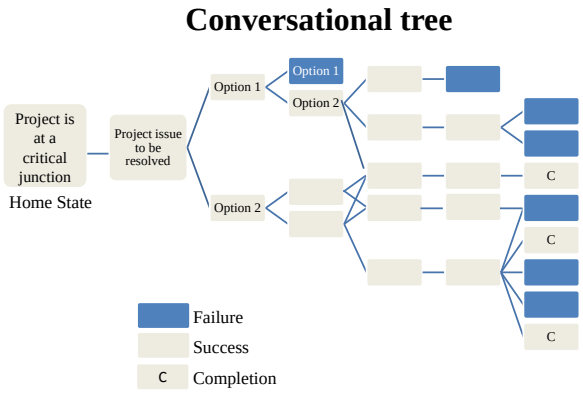
Target audience

The target audience for this game is professionals in the project management environment. Stakeholders such as project sponsors, project managers and project team members may find this game a useful tool to learn how to effectively manage and mitigate real-time project risks through gaining a better understanding of the behavioural preferences of themselves and the people they interact with in a project environment. The game will have a quick learning curve which makes it accessible to anyone interested in a project and communication.

An extension of the game could be to allow participants to select their role. This will increase the complexity of designing and developing the game but could be a worthwhile enhancement should the initial prototype be well received.

4.2 VISUALISATION AND ACTIONS OF PROPOSED GAME'S BRANCH

Figure 14 Conversational tree



A sample of game design options

The conversations will be from a pre-set script with options the player can choose from. Potential options or actions the player could choose from are listed below (Construction Industry Institute™, 2013:74-75):

- Identify and meet with all the project stakeholders, evaluate the status of the relationships and analyse the relationships to see how you can change your behaviour
- Ask for honest and frequent feedback
- Start weekly face-to-face communication with the client
- Call a meeting to clearly explain project objectives and let the employees know what will happen if they let you down
- Conduct an alignment meeting with all the stakeholders

The actual options in the game will be tailored according to the typical stakeholder behavioural preferences.

CHAPTER 5: OVERALL CONCLUSION AND SUMMARY

5.1 MEETING THE RESEARCH OBJECTIVES

The researcher's premise was that communication training can strengthen the behaviour of project stakeholders. Projects often fail even when the right systems and procedures are in place. The researcher postulated that the people aspects in project management are often ignored and misjudged. Since people are responsible for the planning and execution of projects, it is important to attempt to understand the behavioural preferences of people to optimise the success of your project.

The primary objective of this research project was to investigate the use of a serious games based intervention to mitigate the risks of inadequate communication within a project environment.

In order to achieve the primary objective, the following secondary objectives were formulated for the study:

- Investigate the validity of the perception that communication plays the most important role in determining project success using a questionnaire and comparative analysis tool
- Evaluate the use of a workshop based communication training intervention based on the Marston DISC behavioural style model
- Translate the intervention into a proposed serious game to train project stakeholders on key principles of effective project communication and as such contribute to the mitigation of the risks of inadequate communication in projects

How the researcher went about achieving the secondary objectives, as well as the main findings will be discussed in the following paragraphs.

Investigate the validity of the perception that communication plays an important role in determining project success using a questionnaire and comparative analysis tool.

A literature study was conducted in Chapter 2 and 10 critical success factors were identified. The 10 identified factors are a mixture of the technical or hard side of the project

management process and the socio-cultural or soft side of project management. A questionnaire with the purpose to determine stakeholders' view on the critical project success factors was administered to the target population, project stakeholders. Specific project stakeholder roles used in the study were defined as business sponsor, business user, project manager and project team member.

As discussed, analysed and interpreted in Chapter 3 a sample of 34 representative participants completed the questionnaire. The participants were requested to fill in a comparative analysis tool. The Instant Priorities method was used to analyse the pairwise comparisons. The ranking obtained from the Instant Priorities method were confirmed by the Analytical Hierarchy Process. The Analytical Hierarchy Process is a systems analysis technique for solving decision problems.

The overall result supports the research premise that communication plays an important role in project success. The ranking of the factors for success can be used as an initial priority list for project management.

Based on the results obtained in Chapter 3, one can describe a project's probability for success as a qualitative function of the top four factors.

A successful project is:

- Defined by a clear business case, scope and requirements (Ranking: 2 - Hard)
- Driven by stakeholder ownership, understanding and involvement (Ranking: 1 - Soft)
- Safeguarded by risk management (Ranking: 3 -Hard)
- Held together by communication (Ranking: 4 - Soft)

Furthermore, communication was the most important critical success factor to the users of projects, and not valued as critical by project team members. This indicates the gap for why training in communication will benefit project management.

Evaluate the use of a workshop based communication training intervention based on the Marston DISC behavioural style model.

The researcher observed a workshop on communication within projects. Project stakeholders belonging to a large insurance company in South Africa attended the workshops. Marston's DISC behavioural style model was used to evaluate and explain the behavioural preferences of different project stakeholder groups.

Mapping the stakeholder groups to a DISC style as seen in Chapter 3, the following typical styles were found:

- Dominant project sponsor
- Steady project user
- Conscientious project manager
- Steady and conscientious project team member

For example, a project sponsor will require communication tailored to the dominant style to allow for quick and accurate decisions on project issues. The project user, on the other hand, will be most impacted by the change and will require communication geared to the needs of a person with a steady behavioural style. Customising communication for project stakeholder groups can be expected to improve the effectiveness of project communication. The stakeholder's individual preferences should be taken into account during individual communication.

The results of the first two research objectives were translated into a project success factor model that explains the importance of communication in project success. This model can be found at the end of Chapter 3.

Translate the intervention into a proposed serious game to train project stakeholders on key principles of effective project communication and as such contribute to the mitigation of the risks of inadequate communication in projects.

In Chapter 4 a serious game was proposed based on the results of the second research objective, literature study in serious games and a game design workshop. The aim of the game or training tool is for participants to understand their own communication preferences in conjunction with the communication preferences of typical project stakeholders and individual team members. The proposed tool requires the participants to map project team

members to behavioural styles. The structure of the game is a conversation tree with branches to simulate success or failure of a project which was initially at a critical junction.

5.2 SUGGESTIONS FOR FURTHER WORK

The critical success factors could be refined by statistically validating the ranking with a larger sample size of the project stakeholders. However, the sample size for this study was representative and meaningful conclusions could be drawn from the results.

The research could be furthered by designing, writing and developing the proposed serious game. The literature study would be expanded on communication within project management and on the application of serious games. Also investigating the interaction of communication on the other critical success factors in project management may strengthen the design of the serious game. Further research would follow a design science approach. The developed tool would have to be tested through action research.

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APPENDIX A: RESEARCH QUESTIONNAIRE

Cover letter

To whom it may concern

SUBJECT: RESEARCH WORK – THE MITIGATION OF PROJECT RISK – A SERIOUS GAMES PROPOSAL

I, H. Pretorius, am currently enrolled at the North West University as an M.Sc student. For this course, a dissertation needs to be submitted, and research work will be undertaken.

The topic of my study is The Mitigation of Project Risk. This questionnaire determines the critical success factors for projects by means of a comparative analysis tool. You have been selected to complete the questionnaire because I believe you can help me with this research.

Please respond to each question, if you are unsure you are welcome to ask me for assistance. This questionnaire has been designed to be filled out quickly and easily. The results of this survey will **only** be used for the purpose as mentioned above.

Please return the questionnaire within ten days. If you require any further information please e-mail hedre.pretorius@gmail.com.

I thank you for your participation in this research.

Kind regards

H. Pretorius

Questionnaire

SECTION 1: BACKGROUND INFORMATION

1.1 As a Project Stakeholder, what role do you play in projects?
Choose the most appropriate
☐ Project Sponsor
☐ Project User
☐ Project Manager
☐ Project Team Member

1.2 Sector(s):	
Choose the most appropriate	
☐ Aerospace & defence	☐ Government/ public services
☐ Banking and financial services	☐ Healthcare & pharmaceuticals
☐ Chemicals	☐ Hospitality & leisure
☐ Communications	☐ Industrial manufacturing
☐ Consulting	☐ Insurance
☐ Education	☐ Metals & mining
☐ Energy & utilities	☐ Retail & consumer
☐ Engineering & construction	☐ Technology
☐ Entertainment & media	☐ Transportation & logistics
☐ Forest, paper& packaging	

1.3 Number of employees in your company:
Choose the most appropriate
☐ <10
☐ 10 – 100
☐ 100 – 1000
☐ >1000

1.4 Typical project team size:
Choose the most appropriate
☐ <5
☐ 5 – 10
☐ 10 – 20
☐ >20

1.5 What is the average monetary value of projects undertaken by you?
Choose the most appropriate
☐ Less than R500 000
☐ R 500 000 – 1 000 000
☐ R 1 000 000 – 10 000 000
☐ R 10 000 000 – 100 000 000
☐ Over R 100 000 000

1.6 How many years' experience:
Choose the most appropriate
☐ Less than 5 years
☐ 6 – 10 years
☐ 11 -15 years
☐ 16 – 20 years
☐ 20 years and more

SECTION 2: DETERMINING THE MOST IMPORTANT CRITICAL SUCCESS FACTORS IN PROJECTS

Please fill in the Comparative Analysis Tool on the next page

Note: I am interested in your own view on the factors that contribute most to project success.

INSTRUCTIONS:

- Work along the rows. Compare the factor in the row against the factor in each column.
- If the **factor in the row** (e.g. communication) is a **more important** contributor to success **than that of the column** (e.g. stakeholder ownership, etc.), enter a **1** in the corresponding white block.
- If the factor in the row (e.g. communication) is a **less important** contributor to success than that of the column (e.g. stakeholder ownership, etc.), enter a **0** in the corresponding white block.
- **You need only fill in the white blocks.**

Comparative Analysis Tool										
Determinants of Project Success	**Planning**	**Expectations**	**Clear business case, scope and require-ments**	**Project scope, timeline and team size**	**Project implemen-tation team**	**Stakeholder ownership, understand-ing and involvement**	**Project manage-ment method**	**Risk manage-ment**	**Vendors/ sub-contractors/ consultants**	**Communi-cation**
Planning										
Expectations										
Clear business case, scope and requirements										
Project scope, timeline and team size										
Project implementation team										
Stakeholder ownership, understanding and involvement										
Project management method										
Risk management										
Vendors/subcontractors/ consultants										
Communication										

SECTION 3: FURTHER INFORMATION

Would you like to receive any further information on this research project?	☐ Y	☐ N
If Yes, please provide your name and email address		
Name:		
Email address:		

THANK YOU!

APPENDIX B: FULL PAPER ACCEPTED FOR IEEE ENTERPRISE SYSTEMS 2013 CONFERENCE PROCEEDINGS

Why use communication training as enterprise-wide project risk mitigation tool?

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***Abstract* — Complex enterprise-wide projects often fail even when formal project management methods are followed. Project management processes and methodologies are well defined and described in academic and business literature. There is however less published research on the human factors that are critical for project success. This paper describes the results of a study on whether project stakeholders view communication as one of the critical success factors for project success. Critical project success factors were identified from a literature study and ranked by 34 project stakeholders using a comparative analysis technique. The results were translated into a project success factor model that explains the importance of communication in project success. The results of this research project support the view that communication training across stakeholder groups should be included as an integral part of the enterprise-wide project risk mitigation tool kit.**

Index Terms – enterprise-wide projects; communication training; critical success factors; project stakeholders; project risk mitigation

I. INTRODUCTION

Companies that operate in hypercompetitive technological environments are increasingly reliant on large capital projects to support and expand their business. Such enterprise-wide projects are characterised by complexity, uniqueness, assumptions, constraints and stakeholder expectations [1].

One can define two dimensions to carrying out projects. The first dimension is the technical or hard side of the project management process. This technical dimension consists of the formal, directed, purely logical parts of the process as defined by the typical deliverables of formal project management methodologies. The second dimension is the socio-cultural or soft side of project management. This dimension focuses on creating a temporary project-based social system within a larger organisational environment, for example: how people work together, relationships and politics, project ownership, intangible objectives and influencing project stakeholders.

The hard and soft sides of a project can be seen as the 'science' and the 'art' of a project, respectively. For a project to be successful, both dimensions must be adequately managed. However, some project managers become overly focused on the planning and technical dimension of projects. The people aspects are often ignored and misjudged, leaving project stakeholders disappointed. Since people are responsible for the planning and execution of projects, it is important to attempt to understand the behavioural preferences of people to optimise the success of your project [2].

The primary objective of this research project was to propose an intervention to mitigate the risks of inadequate communication within a project environment. This paper describes the results of the initial study to confirm that such an intervention is necessary and will be useful to project stakeholders.

II. PROJECT STAKEHOLDERS

A stakeholder can be defined as any group or individual, internal or external to the organisation, who may influence and in turn be influenced by a particular project's outcome [3]. Stakeholders invest in the outcome of the project by contributing time, skills, knowledge or funding [4].

For the purpose of this study four typical project stakeholder groups were identified:

- Project managers
- Business managers, project sponsors and business owners
- Project users
- Project team members

These stakeholders have different needs and expectations that must be fulfilled for the project to be deemed successful. It is therefore important to understand how to manage the expectations of each stakeholder to be able to successfully deliver on projects [5].

A. The Project Manager

The project manager is responsible for planning, scheduling, and controlling all project activities. In this role, the project manager acts as the link between the different project stakeholders. The project manager's role should therefore include the identification and management of stakeholder expectations to satisfy their needs on the project. This implies that the project manager must establish a common understanding of the business problem with the project stakeholders.

Optimal execution of this role requires sustainable working relationships with other project stakeholders. To be able to do this, the project manager must be a strong communicator, have excellent management skills, be innovative, be knowledgeable about technology, have created an established rapport with the project team and client organisation, be able to lead his/her team and be able to work well under pressure [6].

B. Business Managers, Project Sponsors and Business Owners

The project sponsor is the most senior stakeholder, as s/he takes ownership of the business problem and is accountable for ensuring a successful project outcome. The project sponsor has the power to influence decisions and should be responsible for obtaining stakeholder and employee buy-in to ensure that the project is successful. In this role, s/he will identify and liaise with other project stakeholders who may be impacted by the project and who may therefore assist or hinder the project. The project sponsor is also accountable for the use of external stakeholders such as vendors and consultants on the project. Like the project manager, the project sponsor must coordinate communication and encourage open relationships with the project stakeholders while acknowledging and addressing their concerns and interests [7].

C. Project User

In this study, the project user is defined as the main user and beneficiary of the project deliverables. The user has ultimate say on whether the project was successful and can be an individual, a group of people with a common objective, an organisation or a group of organisations.

D. Project Team Member

The project team member is the person who reports directly or indirectly to the project manager and who is responsible to achieve the deliverables within the project constraints. The team members have to inform the project manager of project risks and issues that require resolution by other stakeholders. It is important that team members understand the needs and expectations of the other project stakeholders to be able to tailor successful delivery of the project [8].

III. Critical Project Success Factors

As a first step, a literature study on project success factors was done and 10 key project success factors were identified:

A. Planning

Planning leading to a project plan defines how a project will be executed and is used as a basis for the monitoring and controlling of the project. A typical project plan is geared towards addressing the hard technical project dimension of scope, quality, time, costs, resources and risks. It is essential that the project plan is based on realistic assumptions and is aligned to the specific requirements of a project. However, planning well is only the start of your success [9].

B. Expectations

Each stakeholder group's expectations of the project should be identified and constantly assessed throughout the life of the project to optimise project success. Communication is a crucial tool to facilitate stakeholder expectation management. As mentioned in Reference [10] Preble proposes an iterative approach to stakeholder expectation management based on stakeholder management theory. This approach includes the following steps:

- Identify stakeholders and their expectations
- Assess these expectations against the business objectives
- Prioritise expectations according to project constraints
- Communicate prioritised expectations to all stakeholders
- Decide on the approach to be taken to meet these expectations
- Monitor and control the expectations throughout the project

Stakeholder expectations are influenced by their perception of the project objectives and how the implemented solution will fulfil these objectives. Therefore, stakeholder assessment of project outcome will be determined by how well they believe their expectations have been met. Each stakeholder must consciously and explicitly define his/her expectations to allow the project manager to understand their view of project success. Expectations may change and must be monitored and managed through the life of the project.

C. Clear Business Case, Scope and Requirements

Effective project management includes clearly defined project objectives and goals, as well as agreement between the project stakeholders on how these goals and objectives will be achieved [11]. Such agreement and understanding of the project business case, scope and requirements will determine both project delivery and ultimate stakeholder assessment of project success.

D. Project Scope, Timeline and Team Size

Our critical success factor of project scope, timeline and team size refers to the impact of the size of the project on project success. The goal of the project scope document is to describe the customer’s needs, rather than how the team will accomplish its goals. The scope document should include the project objectives, deliverables, milestones, specifications, limits and exclusions [12].

By definition, a project has a start and an end date. The project timeline is determined by and, in turn, determines stakeholder expectations and assessment of the ultimate success of a project [13].

Project team members need to be able to communicate with each other. A fundamental principle of systems thinking is that elements of the system relate to one another in greater complexity as the number of elements increases. The size of the team determines the number of

relationships in a project team. Two team members will have a single relationship, three members have three relationships and four have six relationships, etc. The larger the project team, the more relationships the project manager has to manage and control [14].

E. Project Implementation Team

The implementation team is responsible for conducting the project activities. The implementation team includes the technology specialists responsible for implementing the project solution. Other stakeholder groups should interact with the implementation team to ensure that requirements are correctly implemented [15]. The capability of the project implementation team to fulfil their role will impact project delivery.

F. Stakeholder Ownership, Understanding and Involvement

Executive support and ownership is an important factor for project success as they control resources and information that impact the achievement of project objectives. Visible executive support sets the example for the rest of the organization and encourages employee participation and buy-in across the organization. It is critical for business resources to be involved in the project to ensure that they feel part of the change and that their contribution is seen as valuable to the process [16].

G. Project Management Method

A formal project management methodology describes a system of interrelated phases, procedures, activities and tasks that define the project process from start to end. Best practice advice is that companies should adopt a single project management methodology to increase their project management maturity. Maintaining and supporting a single methodology should lower cost, reduce resource requirements, minimise paperwork and eliminate duplicated efforts [17].

H. Risk Management

Project risk is defined as an uncertain and unfavourable event, which if it should occur, negatively affect the deliverables or objectives of a project. Risk may be quantified as the probability that such an event may occur multiplied by its expected impact. Project risk management may be defined as the process concerned with identifying, analysing and responding to uncertainty in projects. In order to successfully manage project risk, the project team must consist of appropriately experienced members who are able to implement the project risk management process [18].

I. Vendors, Subcontractors or Consultants

Few firms have sufficient in-house resources or a comprehensive enough knowledge or skills base to implement a complex enterprise-wide project. Such projects therefore rely on external support obtained from vendors, subcontractors or consultants. The client possesses detailed knowledge of the firm's business processes, organisational context, and competitive situation. Consequently, coordination between the external consultants and the client is critical for project success. This requires facilitating communication and mutual understanding through project management activities for successful implementation.

External consultants are often informally blamed for project failure in large projects and we were interested in where their contribution to project success would be ranked by project stakeholders.

J. Communication

On-going communication throughout the project across the organisation is essential for project success. Communication involves educating all

project stakeholders about the benefits and impact of the project on the organisation as well as communicating the progress of the project. Project communication includes soliciting issues and risks associated with the project from all stakeholders, as well as resolving conflict within the team. Effective communication with the right stakeholders at the right time ensures that the project will be less susceptible to budget, schedule, and resource issues [19].

Communication unlocks the power of all the skills described in the literature to manage projects. Communication on projects is much broader and deeper than simply informing stakeholders about the status of the project. It is the foundation of effective relationship building and creating trust between stakeholders [20].

Table 1 categorises the critical project success factors as relating mainly to either the hard (H) (technical) or soft (S) (behavioural) dimension of project.

Critical project success factor	**Dimension of project management**	
	Hard (H) (technical)	**Soft (S) (behavioural)**
Planning	x	
Expectations		x
Clear business case, scope and requirements	x	
Project scope, timeline and team size	x	
Project implementation team		x
Stakeholder ownership, understanding and involvement		x
Project management method	x	
Risk management	x	
Vendors/subcontractors/ consultants		x
Communication		x

Table 1 Factors relating mainly to either the hard (H) (technical) or soft (S) (behavioural) dimension of project management

IV. Obtaining a Ranking Of The Critical Success Factors

A pairwise comparison matrix containing the 10 critical success factors were constructed as shown in Fig 1. Thirty-four stakeholders from different stakeholder groups compared each factor against its corresponding factor in each column. If the factor in the row was a more important contributor than that of the column, the participant had to enter a "1" in the corresponding white block. If the factor in the row was a less important contributor than that of the column, the participant had to enter a "0" in the corresponding white block.

Pairwise Comparative Matrix

Determinants of Project Success	Planning	Expectations	Clear business case, scope and require-ments	Project scope, timeline and team size	Project implemen-tation team	Stakeholder ownership, understand-ing and involvement	Project manage-ment method	Risk manage-ment	Vendors/ sub contractors/ consultants	Communi-cation	Total	Ranking (Top = 1)
Planning		0	0	1	1	0	1	0	1	0	4	6
Expectations	1		1	1	1	0	1	0	1	0	6	4
Clear business case, scope and requirements	1	0		1	1	0	1	0	1	0	5	5
Project scope, timeline and team size	0	0	0		0	0	1	0	1	0	2	8
Project implementation team	0	0	0	1		0	1	0	1	0	3	7
Stakeholder ownership, understanding and involvement	1	1	1	1	1		1	0	1	0	7	3
Project management method	0	0	0	0	0	0		0	0	0	0	10
Risk management	1	1	1	1	1	1	1		1	1	9	1
Vendors/subcontractors/ consultants	0	0	0	0	0	0	1	0		0	1	9
Communication	1	1	1	1	1	1	1	0	1		8	2

Fig. 1 Pairwise comparative matrix

Tables 2 and 3 give a detailed description of the participants' stakeholder roles and their level of experience in their roles.

Stakeholder role	*Frequency*	*Percentage*
Project Sponsor	9	24%
Project User	5	13%
Project Manager	13	34%
Project Team Member	9	24%
Stakeholder role not provided	2	5%

Table 2 Participant stakeholder roles

Level of experience of stakeholders	***Frequency***	***Percentage***
Less than 5 years	5	13%
6 – 10 years	7	18%
11 -15 years	12	32%
16 – 20 years	7	18%
20 years and more	6	16%
Not provided	1	3%

Table 3 Stakeholder experience level

The results of each individual case were summed per row to obtain a ranking.

After obtaining all the individual rankings, a sum of the rankings was obtained, resulting in an overall ranking of the success factors. Every individual ranking therefore carried the same weight. The method used to obtain the overall ranking was adopted from a technique called Instant Priorities found in Reference [21]. Table 4 gives the overall result.

Critical project success factor	Ranking
Planning (H)	5
Expectations (S)	7
Clear business case, scope and requirements (H)	2
Project scope, timeline and team size (H)	7
Project implementation team (S)	8
Stakeholder ownership, understanding and involvement (S)	1
Project management method (H)	10
Risk management (H)	3
Vendors/subcontractors/ consultants (S)	9
Communication (S)	4

Table 4 Overall ranking of critical project success factors (1 = most important, 10 = least important)

By doing the same for the different stakeholder groups the following rankings were obtained:

Critical success factor	Ranking (1=Most important)			
	Project sponsor	Project user	Project manager	Project team member
Planning (H)	4	6	3	5
Expectations (S)	5	6	7	6
Clear business case, scope and requirements (H)	2	4	1	3
Project scope, timeline and team size (H)	7	8	6	4
Project implementation team (S)	6	6	8	7
Stakeholder ownership, understanding and involvement (S)	1	2	4	2
Project management method (H)	10	9	9	10
Risk management (H)	8	3	2	1
Vendors/subcontractors/ consultants (S)	9	10	10	9
Communication (H)	3	1	5	8

Table 5 Stakeholder groups' ranking of critical success factors

V. Interpretation of the Results

The overall result obtained from the summation of the individual rankings supports the research premise that communication plays an important role in project management. This ranking of the factors for success can be used as an initial priority list for project management. This result deserves further research to refine the proposed factors and obtain a statistically validated ranking of relative importance for the success using a larger sample of project stakeholders.

The first four factors in the ranking consist of a mix of 'Hard' and 'Soft' skills. Communication ranked fourth in the list of ten critical success factors. Communication can be viewed as glue that holds the project together as the application of the other key success factors is dependent on effective communication.

The factors that were ranked lower (5-10) refer to project success factors that may be more easily managed when the requirements of the first four factors are satisfied. An interesting result is that the respondents did not attribute high responsibility for project success to external stakeholders such as vendors, subcontractors and consultants. Project success is therefore mainly seen as the responsibility of internal stakeholders.

Based on these results, one can describe a project's probability for success as a qualitative function of the top four factors as shown in Fig. 2:

A successful project is:

- Defined by a clear business case, scope and requirements (Ranking: 2 - Hard)
- Driven by stakeholder ownership, understanding and involvement (Ranking: 1 - Soft)
- Safeguarded by risk management (Ranking: 3 -Hard)
- Held together by communication (Ranking: 4 - Soft)

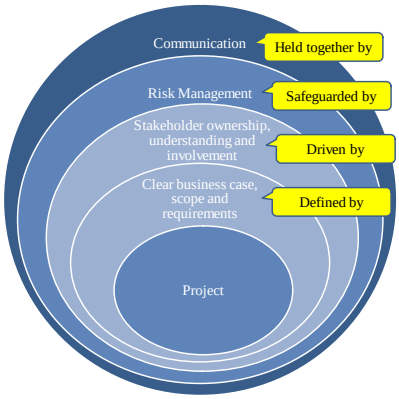

Fig. 2 Project success priority list

The results of this research project therefore support the view that communication training across stakeholder groups should be included as an integral part of the enterprise-wide project risk mitigation tool kit.

VI. Conclusions

The primary objective of the larger research project was to propose an intervention to mitigate the risks of inadequate communication within a project environment. In this study, critical project success factors described in literature were identified and ranked.

The overall ranking of the factors for project success can be used as an initial priority list for project management. This result deserves further research to refine the proposed factors and obtain a statistically validated ranking of relative importance for the success using a larger sample of project stakeholders

The results of this study support the view that communication training across stakeholder groups should be used as an enterprise-wide project risk mitigation tool. A serious games based training tool that teaches project communication will be designed in the next phase of this project.

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