Course Title:	COE
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Assignment/Lab Number:	Lab 5
Assignment/Lab Title:	Requirements Analysis and Specification

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1.0 PART I - REQUIREMENT MANAGEMENT:

TRACEABILITY MATRICES:

Requirement	ID
Enhanced Ordering Process	1
RF Technology and SAP Integration	2
Maintenance and Support	3
Scalability	4
Automated Inventory Management System	5
Cost Effectiveness vs Efficiency	6
Performance and Reliability	7
Customizable User Interface	8
Security Measures for Sensitive Data	9
Data Management and Reporting	10
Compliance with Regulatory Requirements	11

DEPENDS ON: Requirement	1	2	3	4	5	6	7	8	9	10	11
1		*			*		*	*		*	
2					*		*		*		*
3				*			*				
4	*	*	*		*		*				
5	*			*							
6			*				*				
7	*			*	*				*		
8	*						*				
9										*	
10	*							*			
11		*							*		

CONTRADICTS WITH:

Requirement	1	2	3	4	5	6	7	8	9	10	11
1						*					
2											*
3						*					
4						*					
5											
6	*		*	*			*	*	*		*
7						*					
8						*	*				
9						*					
10									*		
11											

SPECIFIED WITH:

Requirement	1	2	3	4	5	6	7	8	9	10	11
1					*						
2											*
3							*				
4	*										
5	*										
6	*										
7			*								
8											
9											*
10	*										
11									*		

PARENT OF:

Requirement	1	2	3	4	5	6	7	8	9	10	11
1					*						
2				*							
3							*				
4	*										
5	*										
6											
7			*								
8											
9										*	
10	*										
11									*		

Requirement One Relationship Frequencies
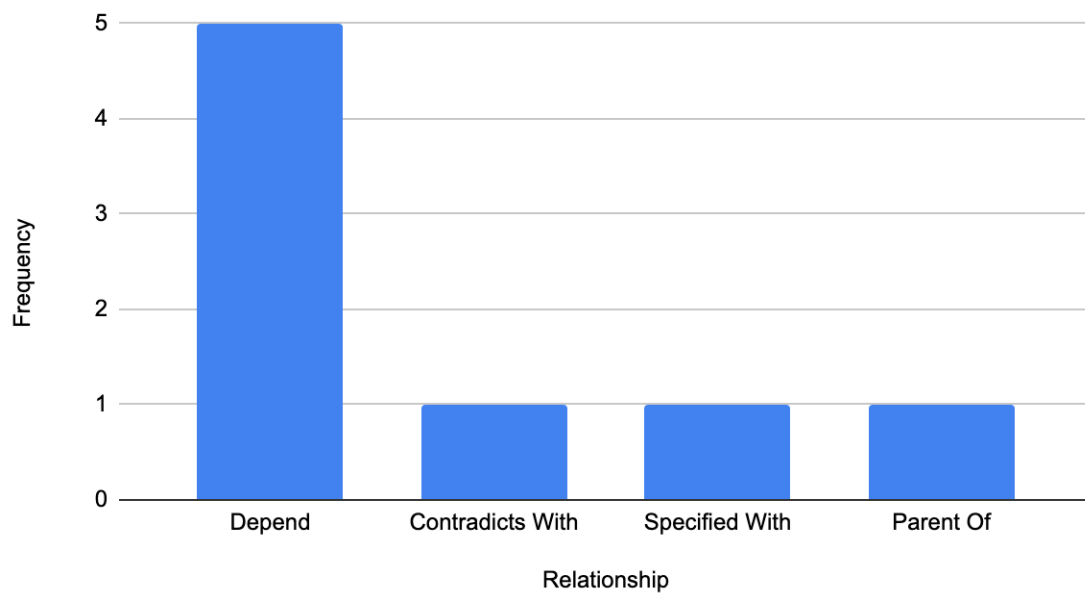
Figure 1.0: Frequency of Requirements

Frequency of "Depends on" Relationships
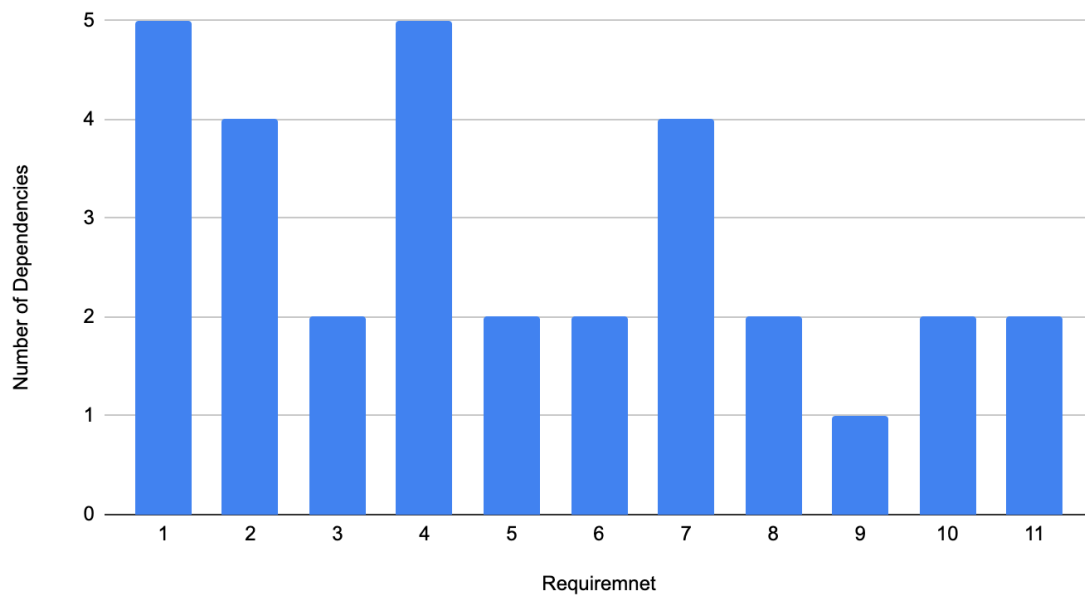
Figure 1.0: Frequency of "Depends on" Relationships Graph

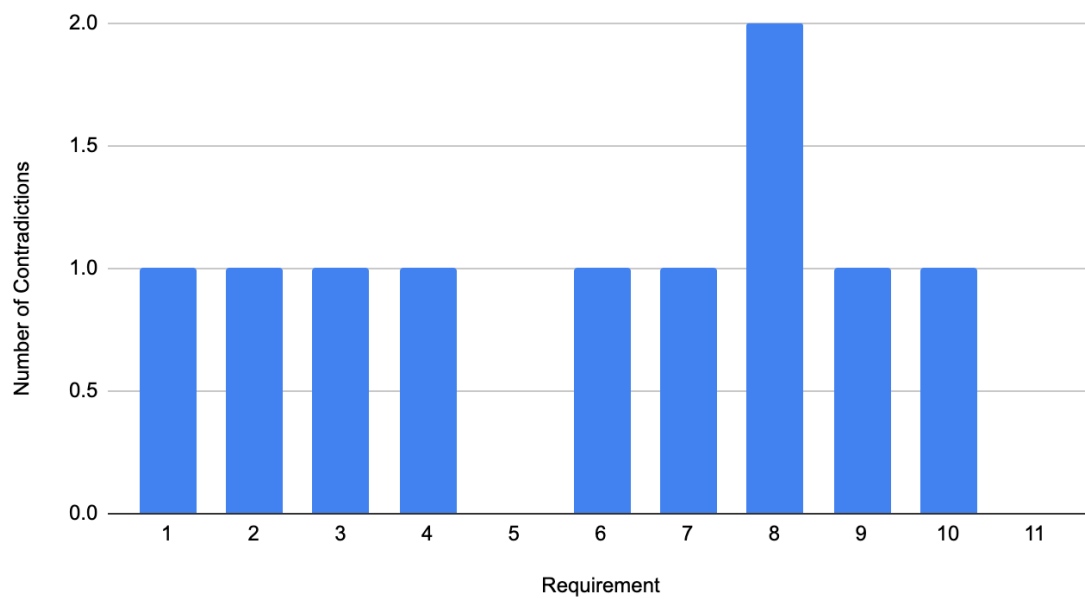## Frequency of "Contradicts with" Relationships

Figure 2.0: Frequency of "Contradicts with" Relationships Graph

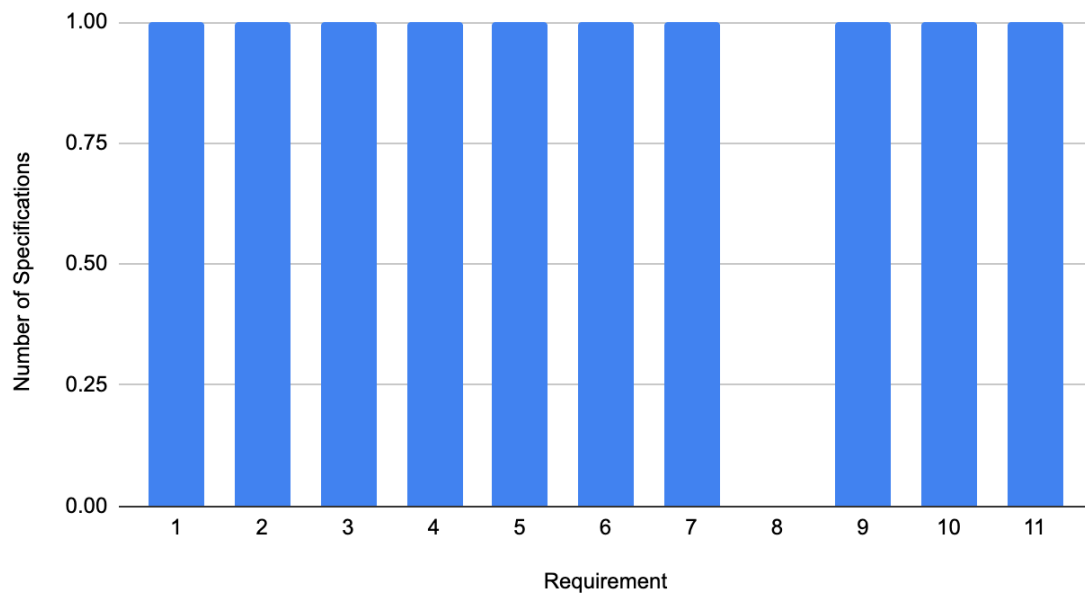## Frequency of "Specified with" Relationships

Figure 3.0: Frequency of "Specified with" Relationships Graph
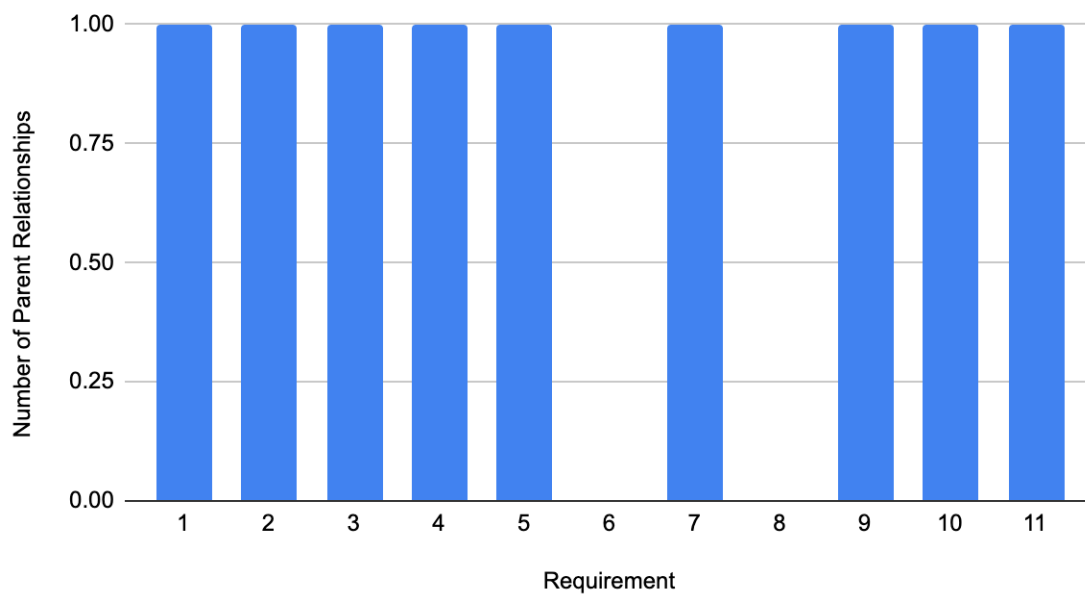
Frequency of "Parent of" Relationships

Figure 4.0: Frequency of "Parent of" Relationships Graph

Analysis:

Requirement	Number of Dependencies	Number of Contradictions	Number of Specifications	Number of Parent Relationships	SUM
1	5	1	1	1	8
2	4	1	1	1	7
3	2	1	1	1	5
4	5	1	1	1	8
5	2	0	1	1	4
6	2	7	1	0	10
7	4	1	1	1	7
8	2	2	0	0	4
9	1	1	1	1	4
10	2	1	1	1	5
11	2	0	1	1	4

Which requirement(s) has the most frequent relationship with all other requirements of any relationship type and why?

In order to answer this question, I will be using the table under the analysis section above. In this table, I have highlighted green for the requirement(s) that have the highest amount of relationships, and found requirement with the most relationships in the SUM column.

For the depends on relationship, it can be seen that requirement one and four have the highest amount of relationships, which are "Enhanced Ordering Process" requirement and "Scalability" respectively. Requirement one has one of the highest depends on relationships because in order to meet the enhanced ordering process requirement, it involves many other requirements to be optimized and working correctly. As such, it naturally depends on various other functionalities and components within the system to facilitate an efficient ordering process. In order to achieve requirement four, it often requires integration with various components and technologies to ensure that the system can handle increased demands effectively. As a result, scalability depends on several other functionalities within the system

For the contradicts relationship, it can seen that requirement six has the most contradictions compared to any other requirement, requirement six being "Cost Effectiveness vs Efficiency". Requirement six seeks to limit the cost and reduce spending as much as possible to maintain the most efficiency with the spending. Simply put, as we strive to control costs, we must recognize the potential conflicts that could hinder our ability to achieve our system's full objectives. Balancing cost containment with

operational effectiveness underscores the complexity of our decision-making process and underscores the need for strategic approaches to address these challenges.

For the specifies relationship, it can be seen that overall, every requirement has another requirement that specifies what it needs to achieve. This is makes sense because it was also seen in our depends on relationships, a lot of requirements depend on each other as well which shows strong coupling. However, requirement eight does not specify anything, which is "Customizable User Interface" requirement. Unlike other requirements that rely on various functionalities or components within the system to fulfill their objectives, Requirement 8 serves as an enabling feature that enhances user experience but does not directly interact with other requirements in a dependent manner.

For the parent of relationship, it can be seen that overall, every requirement has another requirement that specifies what it needs to achieve. This is makes sense because it was also seen in our depends on relationships, a lot of requirements depend on each other as well which shows strong coupling. However, requirement six and eight are not the parent of anything. Requirement six serves as a guiding principle or overarching objective rather than a component that directly influences or governs other requirements. As such, it may not have specific child requirements under its purview. Requirement eight focuses on a specific feature or aspect of the system—namely, the user interface customization. While this feature may enhance the usability and effectiveness of the system, it typically operates independently and does not directly govern or influence other requirements.

By looking overall at which requirement has the most relationships, it can be seen that requirement six has the highest number of relationships (10). This is because it has the highest amount of influence on the decision-making processes within the system. Requirement 6 is a fundamental principle that effects all aspects of system design and implementation. Balancing cost-effectiveness with efficiency is a core consideration in resource allocation, technology selection, and process optimization. Consequently, it intersects with numerous other requirements as decisions are made regarding trade-offs and priorities. Overall, Requirement 6 emerges with the most relationships due to its fundamental nature, cross-cutting impact, complex trade-offs, and strategic significance within the system architecture.

2.0 PART II - RISK MANAGEMENT AND ANALYSIS:

Risks for "Wireless Warehouse Initiative":

1. Technology Integration Complexity Risk
    a. The specific challenge of integrating real-time inventory tracking RF technology with the SAP ERP system could lead to unforeseen technical incompatibilities, demanding additional custom software development, which could exceed initial estimates, leading to delays and cost overruns.
2. Data Security & Privacy Risk

      a. The integration of new technology could introduce vulnerabilities in data security, risking sensitive information exposure. This is particularly critical given the increasing sophistication of cyber threats.

3. Staffing and Skill Gaps Risk
      a. The current warehouse staff's lack of experience with SAP systems could lead to an increase in the training budget and extend the training, which in result would delaying full system adoption.

4. Technology Obsolescence Risk
      a. With the rapid advancement in AI-based inventory management solutions, there's a risk that the chosen RF technology could become outdated

5. Vendor Dependency Risk
      a. Sole reliance on a single supplier for RF scanning equipment could result in project delay if the vendor faces supply chain disruptions.
      b. This could be problems with the company itself, or other reasons such as geopolitical tensions in their manufacturing region.

6. Regulatory Compliance Risk
      a. Changes in regulatory standards related to warehouse operations, data privacy, or technology use during the project's lifecycle could impose new requirements, leading to rework or additional compliance costs.

Project Objectives That Will Be Impacted By Risks:

1. **Cost**
      a. Technology Integration Complexity Risk
            i. Increased cost due to the need for additional custom software development.
      b. Data Security & Privacy Risk
            i. Increased costs for implementing advanced security measures and potential fines for breaches.
      c. Staffing and Skill Gaps Risk
            i. Higher training expenses to bring staff up to speed on the new SAP system.
      d. Technology Obsolescence Risk
            i. Additional investment required for future upgrades or replacements to stay current.
      e. Regulatory Compliance Risk
            i. Increased costs associated with ensuring compliance with new or changing regulations.

2. **Time**
      a. Technology Integration Complexity Risk
            i. Delays in project timeline due to technical difficulties and extra development time.
      b. Staffing and Skill Gaps Risk
            i. Longer timeline for full system adoption due to longer training periods.
      c. Vendor Dependency Risk

i.　Project delays if the vendor experiences supply chain problems.
　　d.　Regulatory Compliance Risk
　　　i.　Potential delays if rework is required to meet compliance standards.

3. Scope
　　a.　Technology Integration Complexity Risk
　　　i.　Potential expansion to include unplanned technical solutions or integrations.
　　b.　Technology Obsolescence Risk
　　　i.　The project scope may need to be revised to incorporate new, more advanced technologies.
　　c.　Vendor Dependency Risk
　　　i.　May need to expand the scope to include alternate vendors or contingency plans.
　　d.　Regulatory Compliance Risk
　　　i.　The project scope may expand to include additional features or processes necessary for compliance.

4. Quality
　　a.　Technology Integration Complexity Risk
　　　i.　Risk of decreased system effectiveness if integrations do not meet operational requirements.
　　b.　Data Security & Privacy Risk
　　　i.　Compromised data integrity and trust in the warehouse management system could reduce the perceived quality of the project.
　　c.　Staffing and Skill Gaps Risk
　　　i.　Potential reduction in operational quality during the transition period as staff become accustomed to the new system.
　　d.　Technology Obsolescence Risk
　　　i.　Initial technology may become less effective compared to newer solutions, affecting the overall quality of the warehouse management system.
　　e.　Vendor Dependency Risk
　　　i.　If forced to switch vendors, there is a possibility that new items are lower quality or less suitable components if forced to switch vendors quickly.
　　f.　Regulatory Compliance Risk
　　　i.　Compliance efforts might divert resources and efforts from other quality improvement initiatives.

Monte Carlo Simulation:

Risk	Risk ID
Technology Integration Complexity Risk	1

Data Security & Privacy Risk	2
Staffing and Skill Gaps Risk	3
Technology Obsolescence Risk	4
Vendor Dependency Risk	5
Regulatory Compliance Risk	6

Probability and Scale		
Risk	Probability	Severity Impact
1	40%-60%	3
2	60%-80%	4
3	20%-40%	2
4	80%+	3
5	60%-80%	3
6	40%-60%	2

Risk 1 Trials		Risk 2 Trials		Risk 3 Trials		Risk 4 Trials		Risk 5		Risk 6	
Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity	Probability	Severity
0.4872320542	3	0.592854594	4	0.2983800726	4	0.9218527608	5	0.6851034567	2	0.4801805272	1
0.4486998117	3	0.6598250963	3	0.2558439425	2	0.8927154122	3	0.7529809395	3	0.52921937	1
0.4695705836	3	0.7044452892	4	0.2944081095	2	0.9359699598	6	0.7129418673	4	0.445895474	1
0.4705740025	3	0.7457647535	3	0.2380326258	1	0.8621209967	3	0.684466905	4	0.528915633	1
0.537603434	2	0.6401547315	3	0.1687747472	3	0.9612641545	1	0.5793918141	2	0.5151928083	1
0.4321131085	4	0.7199934786	3	0.408423219	1	0.8985929622	5	0.8471933895	3	0.49603701	1
0.5182347808	4	0.7569654736	4	0.3077018009	1	0.9403902139	3	0.6977430736	3	0.4585140378	1
0.5803450124	3	0.7350064243	2	0.2609866197	1	0.8979797831	6	0.7249850055	2	0.4861629873	4
0.6284068382	1	0.6562562182	4	0.3186076986	4	0.8441896475	3	0.7366692392	1	0.5835441723	1
0.4598133081	3	0.7298599373	4	0.3676403624	1	0.895930916	4	0.754238773	2	0.5294123253	3
0.5167838407	3	0.70832217	4	0.3267154355	2	0.8397420156	4	0.681066677	4	0.4407539783	4
0.5183381755	3	0.7156768241	4	0.2060410372	2	0.9270734578	2	0.6495061904	3	0.4889557249	1
0.5425175732	2	0.6908786058	3	0.2980759886	1	0.9680049923	2	0.7550611067	3	0.5136024397	4
0.501967473	3	0.749424986	3	0.2778084333	1	0.8801688007	4	0.7088255388	3	0.4980928439	3
0.3683666641	3	0.7536490603	3	0.3762865164	2	0.9681890414	4	0.6465665581	0	0.518371237	3
0.4324885351	5	0.7055237671	4	0.3958658373	1	0.8423502344	2	0.6599567847	6	0.4981483296	4
0.5457412208	4	0.7199703486	3	0.3162626261	1	0.8921133908	3	0.7869741822	3	0.5037452426	4
0.4062332036	3	0.6908374	4	0.2659770775	1	0.8998696266	4	0.7054271267	3	0.3975740723	4
0.5078705191	4	0.7509345133	4	0.3016543024	4	0.9767413847	1	0.7265463607	2	0.580916732	2
0.5490092052	4	0.7058945114	4	0.3284381971	3	0.9024196502	2	0.595463049	5	0.4563224822	4
0.4959927544	3	0.7062028723	4	0.3174635912	2	0.9795191803	3	0.6731887148	3	0.5477461091	3
0.497009202	2	0.76750369	4	0.4033353062	4	0.9337026603	2	0.7664953385	4	0.4483203556	3
0.5401175945	3	0.7000295417	4	0.2351890236	1	0.8495562432	3	0.5988556951	3	0.4988523764	2
0.5081583064	3	0.6348812503	2	0.2397281059	4	0.9212540462	3	0.7162362157	4	0.46549169	1
0.4843786896	4	0.6389458324	4	0.300428979	3	0.8412051081	4	0.5581895154	3	0.4115172569	3
0.5269018985	2	0.7672302181	4	0.2844394302	2	0.8366306619	3	0.6727484303	3	0.4401279174	4
0.4382683906	2	0.6637710074	4	0.324520156	1	0.915366107	2	0.6403495969	4	0.4610273158	1
0.4618390209	2	0.7104221281	4	0.2680069761	2	0.9333807929	2	0.6802270595	3	0.4708948499	4
0.5453755395	2	0.7399072223	4	0.3798331472	1	0.9962312485	5	0.6870800109	4	0.5515815732	1
0.4196105313	4	0.7709420523	4	0.3644673541	4	0.9592727934	3	0.6767886395	2	0.5266906887	4
0.5355239965	4	0.7357576661	3	0.2952368481	1	0.9005537485	3	0.6715508459	4	0.4139010841	4
0.5260488381	2	0.6986724394	4	0.296135661	2	0.8731213562	4	0.7450445917	3	0.5050201986	1
0.6211656783	2	0.6847214671	4	0.2719300093	2	1	5	0.7382174062	2	0.446661498	1
0.6318787902	4	0.7026847982	4	0.2844463171	3	0.9281700271	2	0.6579106991	4	0.6648787312	1
0.4981533809	2	0.7717170905	4	0.3141887226	1	0.8863228967	5	0.7878010498	4	0.5542033723	3
0.4896362821	4	0.707316572	4	0.3208777025	3	0.8432838953	2	0.757412172	4	0.4637264604	3
0.4854735745	1	0.6548368602	4	0.3277978067	2	0.8901580338	3	0.7405195028	2	0.5265301156	2
0.5920976897	3	0.7308747325	4	0.2624928546	4	0.8694707242	3	0.6378287897	5	0.5004505714	3
0.5870376842	0	0.629453611	2	0.3193646142	2	0.9896833573	2	0.6939695649	4	0.5082881334	1
0.5434254396	2	0.6413741883	4	0.2322138945	1	0.8448387156	3	0.7158551728	3	0.6330708582	2
0.5343286314	2	0.7187817563	4	0.2510404096	1	0.9426506414	4	0.6659386833	2	0.452505014	2
0.4267898889	3	0.7103608168	4	0.2480863868	1	0.7897407743	4	0.7270046798	4	0.5063467764	1
0.4621087186	3	0.722118771	4	0.3119276861	1	0.8829407709	1	0.6916184612	3	0.5496766034	2
0.5613962576	4	0.7694737313	4	0.2989277725	4	0.8578506524	3	0.6671616039	4	0.5475688287	4
0.5326011263	2	0.658791763	2	0.3474958118	2	0.8749640715	4	0.7626095638	5	0.5017507552	4
0.4896995759	3	0.6126701973	4	0.3353122616	2	0.8558440379	4	0.8623748516	3	0.581148476	1
0.4393172402	1	0.7065887209	4	0.3588451851	1	0.9315160464	3	0.6542281524	1	0.5450028825	1
0.4810592727	3	0.6470442487	3	0.3589627675	4	0.8938678643	2	0.627069041	4	0.4512794341	1
0.5103841458	3	0.7492272629	4	0.3164273949	1	0.9014935664	2	0.6973246282	2	0.4892781123	4
0.4629803408	3	0.6913970132	4	0.2860640944	4	0.8609555983	4	0.7686488615	2	0.498235349	3
0.4139240313	2	0.7284346521	4	0.3621579258	1	0.900959362	3	0.6552266759	1	0.420632857	2

Figure 5.0: Monte Carlo Simulation of Risks

Monte Carlo Simulation Expected Probability, Impact and Expected Risk Factor:

Risk	Expected Probabilities	Expected Impact	Risk Factor
1	0.5019026244	3	1.505707873
2	0.7000081161	4	2.800032464
3	0.3044513887	2	0.6089027775
4	0.8989504134	3	2.69685124
5	0.6988920605	3	2.096676181
6	0.5000385448	2	1.00007709

Risk Ranking:

Risk Ranked in Order of Highest Risk Factor
2
4
5
1
6
3

External Factors
- Competitive pressures or innovations
- Vendor supply chain disruptions
- New regulations requiring compliance adjustments

Processes
- Lack of clear communication channels
- Insufficient risk management procedures
- Inadequate project planning or oversight

Resources
- Limited availability of critical equipment or software
- Budget constraints leading to compromises
- Time constraints affecting project phases

People
- Skill gaps in using new technologies
- Resistance to change among staff
- Dependency on key individuals or vendors

Technology
- Technology becoming obsolete
- Integration complexity between different systems
- Security vulnerabilities

Project Implementation Challenges

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