UNIVERSITY OF PITTSBURGH

Remote Access Solutions

A SuperDecisions Model

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4/19/2016

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Background

As advanced mobile technologies grow in popularity and ubiquity, allowing employees to access business information remotely transitions from a competitive advantage to a competitive necessity. Providing comprehensive remote access to timely data enables employees to make informed decisions regardless of location. However, the value of these decisions must be weighed against the costs of implementing and maintaining the IT system to ensure that the business is choosing a cost effective solution.

In this decision model, multiple systems will be evaluated against the use case of granting an enterprise sales team access to sensitive sales information hosted on a business network. Each system has different financial, operational, and technological aspects that will affect the decision. Social implications, such as how remote access affects work-life balance, will also be investigated.

Executive Summary

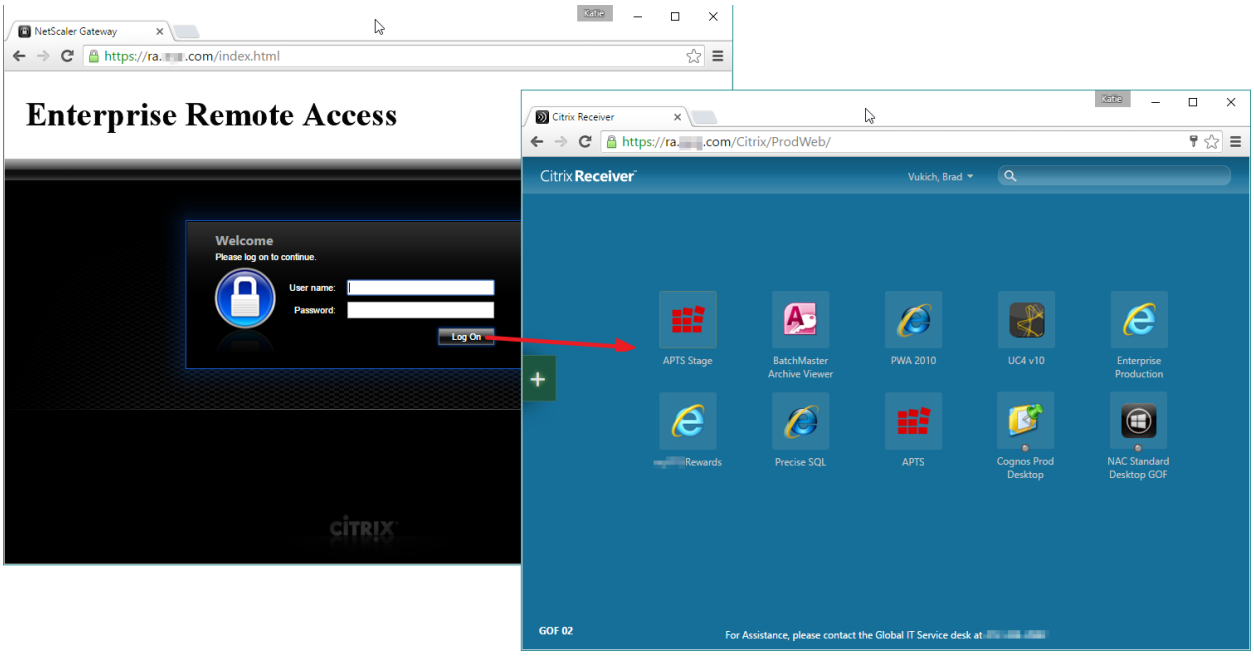
We decided to create a BOCR (Benefits, Opportunities, Costs, & Risks) Model to determine the best remote access solution for new sales reporting software. The following proposed solutions were evaluated in the model: Remote Desktop Access (RDA), Virtual Peer Network (VPN), & Mobile Device Management (MDM) Solution. Each alternative was evaluated under our strategic criteria which represented main characteristics of a successful remote access solution. The four strategic criteria are as follows: Employee Productivity, Innovation, ROI, and Work/Life Balance. Each alternative was evaluated under Financial, Operational, and Technological Control Criteria in the BOCR Model. The final results of our analysis ranked the alternatives in the following order: Mobile Device Management Solution, VPN, and Remote Desktop Access.

Alternatives

The alternatives being considered for the information technology solution and their overall advantages and disadvantages are as follows.

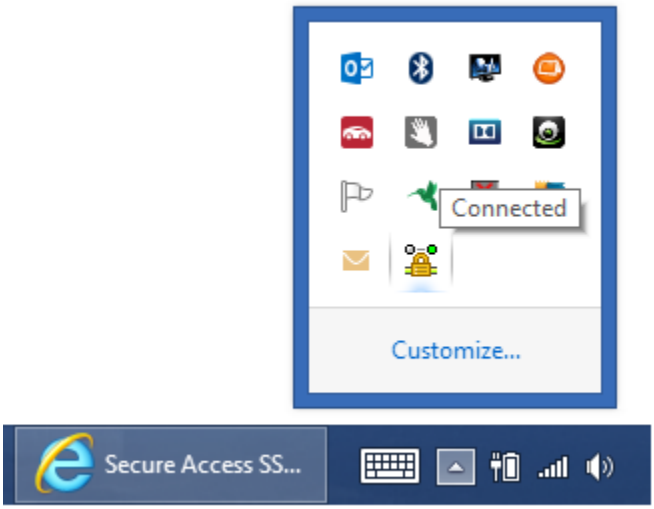
Remote Desktop Access

RDP requires network access for any productivity, but can be accessed from any device, even public workstations. However, this system uses a user interface that may not exactly reflect the working environment of the employee while working in the office, reducing familiarity and, therefore, overall productivity during use. It also requires some redundant software licensing.



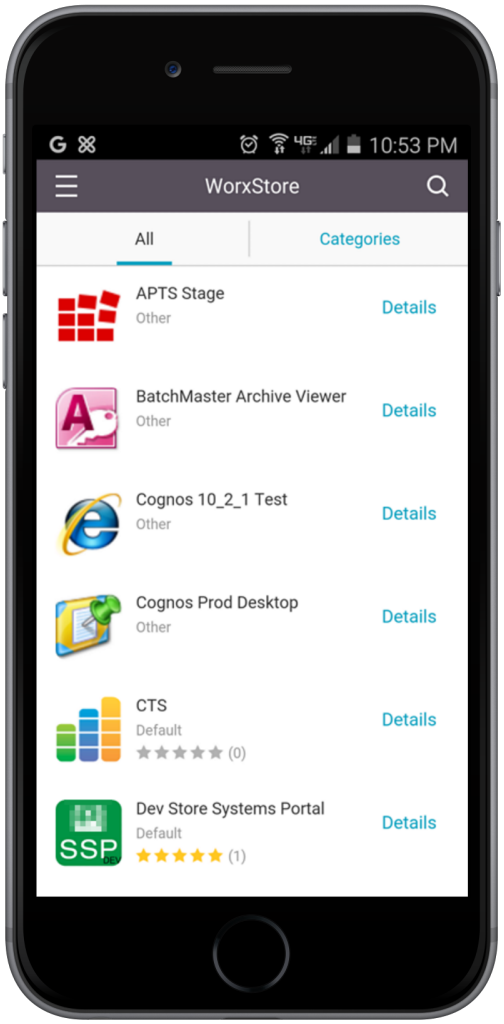
VPN

A Virtual Peer Network allows a user to connect a device to a physically separate network, i.e. a business network from home using a proxy. This allows them to retrieve company data assets remotely while still using the same computer environment with the same software they always use. This doubles as a downside – employees can only use their explicitly enrolled workstations to access the VPN and access information, which may be cumbersome or inconvenient.



Mobile Device Management Solution

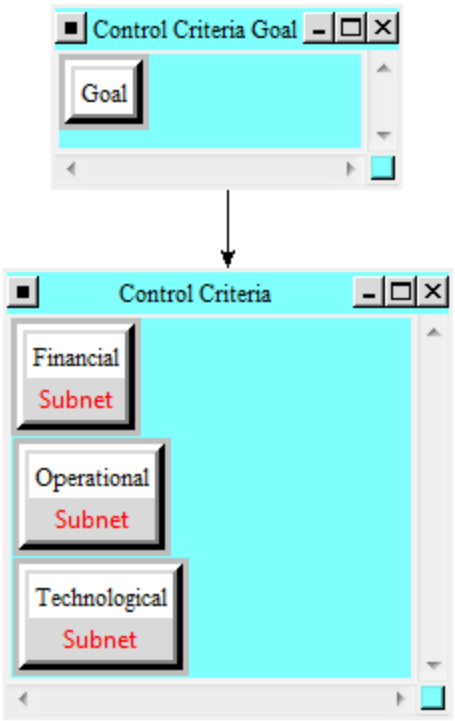
An MDM solution involves identifying existing mobile apps and developing a suite of custom apps to fulfill business productivity requirements on mobile devices. The company can either provide mobile devices or implement a “BYOD” (Bring Your Own Device) policy. While this is the most convenient options for employees, this is considered to be by far the most expensive option for a company to implement.



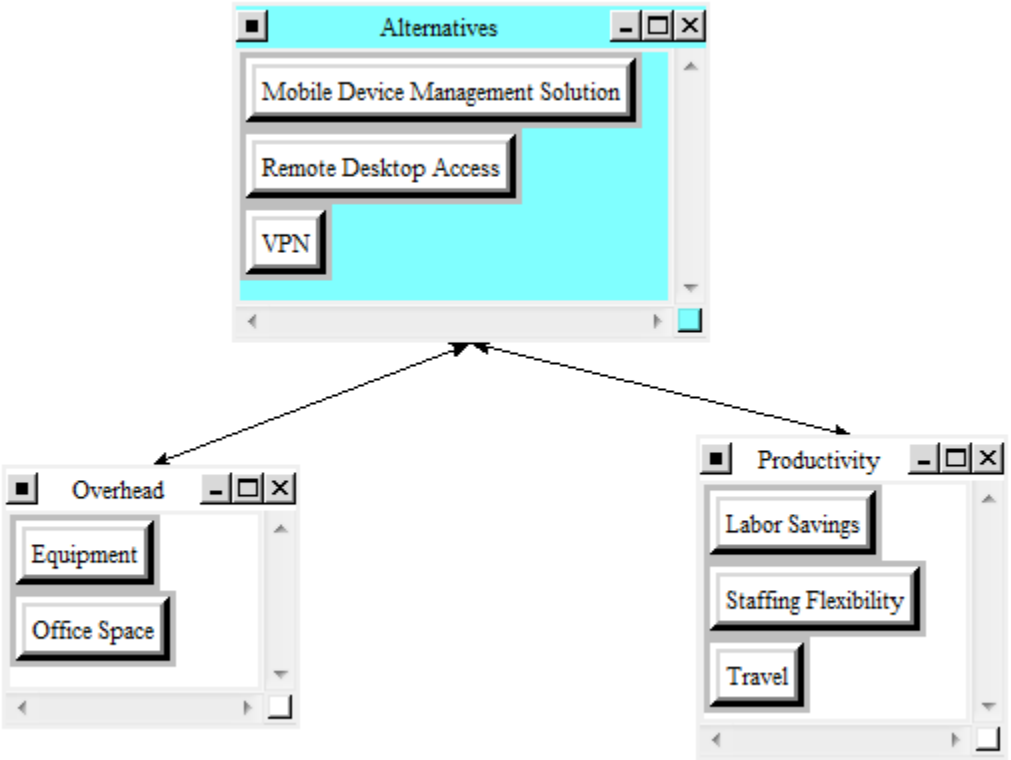
BOCR

Benefits

The benefits model has three control criteria, Financial, Operational, and Technological. The Financial benefits include Overhead and Productivity benefits. The Operational benefits include Communication and Information Connectivity benefits. The Technological benefits include a Maturity cluster of Benefits.



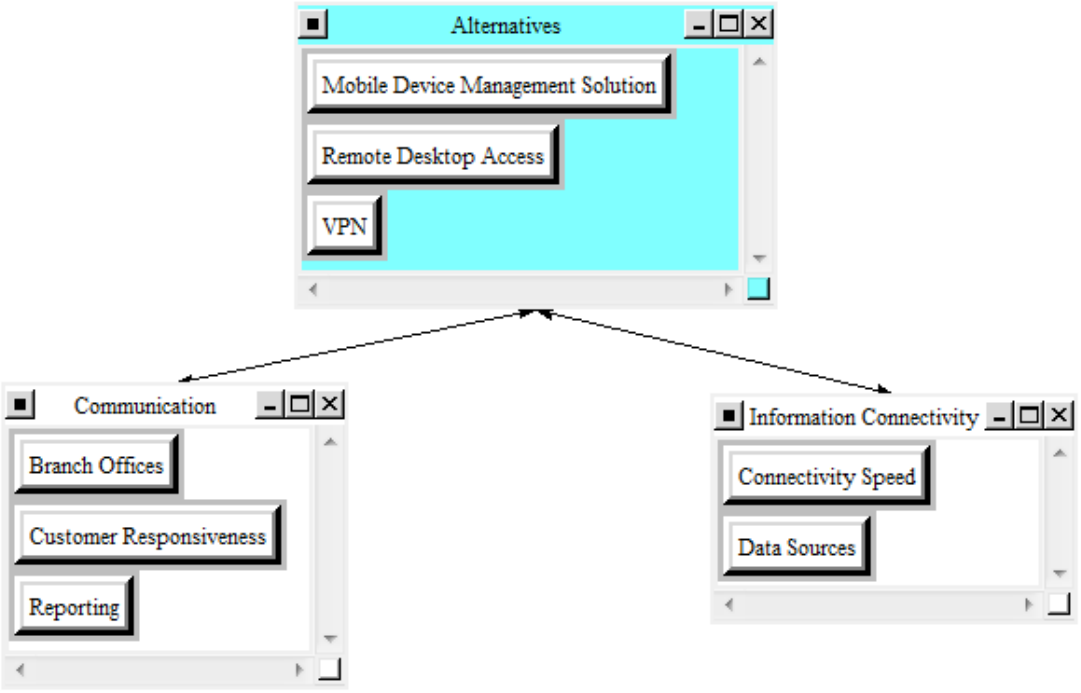
Financial Subnet View



Financial Subnet Summary

The financial benefits were split between Overhead and Productivity. Within the Overhead cluster, Office Space was ranked significantly much more important than Equipment benefits. Under productivity benefits, the importance was more evenly distributed, with Staffing Flexibility being the highest ranked node. Within this subnet, a Mobile Device Management Solution was ranked the highest with a 0.45 normalized priority value.

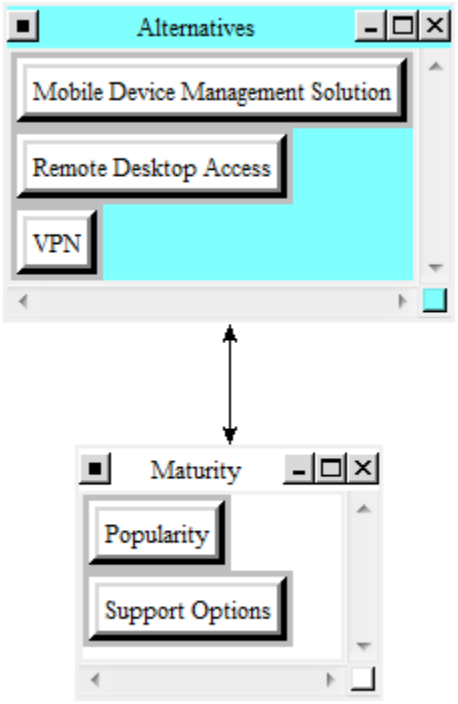
Operational Subnet View



Operational Subnet Summary

The Operational benefits were split between Communication and Information Connectivity. Under Communication benefits, Customer Responsiveness was ranked higher in importance than both the Branch Offices and Reporting nodes. Within the Information Connectivity cluster, Connectivity Speed was only ranked slightly higher than Data Sources. Overall, a Mobile Device Management Solution was ranked the highest, with a 0.49 normalized priority value.

Technological Subnet View



Technological Subnet Summary

The Technological benefits were linked directly to Maturity benefits. Within the Maturity cluster, Support Options was ranked significantly more important than Popularity. Within the technological subnet, a Remote Desktop Access Solution was ranked the highest with a 0.38 normalized priority value.

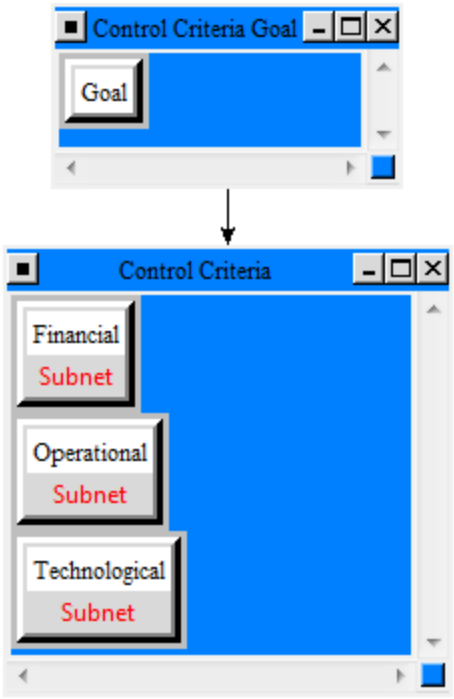
Synthesis of Benefits

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 1.Benefits

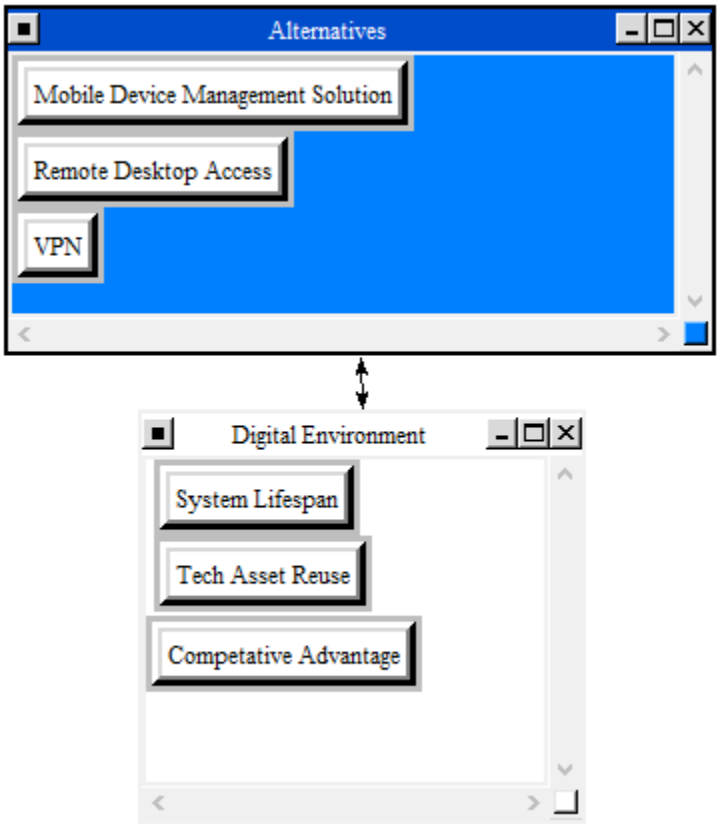
Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		1.000000	0.374826	0.936985
Remote Desktop Access		0.870109	0.326140	0.815279
VPN		0.797794	0.299034	0.747521

Opportunities

The opportunities model has three control criteria, Financial, Operational, and Technological.



Financial Subnet View

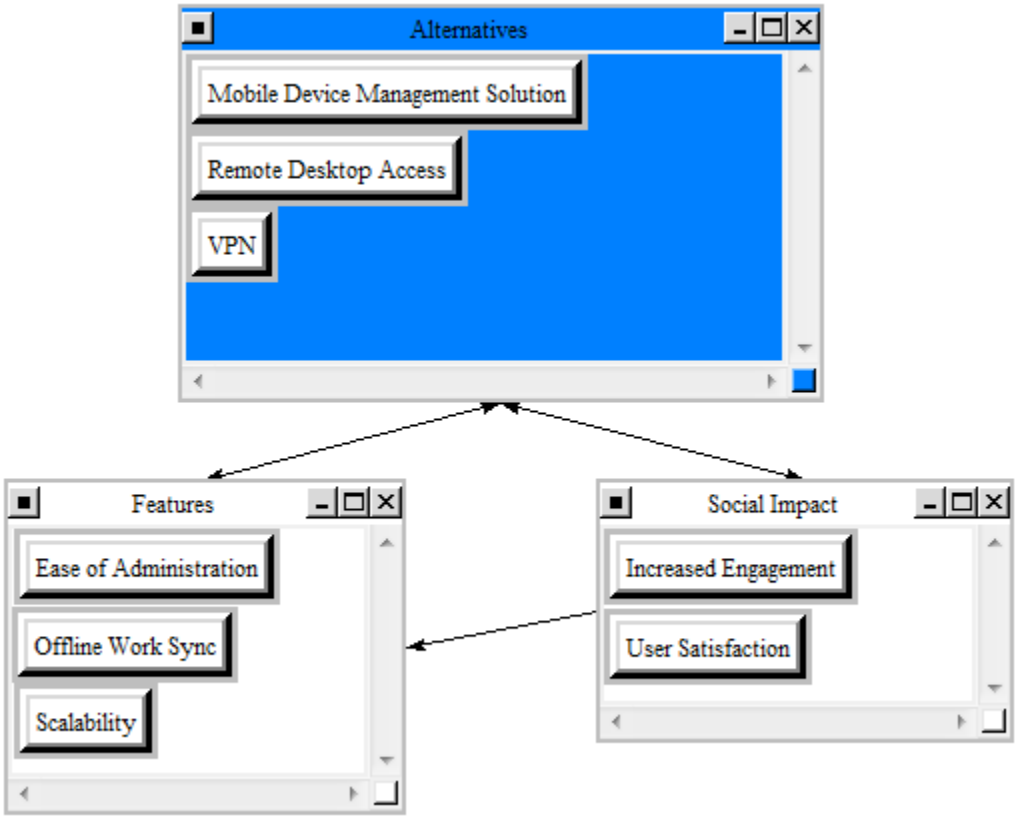


Financial Subnet Summary

Financial opportunities comprise of potential gains and savings as a result of implementing the remote access solution. These gains and saving come from two main areas: building a long-lasting system and using technological assets that can be reused and leveraged for other projects, applications, or systems. The last aspect is the alternative's potential to create competitive advantage, allowing employees to be more effective and increase the company's market share. Overall, system lifespan yielded to be the most important of these elements.

As the MDM solution is the most forward-thinking option, this is considered to be the solution that would be the most relevant in the future and prove to have the longest lifespan, equating to the greatest financial opportunity with a 0.44 normalized priority value. VPN is next, and RDA has the least opportunity.

Operational Subnet View



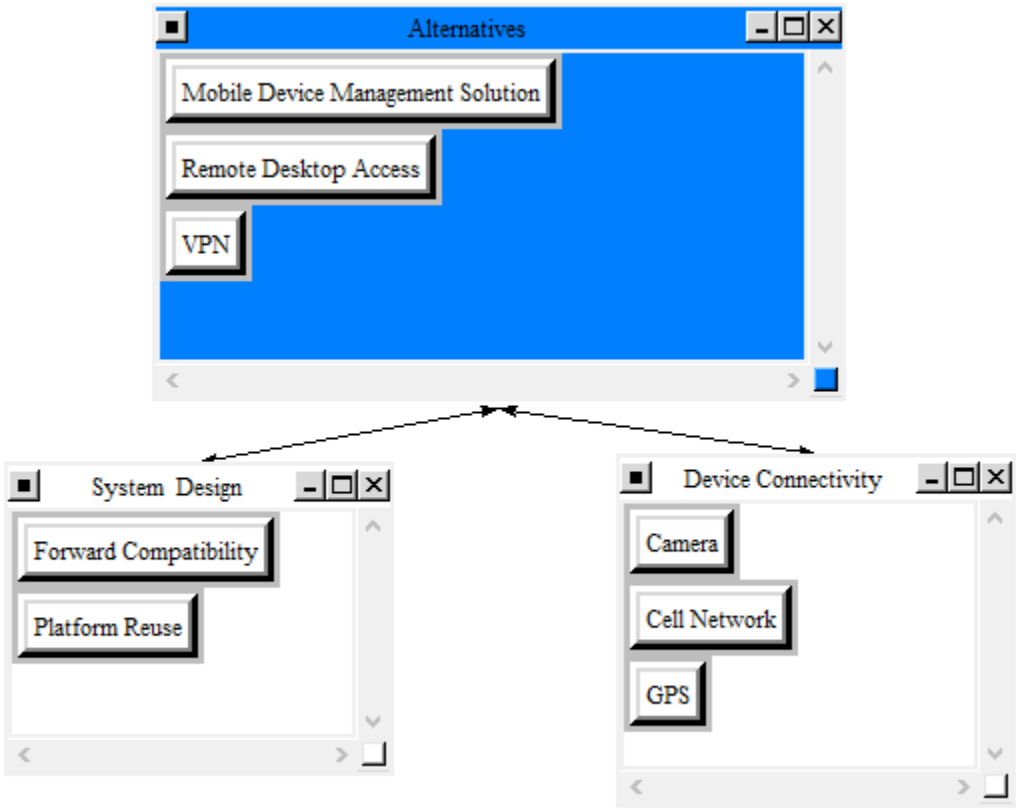
Operational Subnet Summary

Operational opportunities exist in two main areas, the first, features, being an aspect of the solution itself, and the other, social impact, relates to how the solution affects employee behavior and moral. Features of the system can potentially allow easier administration and simple options to scale up the system as the number of business users grow if necessary. Also, features may allow employees to work offline depending on the specific design of the solution, potentially increasing productivity if so. Socially, a well performing remote access system has the potential to increase engagement by providing increased

accessibility and greater user satisfaction. Satisfaction is contingent on the quality of the system, which is influenced by the ease of administration attribute.

In this case, the feature criteria are more concrete and plausible, and so are more heavily weighted. Of the features, ease of administration and scalability were most important. These are both strength of a VPN solution, which landed the highest normalized priority value of 0.49. RDA was next, and MDM proved to have the least operational opportunity.

Technological Subnet View



Technological Subnet Summary

Technology-based opportunities relate to exciting capabilities that each solution may have to connect to other devices and extend functionality in the future. The device connectivity criteria compares each alternative's capability for connectivity to a camera, cell network, or GPS module for tandem use in an application, whereas the system design criteria rates the likelihood that the system will be able to interface with new technologies released in the future.

Smart devices, the end point of the MDM solution, is the most modern and capable client device available within the alternatives, giving it immediate advantage and the highest priority in these criteria of 0.51. The VPN solution only affects networking, not hardware or software compatibility, meaning it is not advantageous or disadvantageous in regard to these criteria. Finally, due to connectivity requirements that abstract the user's workstation from the client device, RDA does not handle device connectivity well, nor

does the monolithic design encourage forward compatibility. These limitations give it the least technological opportunities.

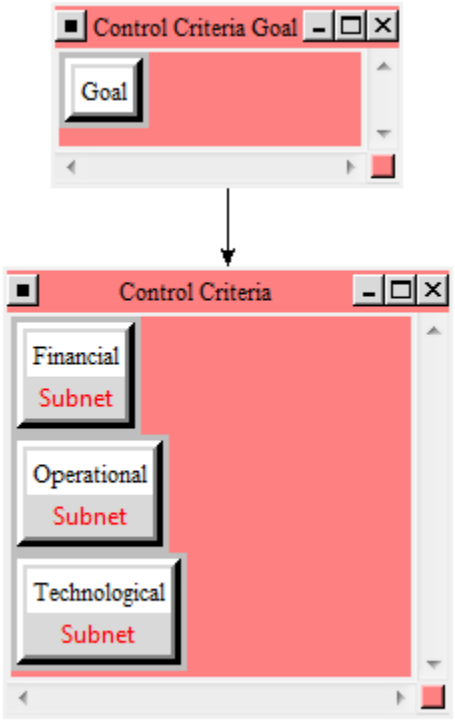
Synthesis of Opportunities

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 2.Opportunities

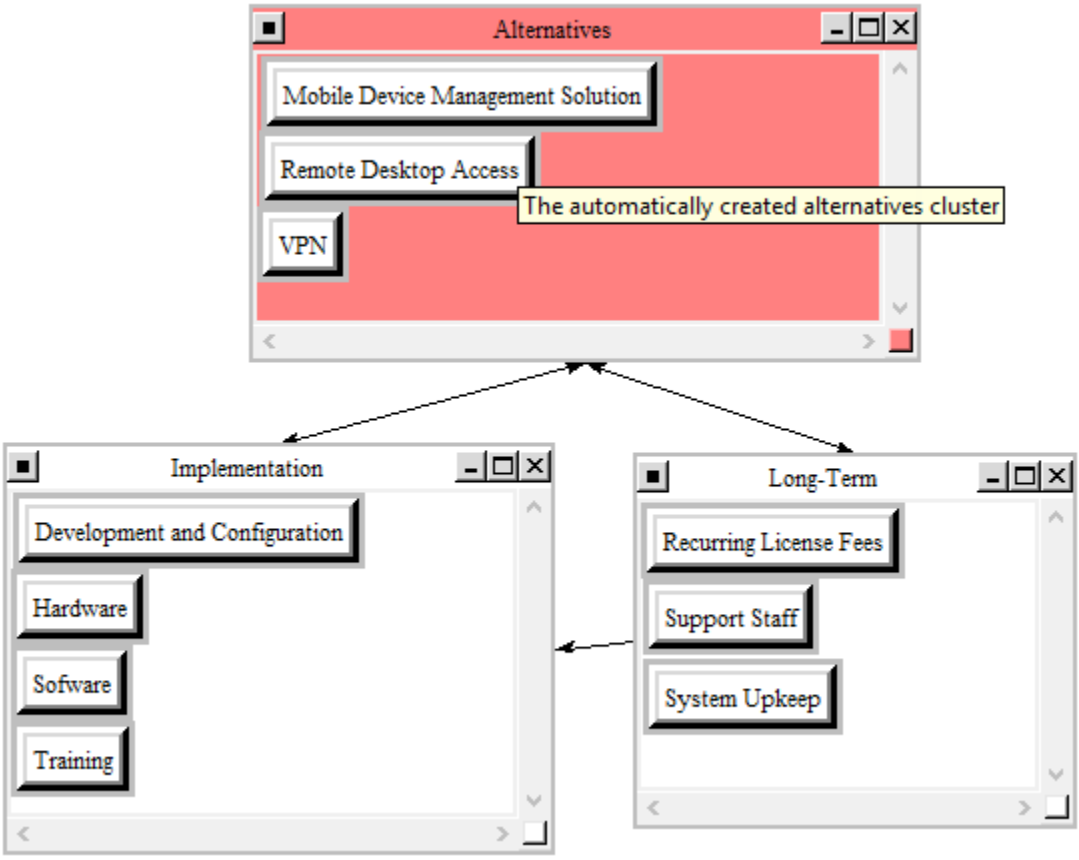
Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		0.937222	0.368696	0.788854
Remote Desktop Access		0.604770	0.237912	0.509031
VPN		1.000000	0.393392	0.841694

Costs

The costs model has three control criteria, Financial, Operational, and Technological.



Financial Subnet View

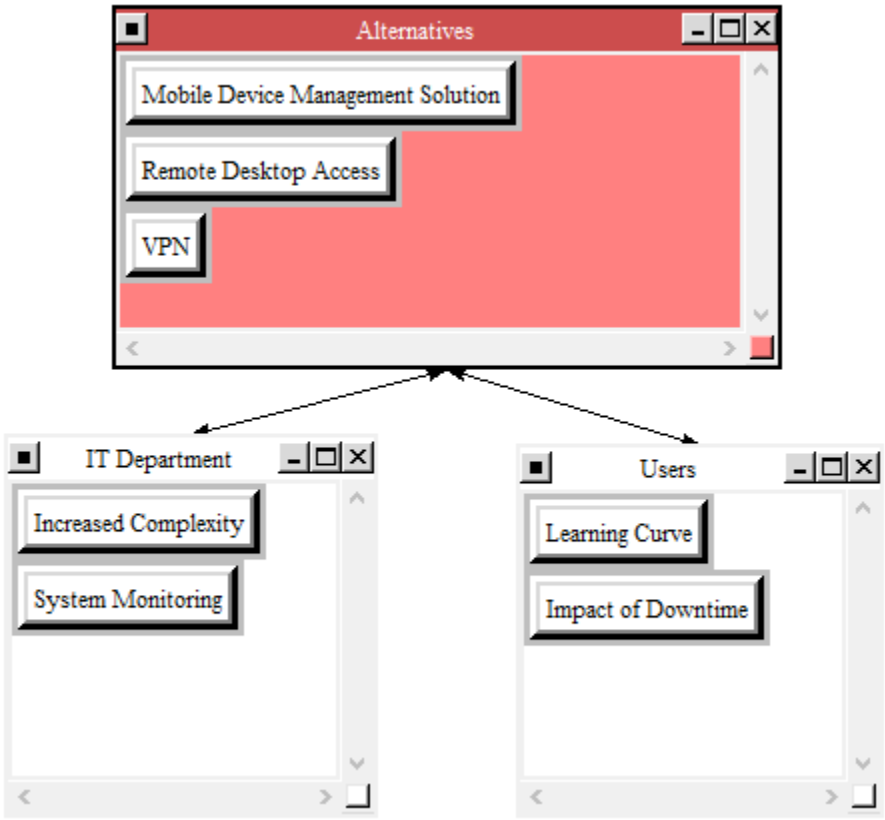


Financial Subnet Summary

Financial costs are broken into two groups: implementation costs (initial setup and configuration) and long-term costs (maintenance and support). In both cases, these costs can include expenses for physical hardware, logical hardware, and labor, both directly and indirectly related to the system. Since long-term costs could take place over 10 or more years, opposed to the one-time costs of implementation, long term criteria get more weight. Also, the long-term system upkeep attribute is linked to the implementation criteria: the more elements are added during installation, the more must be maintained during the system lifespan.

Comparisons showed that the MDM solution had the highest cost in this heavy category, setting it as the most financially costly alternative with a priority value of 0.48. RDA is the next most costly, and VPN the least. The consideration of BYOB - Bring Your Own Device (Steele, 2016), where employees use their own smart devices for connection - did not have a significant effect on financial costs.

Operational Subnet View

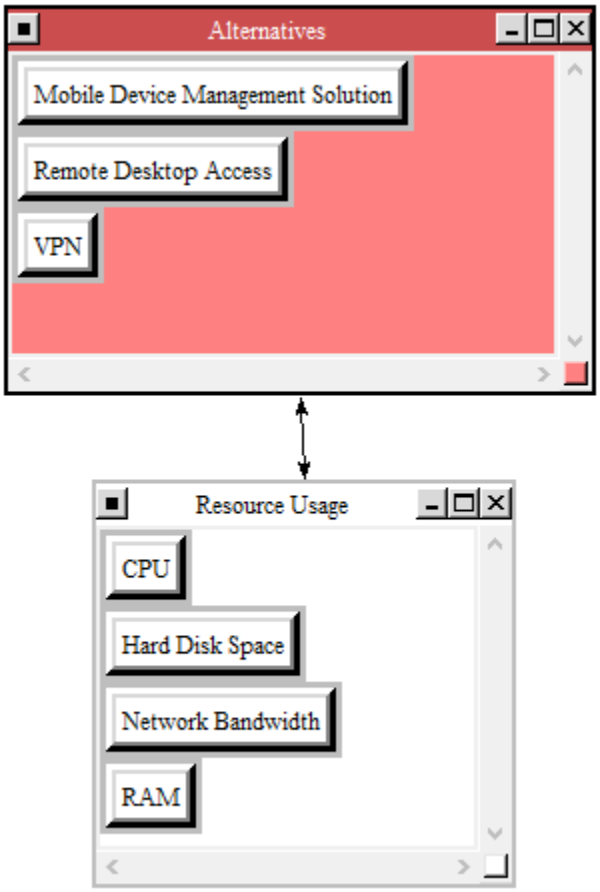


Operational Subnet Summary

Operational costs are divided into 2 criteria groups representing two internal sides of the system: the users, and the IT administrators. From the user perspective, the new system will impose a learning curve and associated drop in productivity and increase in error, the magnitude of which will be unique to each alternative. It is inevitable that users will also experience downtime at some point in the system lifetime. The technical differences in each system yield varied behaviors during downtime, and thus produce different cost operational costs during downtime. The IT department's operational costs are derived from the requirement of maintaining and monitoring a more complex and multifrontal environment.

Remote Desktop Access requires network access to complete any work, has the steepest learning curve, and requires IT to maintain user local and remote environments independently. The aspects give RDA the largest operational cost by far, having a priority value of 0.63. MDM is the second most costly, and VPN the least.

Technological Subnet View



Technological Subnet Summary

Technological costs can be measured in gigabytes, processing cycles, and megabits per second. The resource usage criteria gauges how much of a toll each alternative solution takes on new and existing IT infrastructure. The most important criteria of the cluster is network bandwidth, as this resource affects all other network communication, including local, remote, and even automated network transactions between headless servers.

Opposed to MDM and RDA, which inherently route only necessary network requests through the business network, VPN routes all user activity, having the largest impact on this resource. For this reason, it exhibits the highest technological cost and a priority value of 0.61, followed by MDM and RDA.

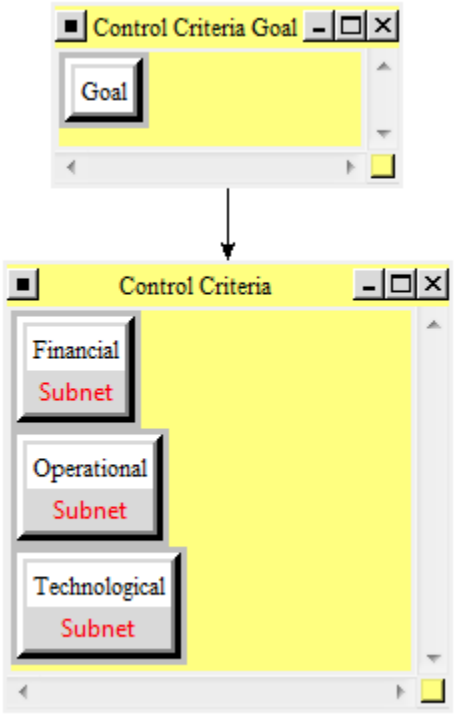
Synthesis of Costs

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 3.Costs

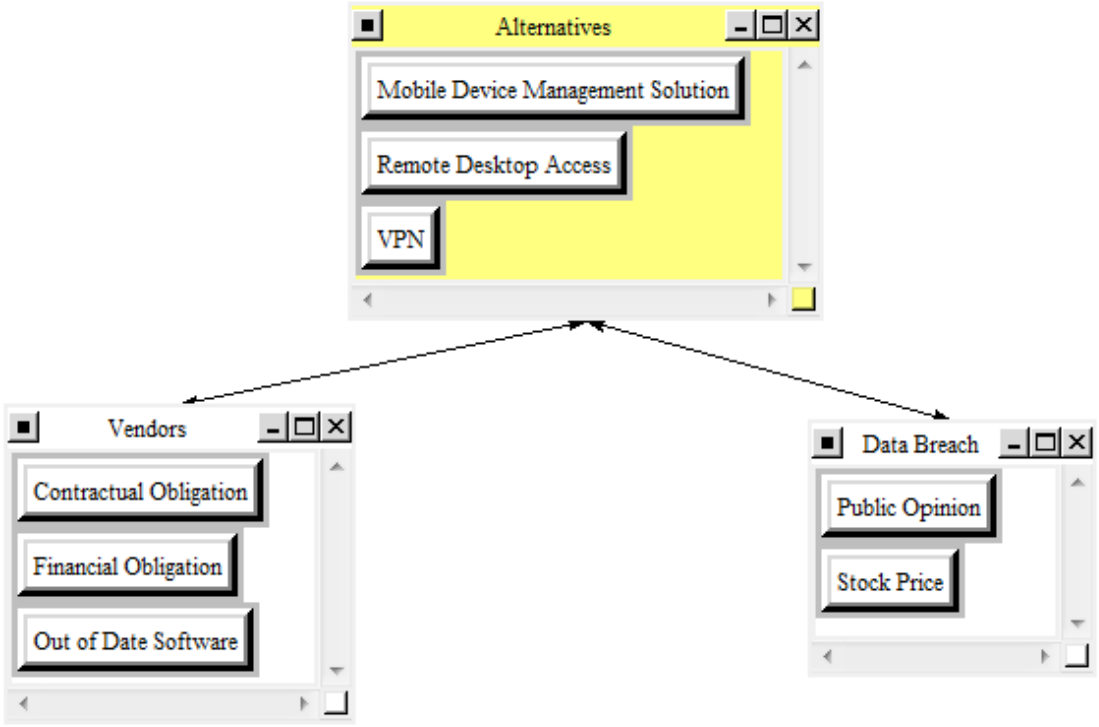
Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		0.775726	0.303805	0.529513
Remote Desktop Access		0.777642	0.304555	0.530820
VPN		1.000000	0.391640	0.682603

Risks

The risks model has three control criteria, Financial, Operational, and Technological. Financial risks include Vendor and Data Breach risks. Operational risks include a Company Culture cluster of risks. Technological risks include Server Impact and Security risks.



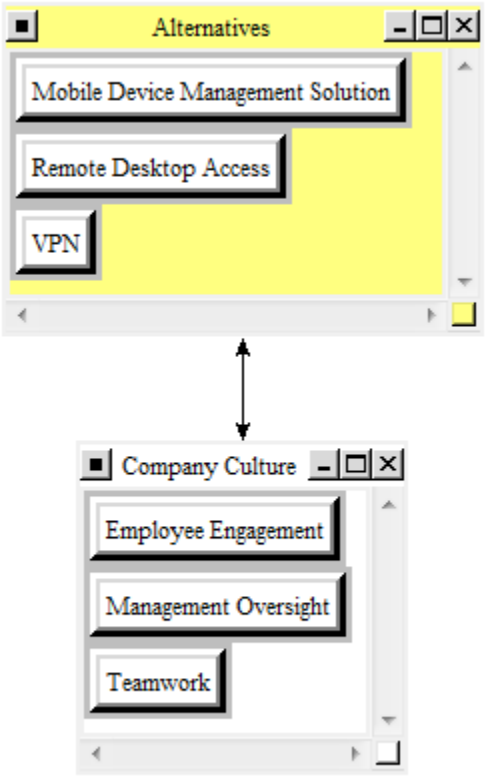
Financial Subnet View



Financial Subnet Summary

The Financial risks were split between Vendors and Data Breach. Under Vendor Risks, Out of Date Software was ranked significantly higher than both the Contractual Obligation and Financial Obligation nodes. Within the Data Breach cluster, Stock Price was ranked significantly much more important than Public Opinion risks. Overall, a Mobile Device Management Solution was ranked the riskiest alternative with a 0.55 normalized priority value.

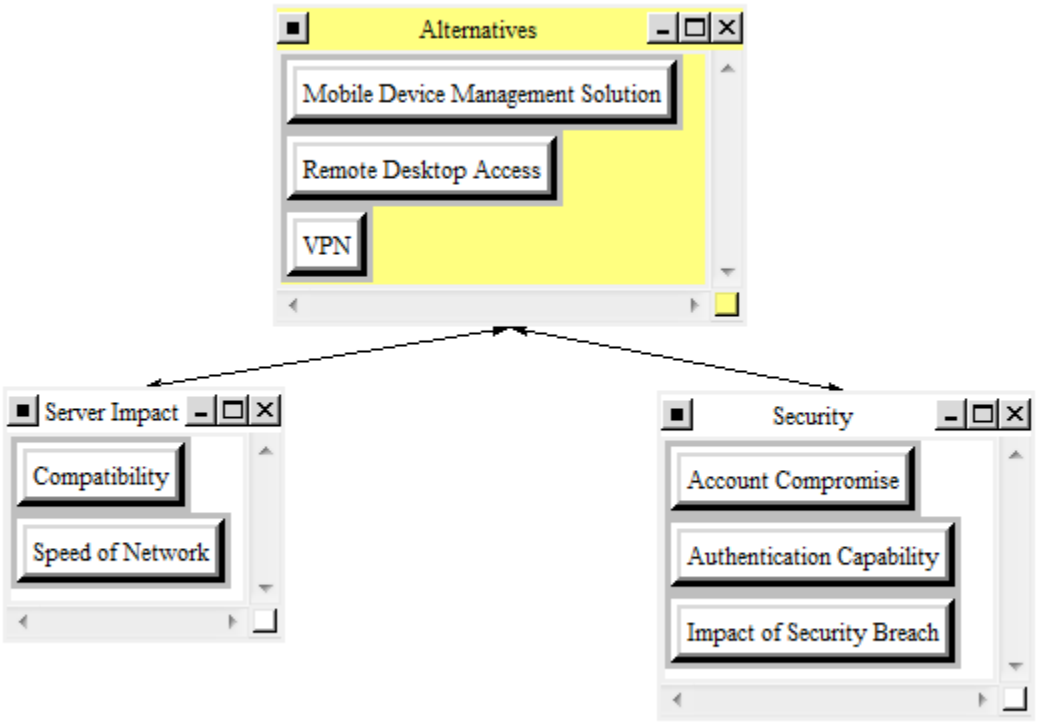
Operational Subnet View



Operational Subnet Summary

The Operational risks were linked directly to Company Culture risks. Within the Company Culture cluster, Management Oversight was ranked significantly riskier than both Employee Engagement and Teamwork. In the Operational subnet, a Mobile Device Management Solution was ranked the riskiest with a 0.46 normalized priority value.

Technological Subnet View



Technological Subnet Summary

The Technological risks were split between Server Impact and Security. Within the Server Impact cluster, Speed of Network was ranked significantly much more important than Compatibility risks. In the Security cluster, the Impact of a Security Breach was ranked riskier than both the Account Compromise and Authentication Capability nodes. Overall, VPN was ranked the riskiest alternative with a 0.47 normalized priority value.

Synthesis of Risks

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 4.Risks

Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		0.986460	0.342772	0.693229
Remote Desktop Access		0.891426	0.309750	0.626444
VPN		1.000000	0.347477	0.702744

Priorities

BOCR	Control Criteria	Clusters	Elements	Priorities
Benefits	Financial	Overhead	Equipment	0.272
			Office Space	0.728
		Productivity	Labor Savings	0.258
			Staffing Flexibility	0.441
			Travel	0.302
	Operational	Communication	Branch Offices	0.243
			Customer Responsiveness	0.554
			Reporting	0.203
		Information Connectivity	Connectivity Speed	0.537
			Data Sources	0.463
	Technological	Maturity	Popularity	0.358
			Support Options	0.642
Opportunities	Financial	Digital Environment	Competitive Advantage	0.227
			System Lifespan	0.374
			Tech Asset Reuse	0.399
	Operational	Features	Ease of Administration	0.578
			Offline Work Sync	0.124
			Scalability	0.298
		Social Impact	Increased Engagement	0.731
			User Satisfaction	0.269
	Technological	Device Connectivity	Camera	0.094
			Cell Network	0.644
			GPS	0.262
		System Design	Forward Compatibility	0.200
			Platform Reuse	0.800
Costs	Financial	Implementation	Development and Configuration	0.227
			Hardware	0.357
			Sofware	0.346
			Training	0.071
		Long-Term	Recurring License Fees	0.161
			Support Staff	0.436
			System Upkeep	0.403
	Operational	IT Department	Increased Complexity	0.639
			System Monitoring	0.361
		Users	Impact of Downtime	0.700
			Learning Curve	0.300
	Technological	Resource Usage	CPU	0.094
			Hard Disk Space	0.103
			Network Bandwidth	0.672
			RAM	0.131
Risks	Financial	Data Breach	Public Opinion	0.296
			Stock Price	0.704
		Vendors	Contractual Obligation	0.208
			Financial Obligation	0.169
			Out of Date Software	0.623
	Operational	Company Culture	Employee Engagement	0.180
			Management Oversight	0.524
			Teamwork	0.296
	Technological	Security	Account Compromise	0.317
			Authentication Capability	0.133
			Impact of Security Breach	0.550
		Server Impact	Compatibility	0.254
			Speed of Network	0.746

Strategic Criteria

Return on Investment

IT solutions are long-term investments. Regardless of the marketed greatness of a system, its resultant efficiencies and real benefits specific to a business must validate its upfront and recurring costs over the system lifespan. This strategic criteria is included to ensure that these remote access solutions are rated with profitability as a primary concern.

Employee Productivity

When considering a remote access solution, it is important to weigh in productivity impacts among alternatives. Being able to work remotely can see huge gains in productivity by having up to date information at any time. Work can now be done from various locations and well-informed decisions can be made with faster response.

Employee Work-Life Balance

One factor to consider when evaluating remote access alternatives is the employee work-life balance. Allowing employees to work remotely can result in positive opinions of the certain company. Certain situations may arise in an employee's life where working remotely may be necessary. Having the option to do so can only enhance the opinion of the company.

Innovation

When making any technology-based decisions, IT professionals usually must make a choice between those that are well-established and reliable versus the new and experimental, but innovative option. When integrating a new business system, it can be beneficial to commit to newer technologies. While this choice usually offers increased capability at the cost of reliability, it also allows the business's IT department to gain experience in emerging trends and encourages users to think of ways the business can benefit from new technologies, poising the company for the future. For these reasons, innovation is taken into account when making decisions.

Ratings Model

Super Decisions Ratings

	Priorities	Totals	Employee Productiv 0.298506	Innovation 0.068699	ROI 0.524930	Work/Life Balance 0.107865
1.Benefits	0.335000	0.557831	Hi	Hi	Med	Lo
2.Opportunities	0.239519	0.398839	Med	Lo	Med	Hi
3.Costs	0.059115	0.098437	Lo	Med	Lo	Lo
4.Risks	0.366365	0.610059	Lo	Med	Hi	Med

Results

Additive Negative

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Super Decisions Main Window: Vukich_Cybak_RemoteAccess_Model.sdmod: formulaic: ratings

Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		1.000000	0.537500	0.217558
Remote Desktop Access		0.316365	0.170046	0.068828
VPN		0.544102	0.292454	0.118374

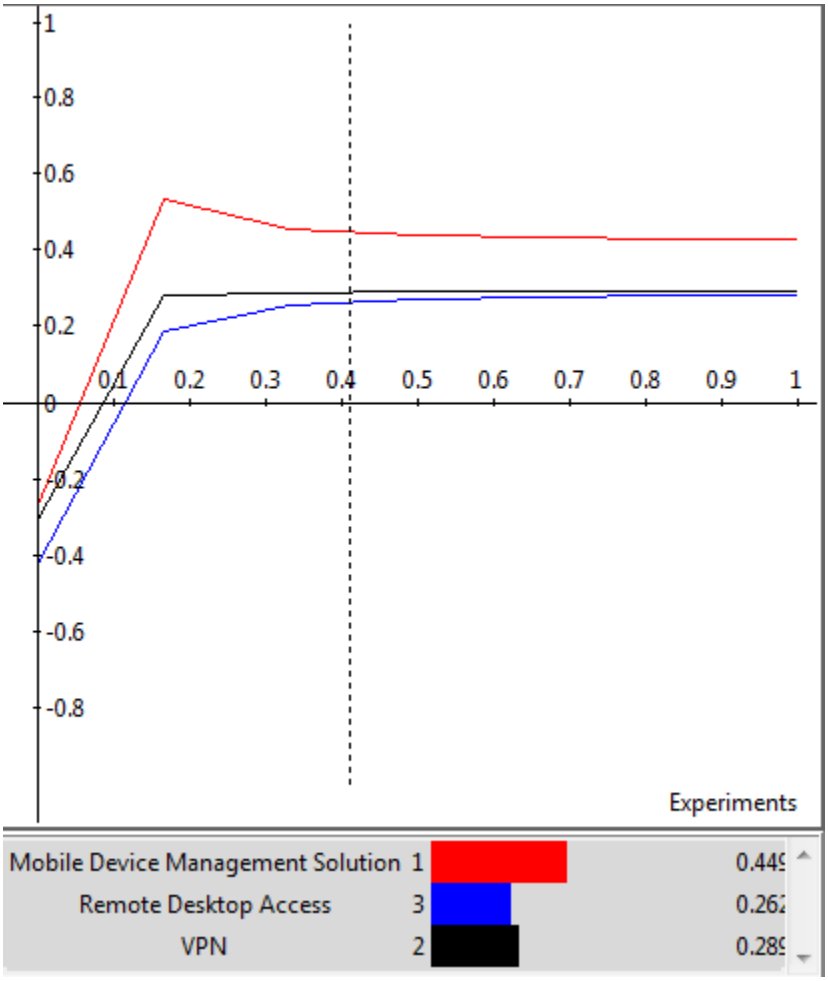
Multiplicative

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Super Decisions Main Window: Vukich_Cybak_RemoteAccess_Model.sdmod: formulaic: ratings

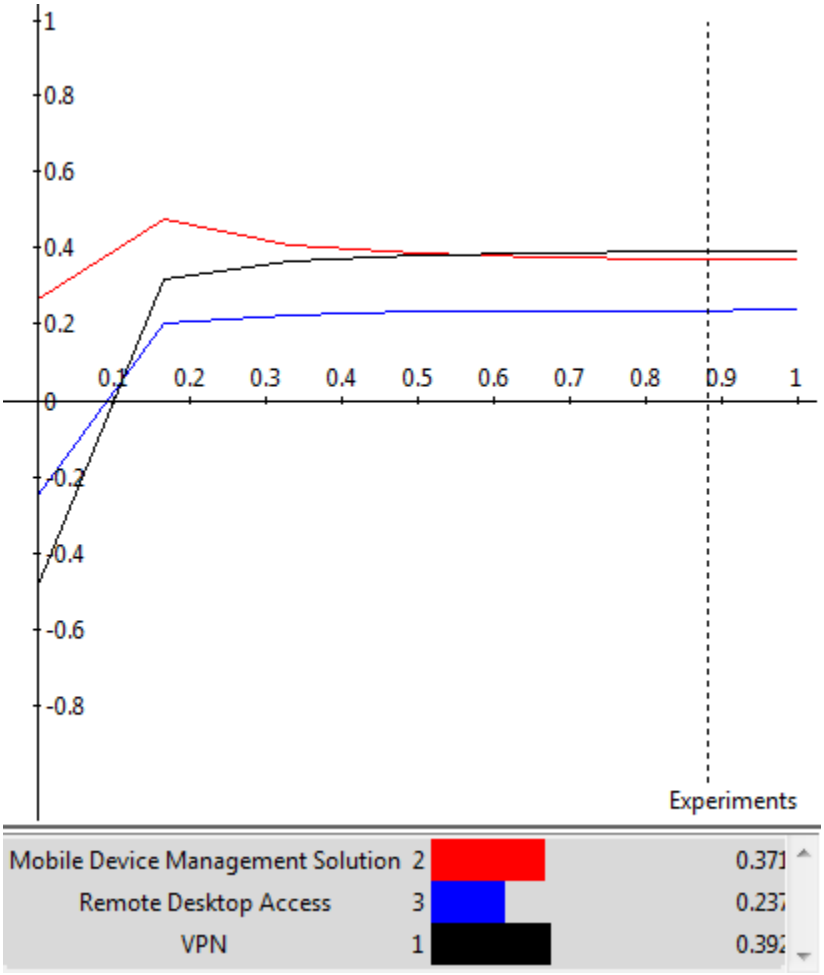
Name	Graphic	Ideals	Normals	Raw
Mobile Device Management Solution		1.000000	0.492680	2.013615
Remote Desktop Access		0.471544	0.232320	0.949508
VPN		0.558172	0.275000	1.123944

Sensitivity Analysis

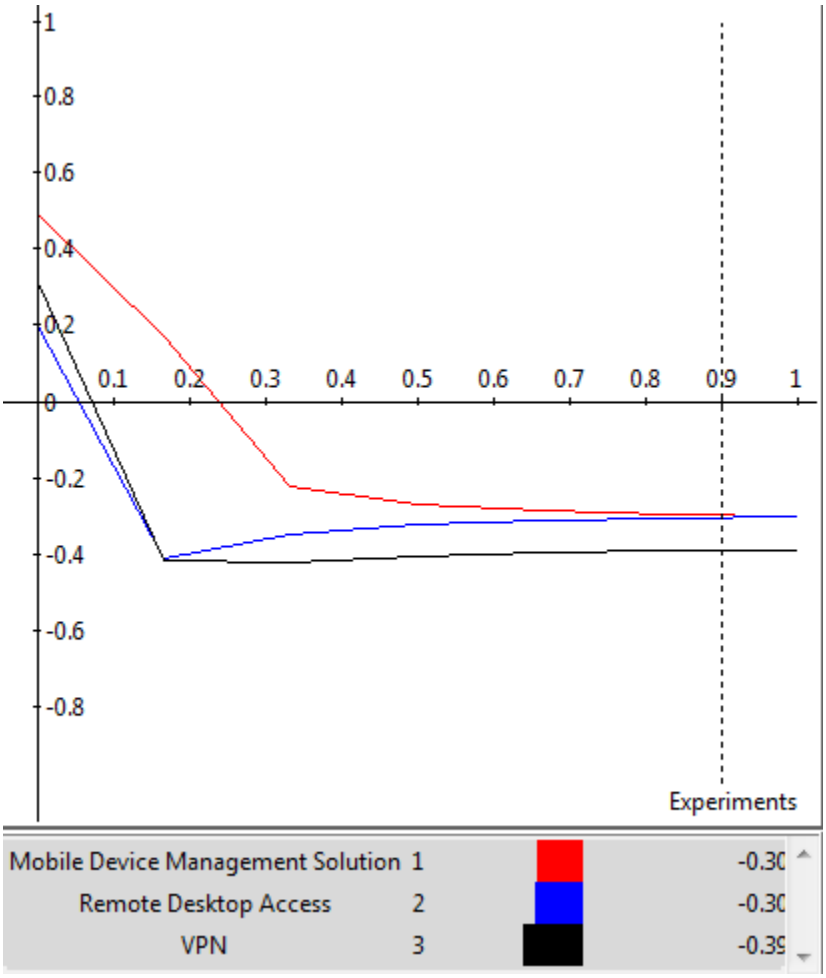
Benefits



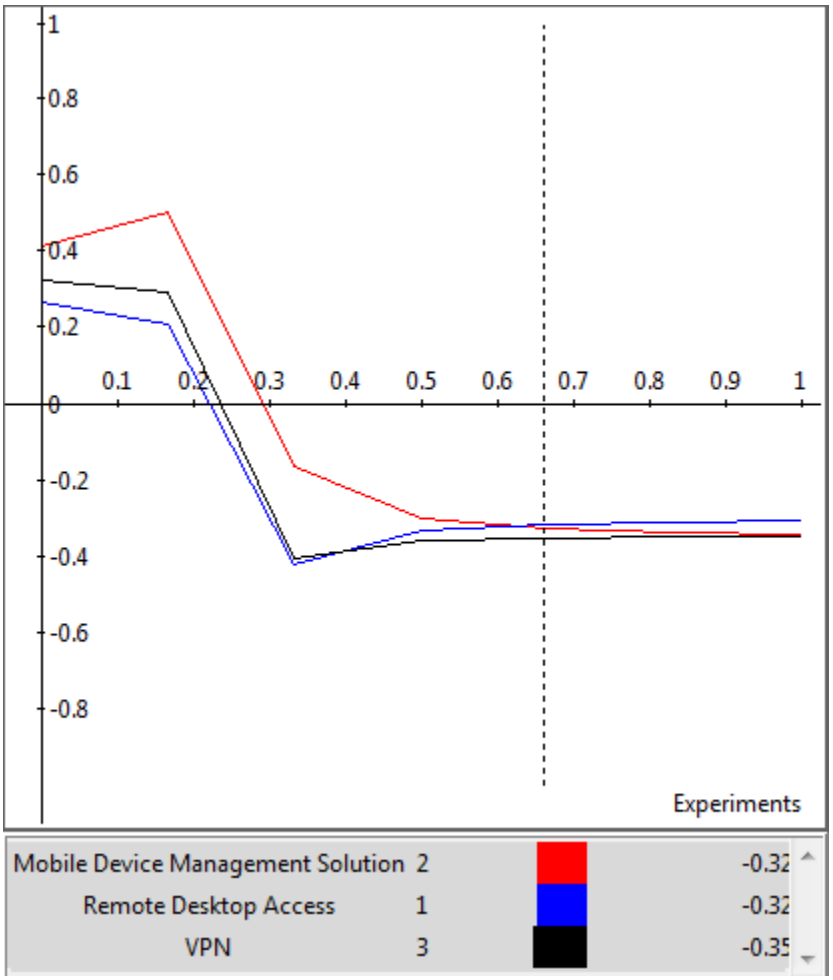
Opportunities



Costs


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Experiments
Mobile Device Management Solution 1 -0.30
Remote Desktop Access 2 -0.30
VPN 3 -0.39

Risks



Conclusion

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Super Decisions Main Window: Vukich_Cybak_RemoteAccess_Model.sdmod: formulaic: ratings

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Mobile Device Management Solution		1.000000	0.537500	0.217558
Remote Desktop Access		0.316365	0.170046	0.068828
VPN		0.544102	0.292454	0.118374

The final results of our model indicate that the best solution would be to implement a Mobile Device Management Solution. While this alternative only ranked highest in the benefits control criteria subnetwork, it consistently ranked very high in all of them. This, coupled with the turbulent priority values the other two alternatives, gives the MDM solution the highest overall rating and, given the assumptions of the model, proves to be the best decision for a new remote access platform solution for a sales reporting application.

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