Legalization of Cannabis in the State of Pennsylvania

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Introduction

Ten states and Washington DC, have now legalized cannabis, or marijuana, for recreational use for adults over 21. Currently, 33 states have legalized medical cannabis. At the moment of this project, cannabis remains federally illegal, but the states have the authority to create policy and vote on legalizing cannabis for medical and/or recreational use. For the state of Pennsylvania, cannabis remains illegal for recreational use, but has been decriminalized in a few major cities. In April 2016 Governor of Pennsylvania Tom Wolf legalized medical cannabis and his administration has approved eight universities as certified medical marijuana academic clinical research centers. This subject of this project is to retroactively evaluate the State's decision for legalizing cannabis and to what degree would be preferred in the short-term and long-term.

The Word Health Organization (WHO) reports that "cannabis is by far the most widely cultivated, trafficked and abused illicit drug. About 147 million people, 2.5% of the world population, consume cannabis (annual prevalence) compared with 0.2% consuming cocaine and 0.2% consuming opiates." Acute health effects of cannabis include cognitive impairment as well as hindered motor control and divided attention. Long-term chronic health effects could include: impairment of cognitive functioning causing difficulty in organization and memory recall, development of cannabis dependence syndrome, and heart and lung injury or inflammation.

The US Drug Enforcement Agency (DEA) views marijuana as a Schedule I drug which are defined as drugs with no currently accepted medical use and a high potential for abuse. Other Schedule I drugs include heroin, LSD, Ecstasy, methaqualone, and peyote. In recent decades however, many studies have demonstrated therapeutic effects of cannabis and cannabis derivatives (cannabinoids) for nausea, stress-relief, chronic pain-relief, anti-depression, and control of convulsions and spasms. Physicians cannot legally "prescribe" medicinal cannabis therapy, given its Schedule I classification, but rather in accordance with state laws may certify or recommend patients for treatment. Medical cannabis expenses are not reimbursable through government medical assistance programs or private health insurers.

From a political perspective, it is thought that much of the recent interest in medicinal cannabis is an effect of opioid abuse epidemic. In 2017 the US Department of Health and Human Services (HHS) declared a public health emergency due to opioid abuse. They report that 11.4 million people misuse prescribed opioids and an estimated 130+ people die everyday from opioid-related overdoses. In 2016, opioid overdoses accounted for 42,000 deaths - more deaths that those from car accidents or breast cancer. Forty percent of these deaths involved prescription opioids. These statistics have caught the attention of policymakers and now many government administrations are now focused on driving down the number and strength of opioid prescriptions and to improve evidence-based pain care research.

A 2018 poll conducted by the Pew Research Center found that 62% of Americans, including 74% of millennials, said they supported legalizing cannabis. Outside of the

health-related uses for cannabis, the federal prohibition of cannabis has been costly from a judicial context. The Drug Policy Alliance has reported that in 2016 there were 587,700 cannabis arrests in the US, roughly 40% of all drug arrests. In addition, much of these arrests have shown some statistical racial bias. Of nearly 17,000 people arrested for the lowest level of cannabis possession by the NYPD in 2015, 85% were black or latino. While arrests for cannabis related offenses have decreased since, severe racial disparities remain.

The illicit market for cannabis is estimated to be worth over $40 billion or more in the US. This market is completely untaxed. Legal regulation of cannabis could provide some means of controlling the production levels, quality, and distribution of the cannabis market. It has also been proposed that regulating cannabis will help protect environment as the illegal cultivation has had negative impacts from water diversion, pollution, energy usage, and deterioration of public parks.

Methodology

In review of the possible options with cannabis, three alternatives were considered.

1. Legalization for Recreational Use and Medical Use
2. Legalization for Medical Use Only
3. No Legalization

Recreational Use

Some market research has indicated that the market size for recreational use of legal cannabis use was approximately $9.2 billion in 2017 and expected to grow to $47.3 billion over the next 10 years. Customers for recreational use of cannabis are drawn to the many varieties and characteristics such as size, smell, taste, texture, and potency.

In this scenario, it is important to consider all aspects of recreational use. These can include the implications of production capacity and technology, approved licensing for growing and distribution, supply quotas and taxes, etc. From a production perspective, an increase in the capacity of marijuana farming can lead to land and water resource allocation issues, in addition to an increase in electricity usage. That said, many large-scale operations are developing methods of smarter techniques that include vertical farming, hydroponics, LED lighting, and sensor monitoring. Historically, no limitations or requirements were in place which forced illegal growers into unsafe practices, including unlawful land use. Securing the proper licensing for production and distribution, will help monitor safe and controllable requirements for cannabis production. Because of this markets underground nature, there are many cases where other Schedule I drugs are mixed in with standard cannabis increasing the potential hazards and risks, which help lead to overdoses.

Other considerations, similar to the alcoholic beverage market, include responsible use and acceptable legal limits. Like legal drinking limits, there is a need to educate the market on safe practices. Settings consumers limits and labeling products with necessary information can help. Laws will also create penalties for offenders that violate these restrictions.

Medical Use

Legalization for medical cannabis use has been approved for the State of Pennsylvania and is in the process of being implemented. According to Marijuana Policy Project (MPP), the first dispensary opened in February 2018, with 50 dispensaries opening a year later. MPP believes Pennsylvania to be one of the largest cannabis markets in the country. In order to qualify for medical use, a patient must meet all of the following requirements:

- Must have a qualified medical condition
- Need to be under the ongoing care of a certifying physician
- Must have a processed application and an ID card for use

Limits were placed on the forms of the drug that could be utilized as part of the program. Additionally, implications of the use under the federal government, along with private health insurers would need to be considered. As the federal government still considers cannabis as a Schedule 1 drug, health insurers are not required to reimburse for any costs involved with the use of medical cannabis. An ID does provide protections against legal ramifications and discrimination with respect to the use of medical cannabis, but it does not however permit on-site use at the workplace.

Additionally, growers, processors and dispensaries will need to be licensed, regulated and validated for issuance of medical cannabis. This will impact the distribution and sale of medical cannabis. This may be utilized as a form of income for the state as taxes on the supply of medical cannabis.

No Legalization

This scenario would revert the 2016 decision for the approval of medical cannabis use. In this scenario, all use of cannabis would be considered illegal and not approved in the state of Pennsylvania. This would fall in line with the federal government regulations of cannabis as a Schedule 1 drug. As a result, the historical illegal status quo of cannabis production, distribution, and law enforcement will remain.

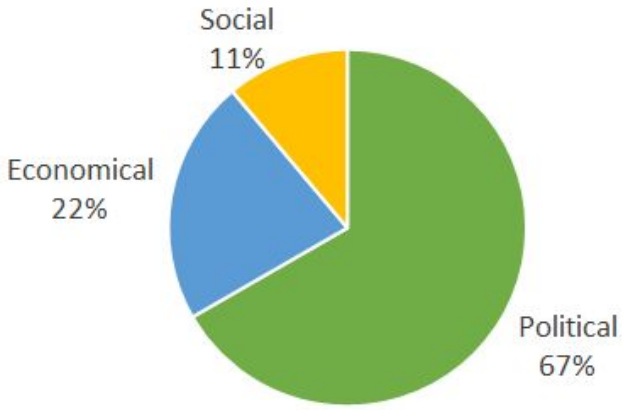
Modeling

Utilizing a Benefits, Opportunities, Costs and Risks (BOCR) model, we develop a model where a preferred solution could be identified. The decision model was constructed with the

goal node segregated into three key strategic criteria and each of the strategic criteria were broken down into subnets. The network is outlined in the table below.

Alternatives		
Recreational and Medical		
Medical Only		
No Legalization		
Strategic Criteria		
Public Opinion	Industry Growth	Political Outcomes
Health and Well-being	Job Stimulation	Tax Revenue
Opioid Epidemic	Technological/Medical Development	Drug Regulation
Illegal Drug Market	Ecological Impact	Re-election/Party Influence

All of the strategic subnets were pairwise compared with respect to one another. The perspective used was that of the lawmakers of the state. The results of the pairwise comparisons are shown below. The primary consideration are the political outcomes and how the individual politicians can keep their jobs, followed by the social impacts and finally rounded out by the industry benefits of the decision.



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BOCR

The BOCR model had three consistent control criteria which were Economic, Political and Social. The table below reviews the considerations for each of the categories for their potential impacts by breaking down the control criteria into subnets.

Benefits	**Opportunities**	**Costs**	**Risks**
Economic	Economic	Economic	Economic
Increase state economy	Encourage University Research	Development of regulations	Economic crashes
Stimulate new industries	Encourage Medical Research	Development of enforcement	Federal legalization
Job growth	Development of smarter manufacturing	Public funding required	
	Improve ecological impact		
Political	Political	Political	Political
Increase tax revenue	Funding for new programs	Drug regulation	Partisan acceptance
Drug regulation	Influence federal regulations	Drug enforcement	Re-election
Drug enforcement	Influence other state regulations	Re-election	Party Influence
Re-election	Drug regulation	Party Influence	
Party Influence	Drug enforcement		
Social	Social	Social	Social
Safe usage	Deter opioid addiction	Protests	Improper usage
Regulated Usage	Lower drug-related criminal activity	Enforcement	Negative health effects
Lower drug-related criminal activity	Safe usage	Morality	No change in illicit drug activity
Deliver on public demand	Regulated Usage		
	Improve quality of life		

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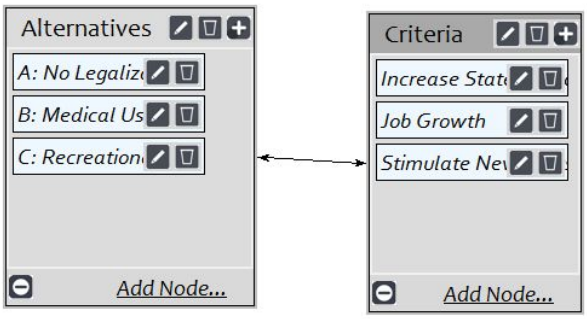
After creating the the control criteria and the relevant subnets, each category was pairwise compared from the perspective of the Pennsylvania State Government. The category models and the synthesized results of each of the bottom level models is broken out below.

Benefits

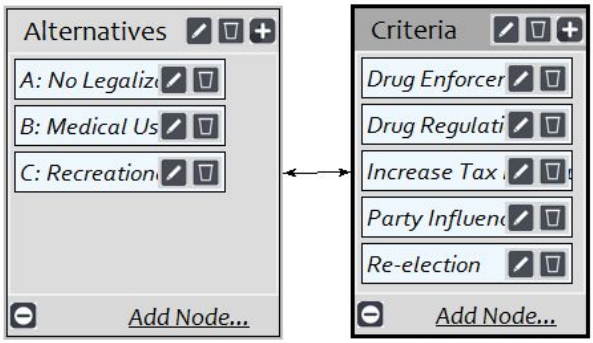
Economic



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 1.Benefits -> 3. Economical

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.255181	0.124604	0.062302
B: Medical Use		1.000000	0.488297	0.244149
C: Recreational Use		0.792752	0.387099	0.193549

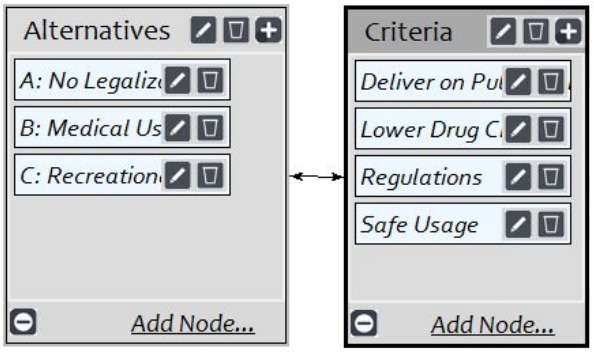
Political



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 1.Benefits -> 1. Political: ratings

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.686128	0.336024	0.168012
B: Medical Use		1.000000	0.489740	0.244870
C: Recreational Use		0.355771	0.174235	0.087118

Social



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 1.Benefits -> 2. Social

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.561587	0.277423	0.138711
B: Medical Use		1.000000	0.493997	0.246999
C: Recreational Use		0.462715	0.228580	0.114290

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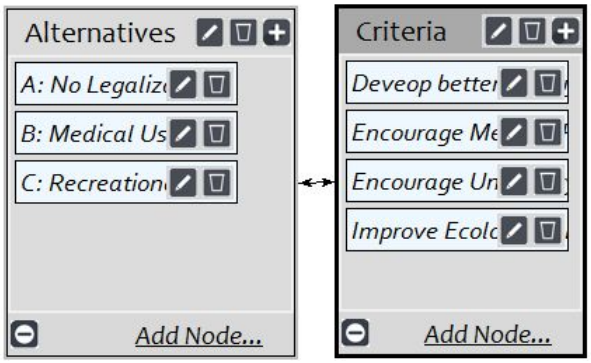
Opportunities

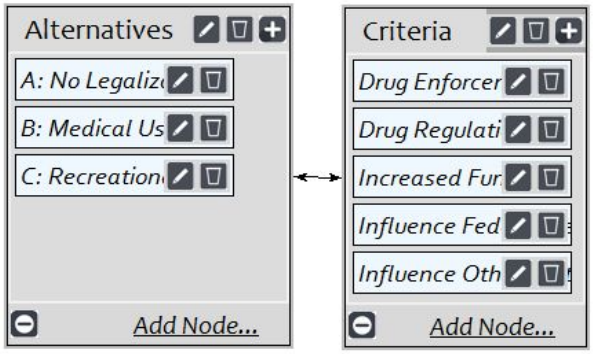
Economic



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 2.Opportunities -> 3. Economical

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.353776	0.200112	0.100056
B: Medical Use		1.000000	0.565645	0.282822
C: Recreational Use		0.414117	0.234243	0.117122

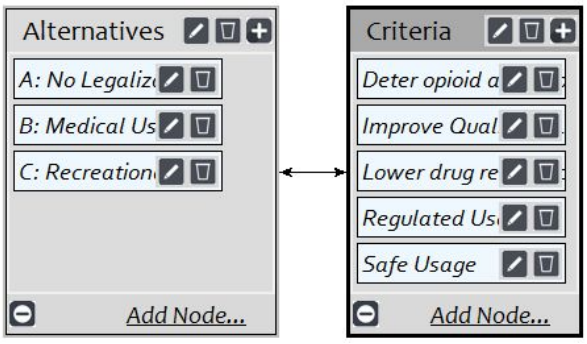
Political



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 2.Opportunities -> 1. Political

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.500279	0.205397	0.102699
B: Medical Use		0.935390	0.384038	0.192019
C: Recreational Use		1.000000	0.410565	0.205282

Social



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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.438720	0.182331	0.091166
B: Medical Use		0.967448	0.402070	0.201035
C: Recreational Use		1.000000	0.415599	0.207799

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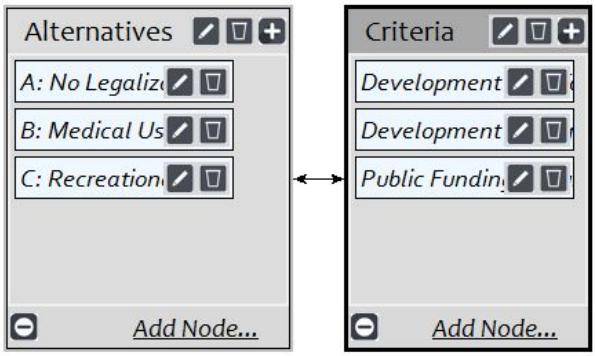
Cost

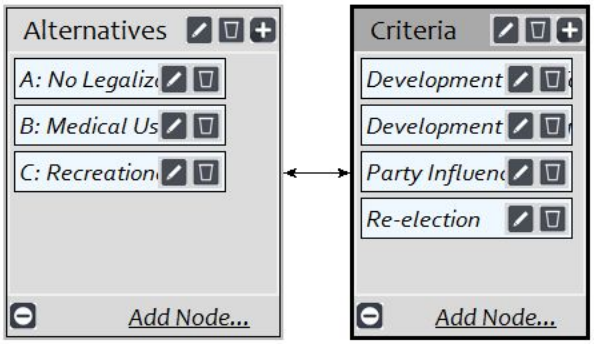
Economic



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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.188207	0.109452	0.054726
B: Medical Use		1.000000	0.581552	0.290776
C: Recreational Use		0.531330	0.308996	0.154498

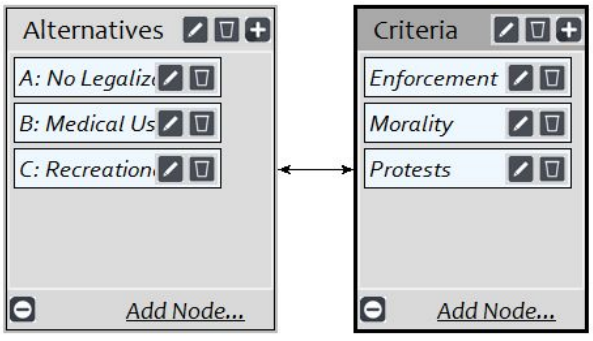
Political



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 3.Costs -> 1. Political: formulaic

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.149602	0.101208	0.050604
B: Medical Use		1.000000	0.676513	0.338257
C: Recreational Use		0.328566	0.222279	0.111140

Social



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 3.Costs -> 2. Social

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.296990	0.184102	0.092051
B: Medical Use		1.000000	0.619893	0.309946
C: Recreational Use		0.316192	0.196005	0.098003

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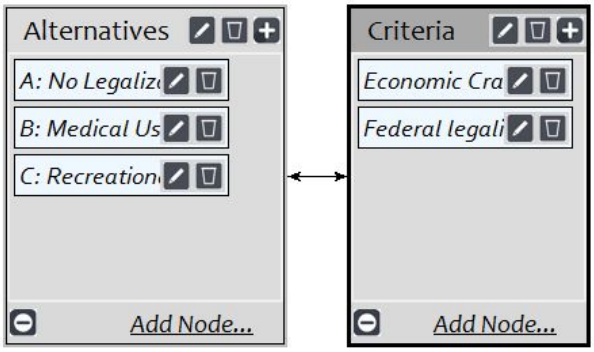
Risks

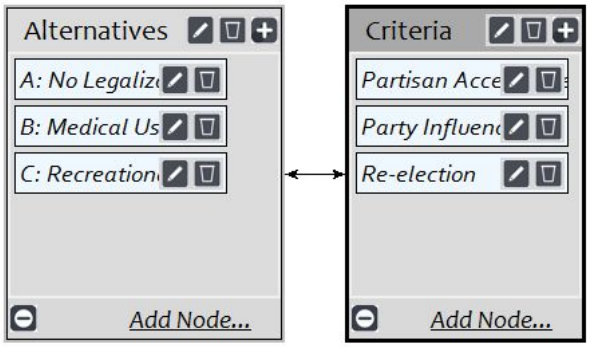
Economic



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 4.Risks -> 3. Economical

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		1.000000	0.527038	0.263519
B: Medical Use		0.286504	0.150998	0.075499
C: Recreational Use		0.610892	0.321963	0.160982

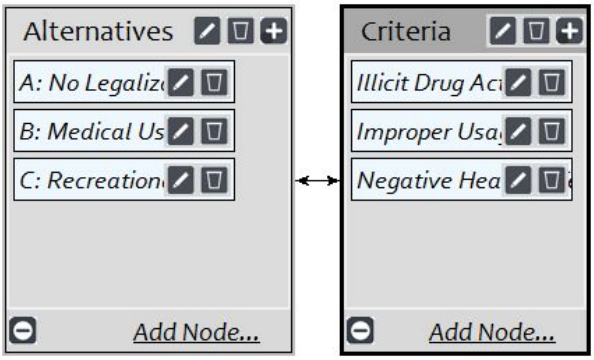
Political



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 4.Risks -> 1. Political

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.404119	0.262455	0.131228
B: Medical Use		1.000000	0.649451	0.324725
C: Recreational Use		0.135644	0.088094	0.044047

Social



Here are the overall synthesized priorities for the alternatives. You synthesized from the network Subnet under 4.Risks -> 2. Social

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.654090	0.277517	0.138758
B: Medical Use		1.000000	0.424279	0.212139
C: Recreational Use		0.702851	0.298205	0.149102

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Results of BOCR

Benefits

"Medical Use" of cannabis was the ideal solution after synthesizing the Benefits category.

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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.098326	0.080016	0.098326
B: Medical Use		1.000000	0.813782	1.000000
C: Recreational Use		0.130503	0.106201	0.130503

Opportunities

Synthesis of the Opportunities category indicates that "Medical Use" alternative with the highest long-term potential benefit.

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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.406897	0.200121	0.398948
B: Medical Use		1.000000	0.491823	0.980464
C: Recreational Use		0.626356	0.308056	0.614120

Cost

Synthesis of the entire cost category resulted in "Medical Use" being the alternative with the highest cost to implement.

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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.187202	0.116936	0.187202
B: Medical Use		1.000000	0.624649	1.000000
C: Recreational Use		0.413697	0.258415	0.413697

Risks

Synthesis of the entire risks category resulted in "Medical Use" being the alternative with the greatest amount of risk involved.

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

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.670646	0.330000	0.564312
B: Medical Use		1.000000	0.492063	0.841445
C: Recreational Use		0.361613	0.177936	0.304277

Additive (Negative)

By utilizing the Additive formula, “Medical Use” is selected as the optimal solution. This result is the best long term option, weighing opportunities and costs as well.

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Main Network: Final Project.sdmod: formulaic: ratings

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.085077	0.058694	0.023832
B: Medical Use		1.000000	0.689901	0.280122
C: Recreational Use		0.364407	0.251405	0.102078

Multiplicative

The Multiplicative formula also has “Medical Use” as the best alternative. This result is the best short term option and primarily considers the benefits and the costs in the final result.

Here are the overall synthesized priorities for the alternatives. You synthesized from the network Main Network: Final Project.sdmod: formulaic: ratings

Name	Graphic	Ideals	Normals	Raw
A: No Legalization		0.318677	0.170865	0.371327
B: Medical Use		1.000000	0.536169	1.165215
C: Recreational Use		0.546407	0.292966	0.636681

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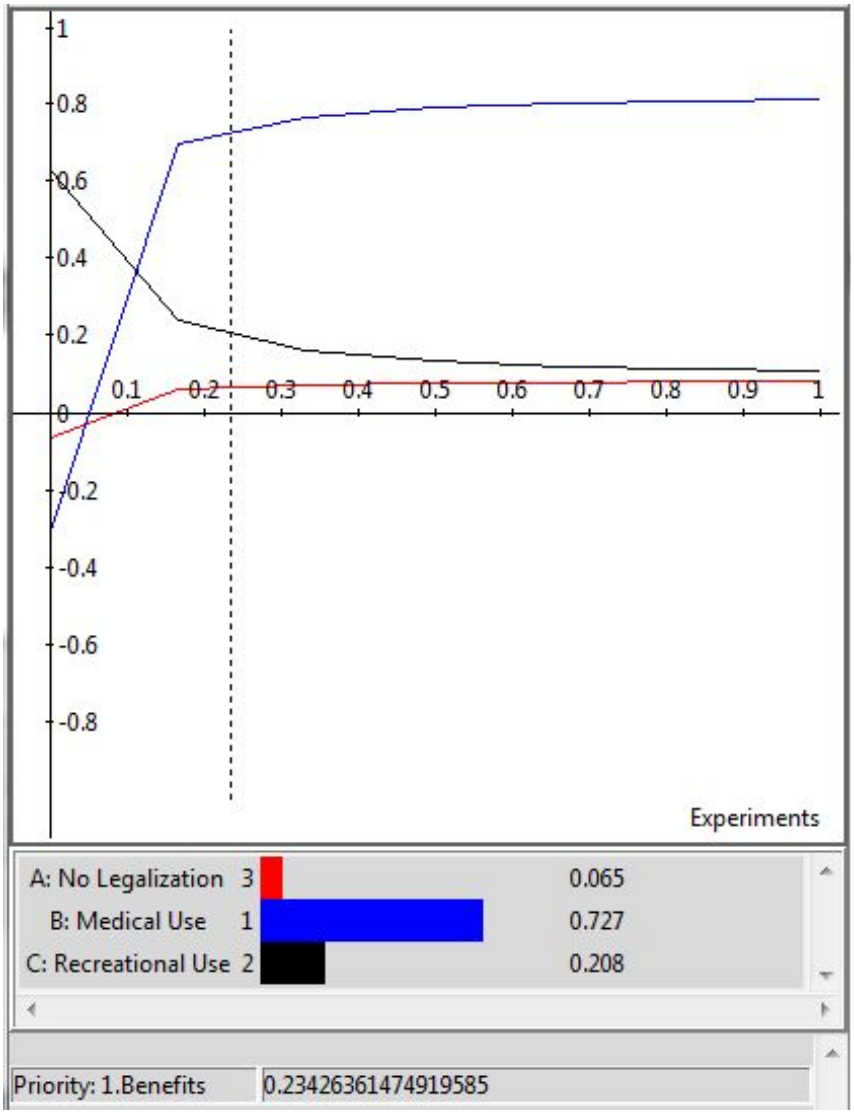
Sensitivity

Once the model was synthesized and results provided, the sensitivity of the model and the lower level criteria was reviewed. This was conducted to see the robustness of the solution and to determine if any small changes in values would impact the overall solution.

Benefits

The sensitivity analysis for the benefits has “Recreational Use” as the best alternative at the low level. In the mid level and high level experiments, “Medical Use” takes over as the best alternative. The “No Legalization” option starts in the middle but is quickly overtaken by “Medical Use” and stays at the bottom after that.



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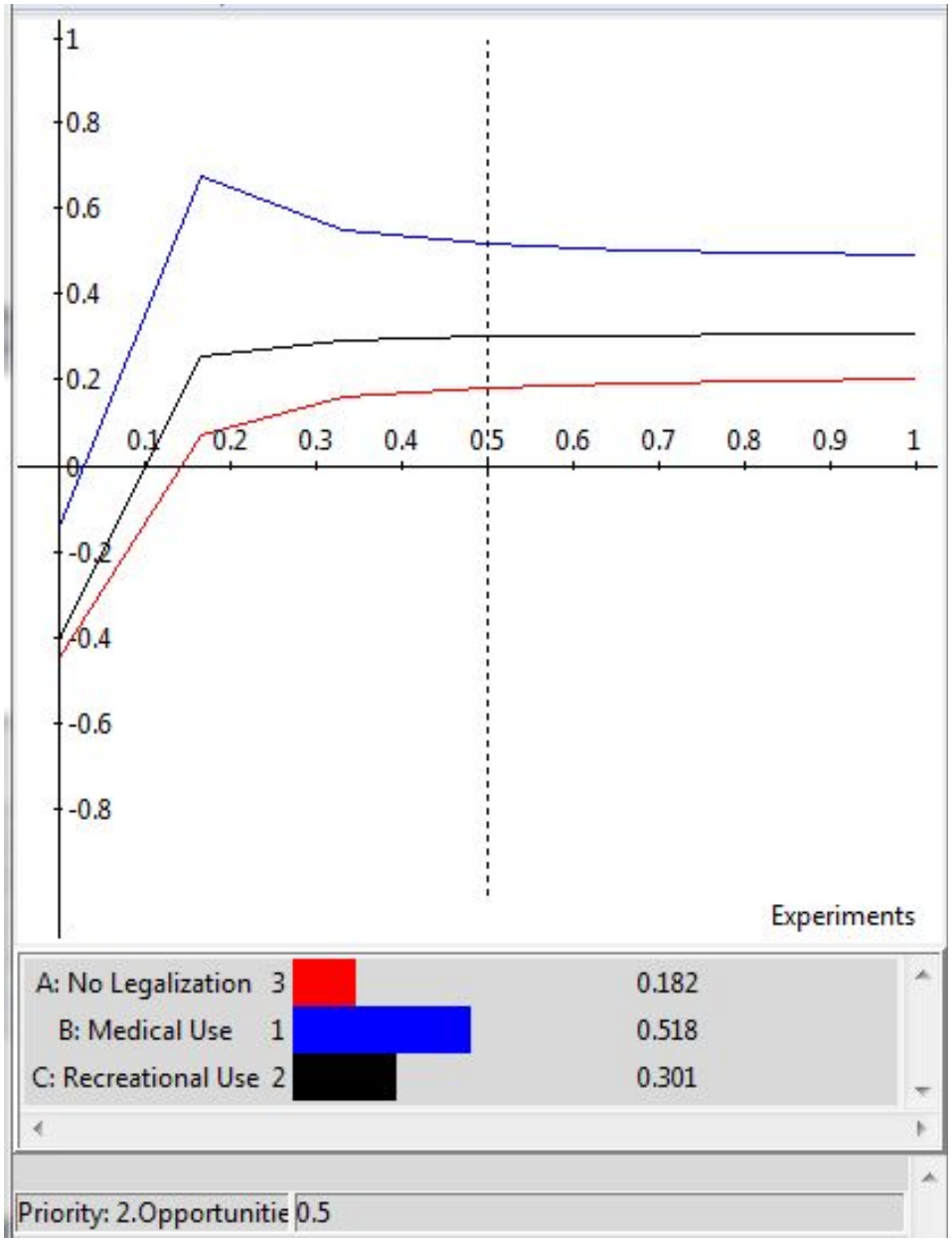
Opportunities

The opportunities have “Medical Use” as the primary option for all areas of the graph. This indicates that the opportunities for “Medical Use” are the best and that it is very insensitive to variations within the rankings.



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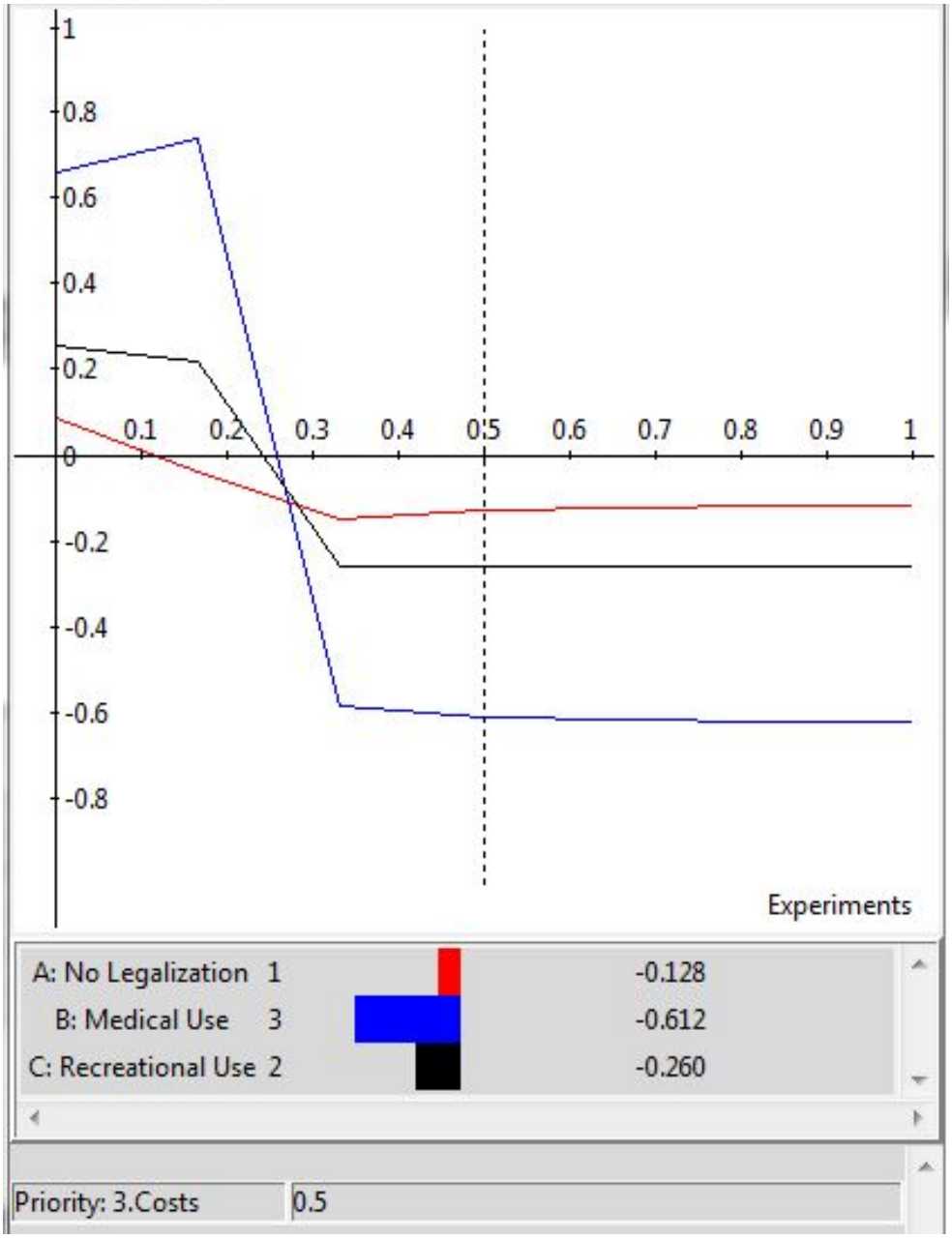
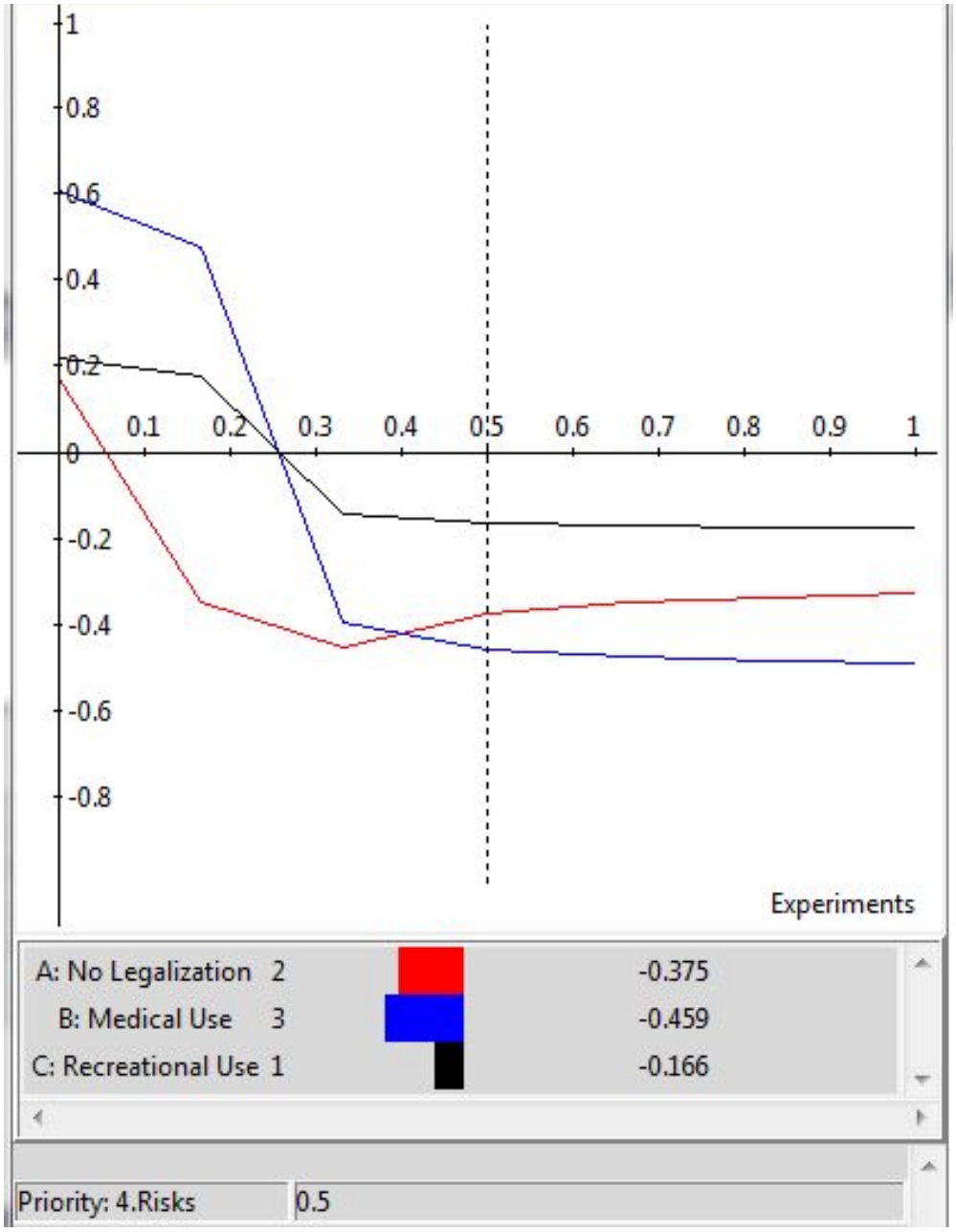
Cost

The cost sensitivity starts with “Medical Use” being the highest cost at the low end of the analysis, as more priority is introduced, around 0.25, the criteria all meet with “No Legalization” taking over as the most costly, while “Medical Use” drops to the lowest level of cost.



Risks

The sensitivity for risks, mimics that of cost. Again, “Medical Use” has the highest risk at the low end of the analysis. Around 0.25, “Recreational Use” takes over as the highest priority for the mid range and the high range of the analysis. At 0.4, “Medical Use” drops below “No Legalization” and is at the lowest level of risk through the remainder of the analysis.



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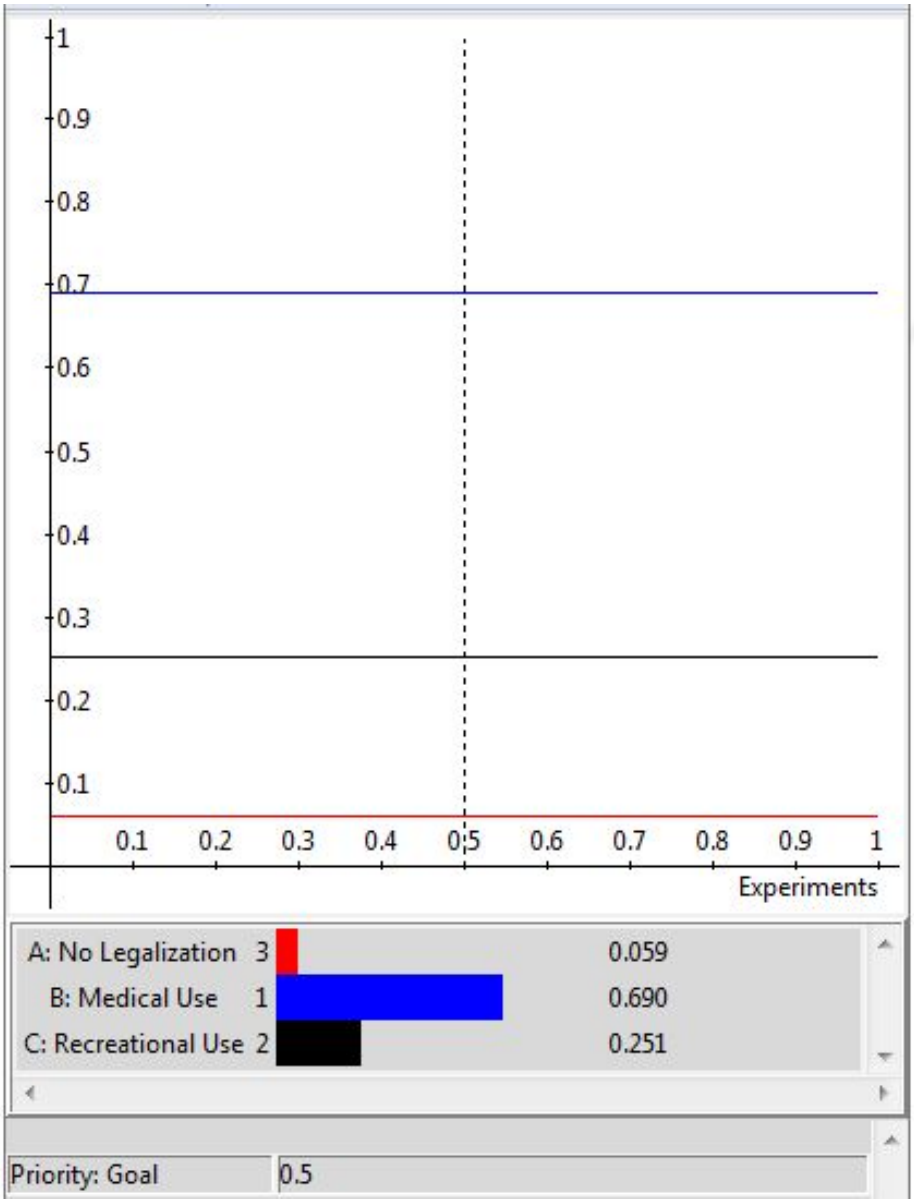
Goal

A sensitivity analysis was also performed on the goal node. The goal node has “Medical Use” as the best alternative for all scenarios. The graph shows little differentiation at all levels of the analysis. This shows that the solution is robust, and inflexive in the solution that it would provide.



[Note: Further sensitivities are provided at the end for review]

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Conclusions

The analysis indicated that the best stance for the State of Pennsylvania is to approve for medical use of cannabis in the state. This option was the most desirable option in both the long-term and the short-term. The additional sensitivity analysis confirmed the robustness of the solution.

Approved Medical Use provides a middle of the road solution so that the elected officials can achieve their primary objective of staying employed and balancing their agenda while maintaining strong support from both sides of the aisle on this issue. The medical use option provides good industry growth as the infrastructure for production, distribution and sale of the medical cannabis will bring added wealth to the state. Because pennsylvania is estimated to be a large market for medical cannabis, the industry opportunities should be significant.

Finally, the use of medical cannabis is the balancing solution on the social front. It does not push in either extreme; fully illegal being the conservative view and recreational use being the progressive approach. Regardless of political opinion, the medical use permits use where there is a need to improve quality of life without overly impacting society as a whole. This solution aligns with the direction of the State. In 2016, Governor Tom Wolf signed Act 16 into law, legalizing the use of cannabis for certain medical conditions and under the care of a certifying physician.

As this issue moves forward, the ratings and the criteria used in this analysis will change. Two major factors will have a significant impact on how this topic progresses. First, the Federal Government will have significant impact on the use of cannabis, medically or recreationally. If the US Government takes a stronger position on cannabis in either direction, it will trickle to all the states and their laws related to its use, or lack thereof. Secondly, Pennsylvania will be affected independently on how the implementation and perception of the medical use application goes. If there are strong positives with the use of cannabis and additional resources, enforcement and regulation are developed, it is likely that recreational use will follow. On the other hand, if the application is poorly executed, additional problems are publicized and corruption or underhandedness is identified, the populace will likely be turned from the idea. If this happens, recreational use will be very unlikely, and no legalization could be back on the table.

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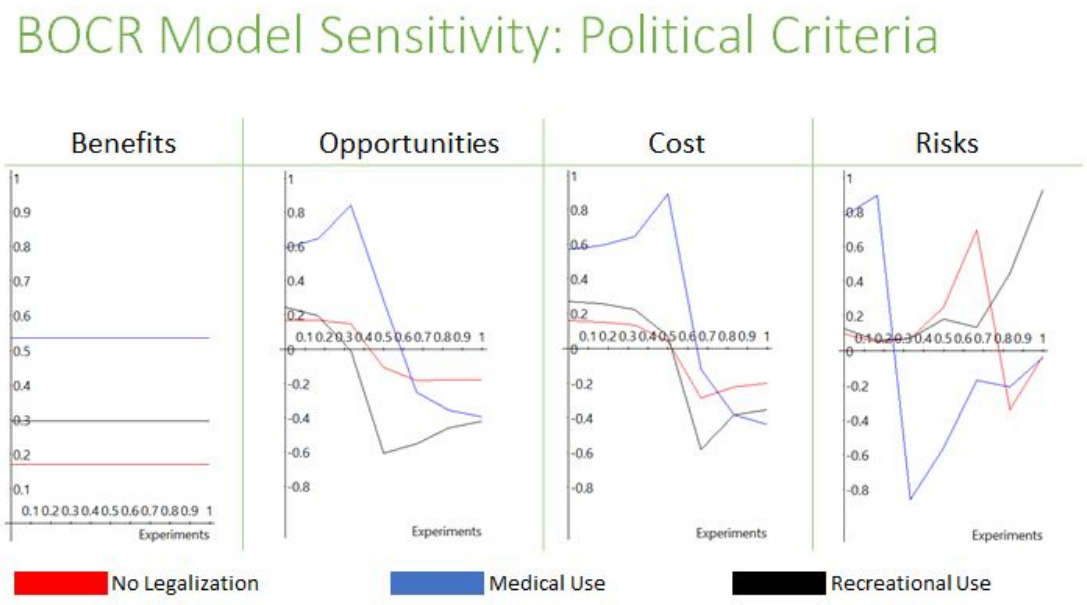
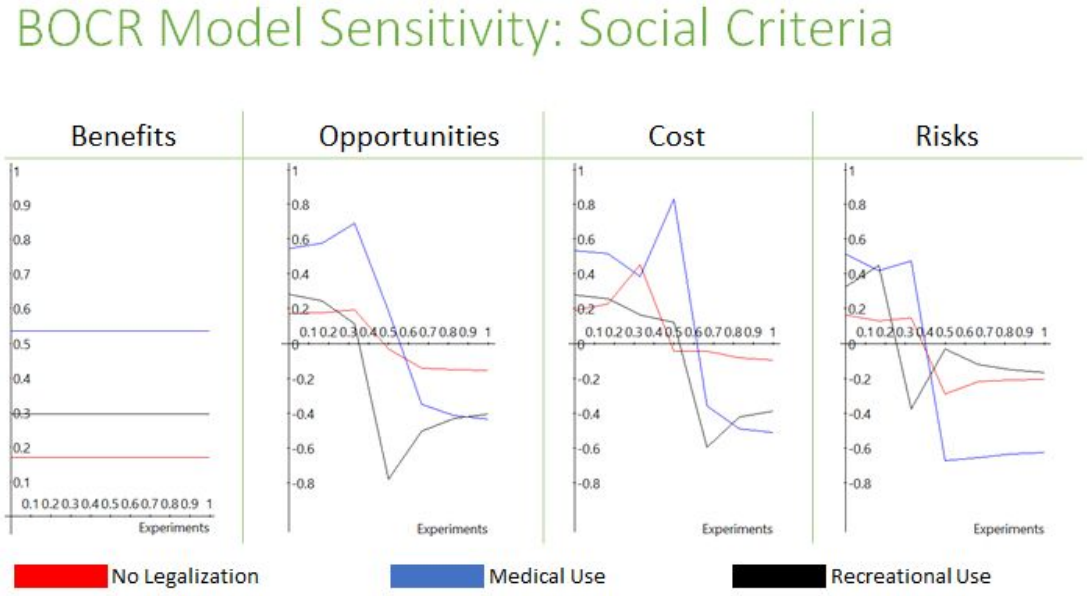
Sensitivity (Additional)





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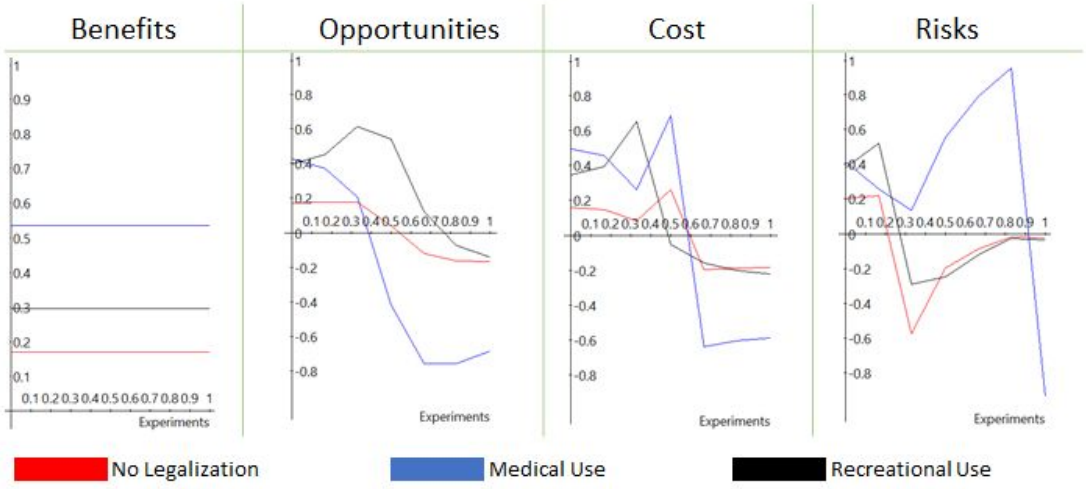
Final Project

BOCR Model Sensitivity: Economic Criteria



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Work Cited

"Cannabis." *World Health Organization*, World Health Organization, 7 Dec. 2010, www.who.int/substance_abuse/facts/cannabis/en/.

Hartig, Hannah, and Abigail Geiger. "62% Of Americans Favor Legalizing Marijuana." *Pew Research Center*, Pew Research Center, 8 Oct. 2018, www.pewresearch.org/fact-tank/2018/10/08/americans-support-marijuana-legalization/.

"Legal Marijuana Market Size, Growth & Analysis | Industry Report, 2025." *Legal Marijuana Market Size, Growth & Analysis | Industry Report, 2025*, www.grandviewresearch.com/industry-analysis/legal-marijuana-market.

"Marijuana Decriminalization and Legalization." *Drug Policy Alliance*, Feb. 2018, www.drugpolicy.org/sites/default/files/marijuanalegalizationanddecriminalization_factsheet_feb2018_0.pdf.

Project, Marijuana Policy. "Pennsylvania." *MPP*, www.mpp.org/states/pennsylvania/.

Public Affairs. "What Is the U.S. Opioid Epidemic?" *HHS.gov*, Https://Plus.google.com/+HHS, www.hhs.gov/opioids/about-the-epidemic/index.html.