

Behavioral Patterns: Small Firms' Recipe for Growth



Fadi Abou Chacra, Joshua Rocha

Advisors: Dr. Josué C. Velázquez Martínez and Dr. Cansu Tayaksi

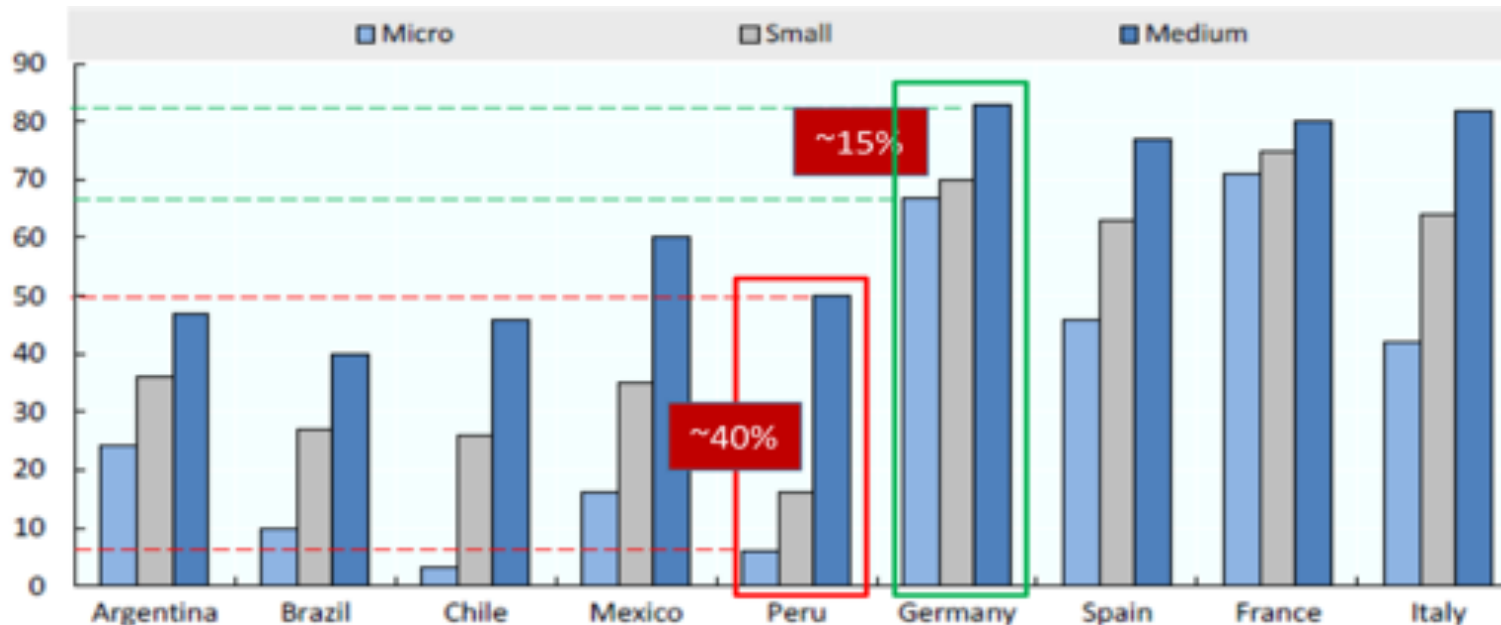
Micro & Small Enterprises (MSEs) & LATAM

More than **99%** of the companies are micro, small, or medium firms
It is estimated that 2/3 will fail within 42 months in LATAM (GEM)



Account for 70% of the jobs in most OECD countries

Represent, on average, more than half of total exports in value added terms. (OECD)



MIT GeneSys



The objective is to provide a framework of managerial insights aimed at improving productivity and competitive advantage in the small firms.

What behavioral patterns in supply chain management affect the growth and productivity of micro and small firms (MSEs)?

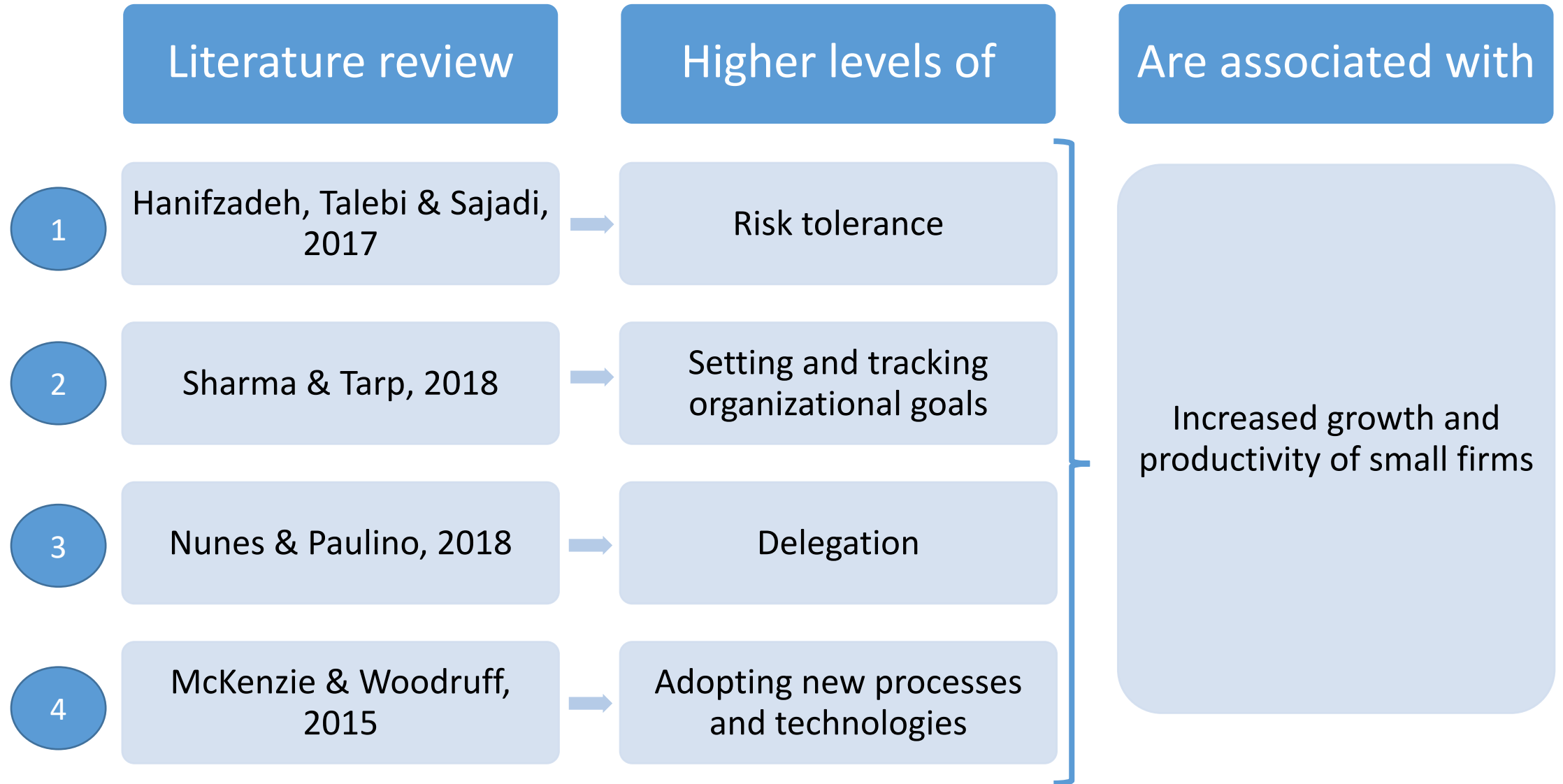
Identify managerial and behavioral patterns that are associated to the productivity and growth of MSEs



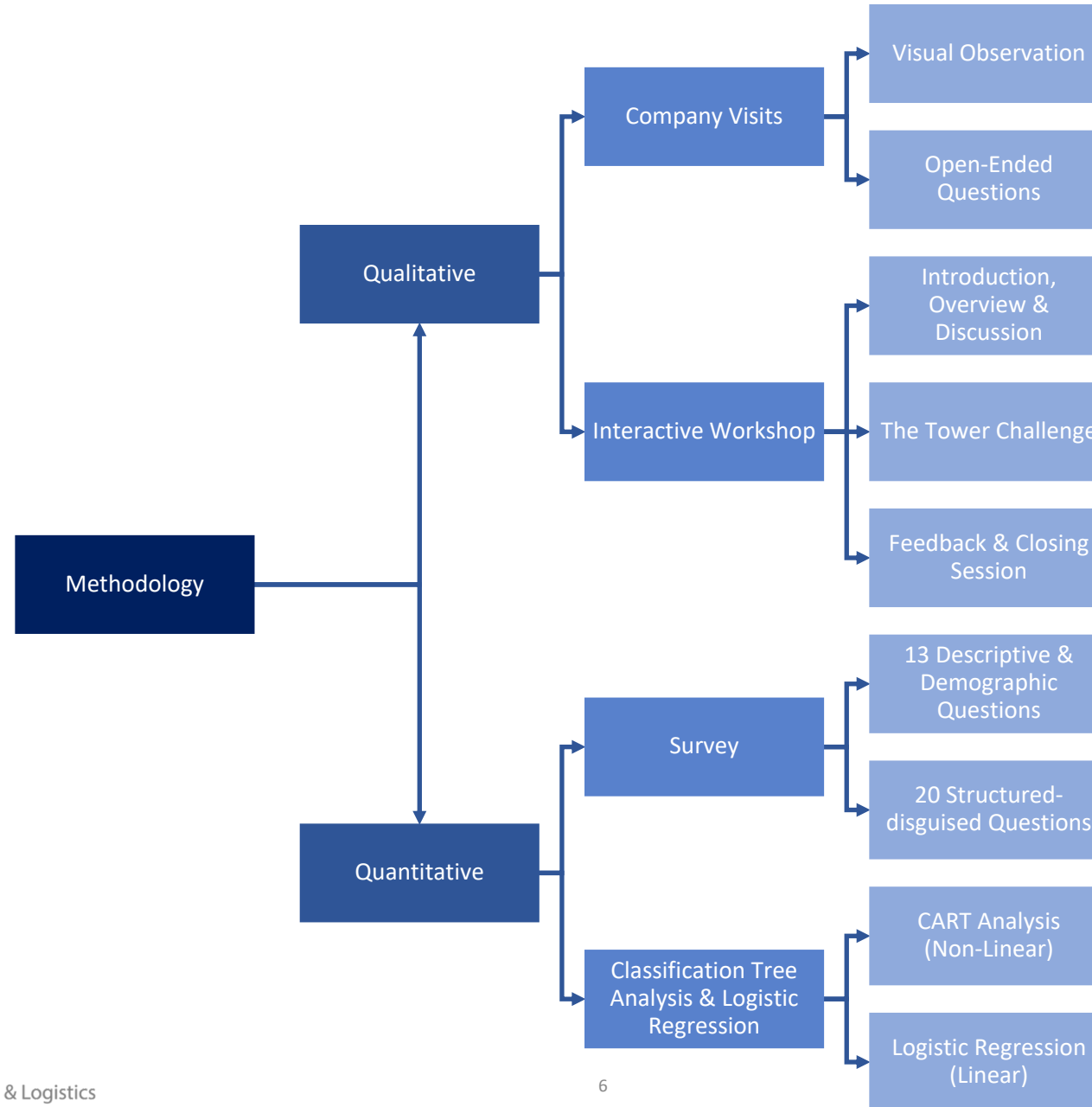
Build a conceptual framework for future research

Conduct qualitative and quantitative **analysis** of the identified managerial behavioral patterns

Hypotheses



Methodology Framework



Company Visits

Visited three companies in Mexico

- Visual observation: assets, processes and human interactions
- Open-ended questioning: business practices that are not immediately apparent through passive observation

Hand-made jewelry



Stationery



Cosmetics

Interactive Workshop

- Conducted in Guadalajara, Mexico
- Twenty five (25) MSE owners participated
- The workshop was divided into three segments:



1



2



3

The Tower Challenge

Adapted from the Marshmallow
Challenge

What behaviors do managers exhibit in
real-life?



The Tower Challenge: Objectives & Structure

- Build the tallest tower possible using spaghetti noodles and marshmallows
- Every 1 cm in height earns \$0.10
- Opportunity to purchase additional supplies each round
- 3 Rounds
- The objective of the game is to have the most money at the end of round 3



Structured Disguised Survey

- Answers to the questions are predetermined (i.e., Multiple Choice)
- Participants do not know the exact purpose/intention of survey but can easily answer questions
- Avoid social desirability bias

I enjoy working with others		I do not enjoy working with others	
Strongly Agree	Agree	Agree	Strongly Agree

I enjoy working with others		I enjoy working on my own	
Strongly Agree	Agree	Agree	Strongly Agree

Qualitative to Quantitative

I enjoy working with others		I enjoy working on my own	
Strongly Agree	Agree	Agree	Strongly Agree
3	2	1	0

Goal Oriented	3	2	1	0	Task Oriented
Risk Tolerant	3	2	1	0	Risk Averse
High Delegation	3	2	1	0	Low Delegation
High Adoption	3	2	1	0	Low Adoption

Participant #	Goals	Risks	Delegation	Adoption
18	3.00	1.98	1.80	2.40
1	2.20	1.32	2.40	2.40
13	1.00	1.65	1.00	1.60
27	1.40	1.36	2.20	2.20
3	2.20	1.43	1.80	2.60

Model Structure

- Four model features

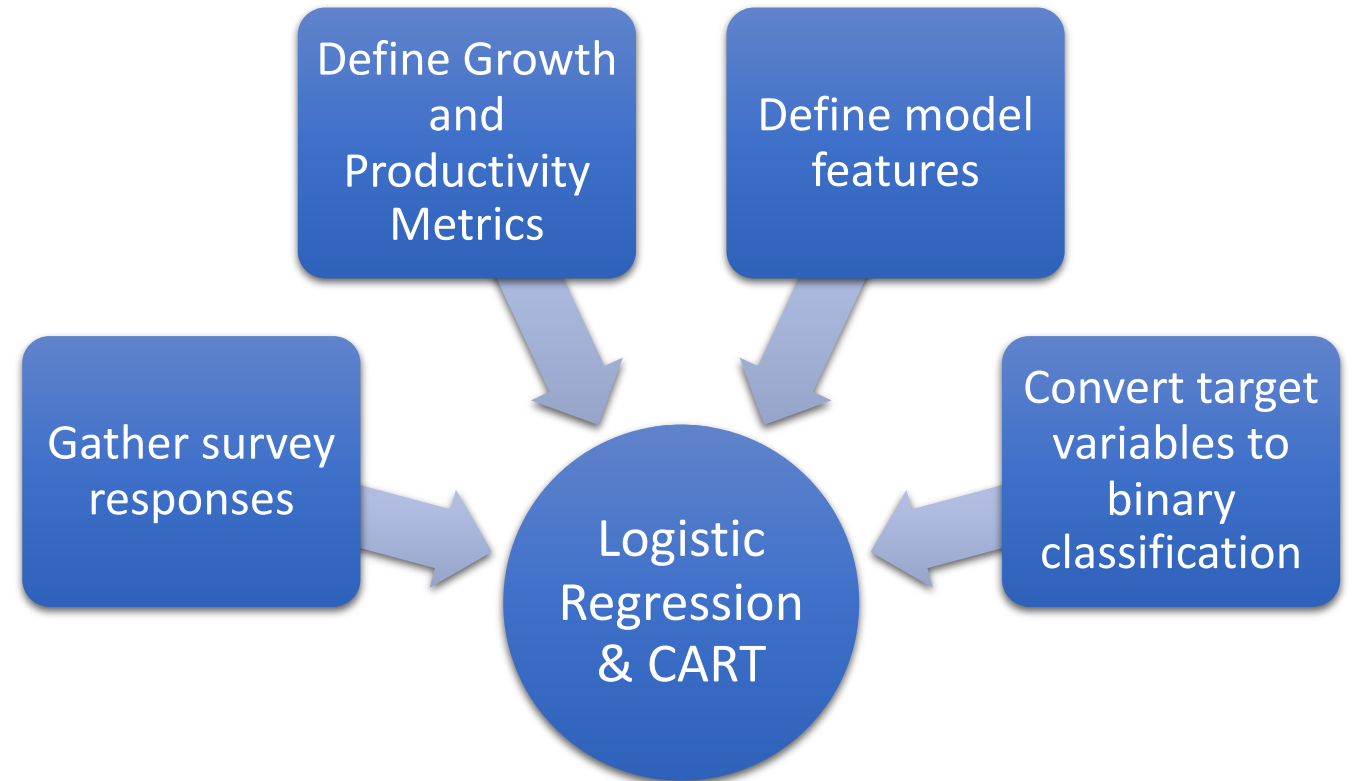
- Risk
- Goals
- Delegation
- Adoption

- Three target variables

- Revenue Growth
- Employee Growth
- Productivity

- High Growth/High Productivity = 1

- Low Growth/Low Productivity = 0



Descriptive Statistics

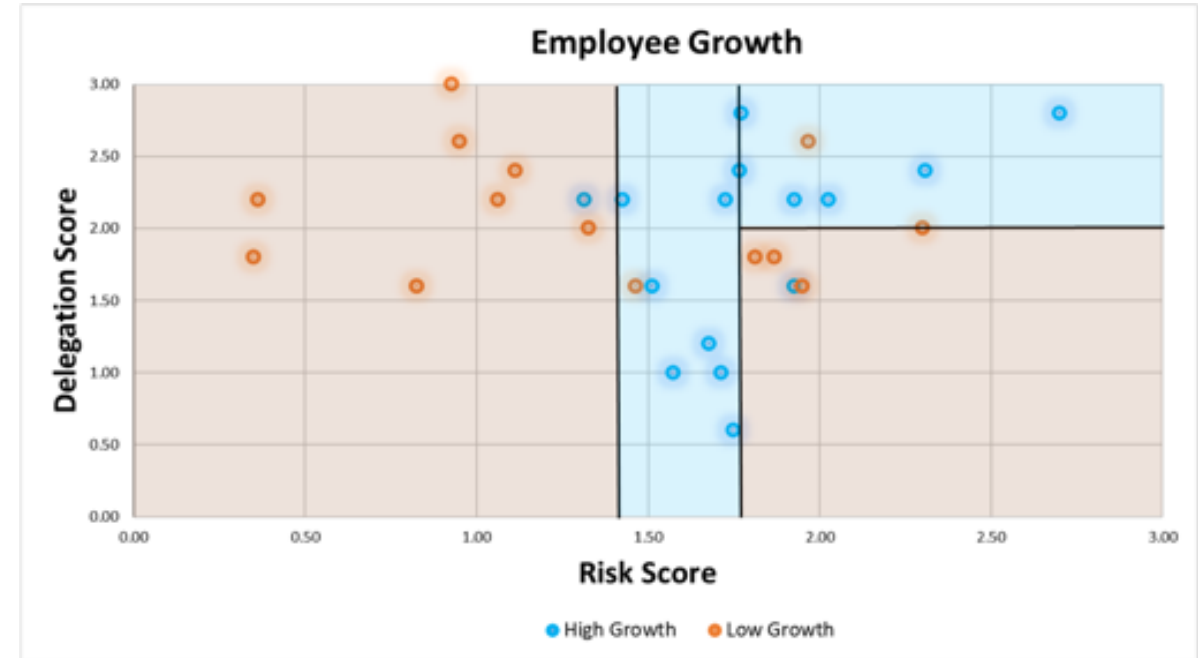
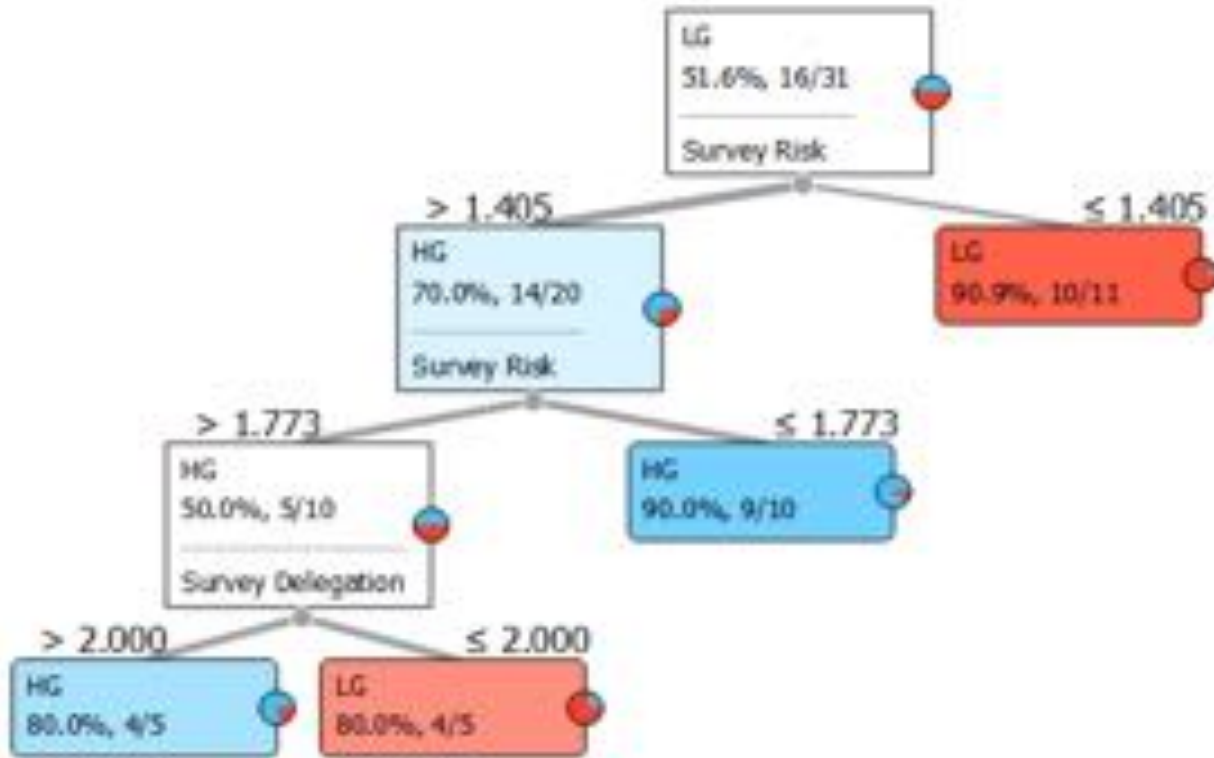
	Number of employees in 2018	Avg Annual Rev 2018 USD	Rev Growth	Employee Growth	Productivity
Median	13	\$187,210	0.27	0.20	\$13,570

	Survey Goals	Survey Risk	Survey Delegation	Survey Adoption
Avg	1.90	1.55	1.99	2.05
Median	2.00	1.68	2.20	2.20
Std Dev	0.52	0.52	0.56	0.43
CV	0.27	0.34	0.28	0.21

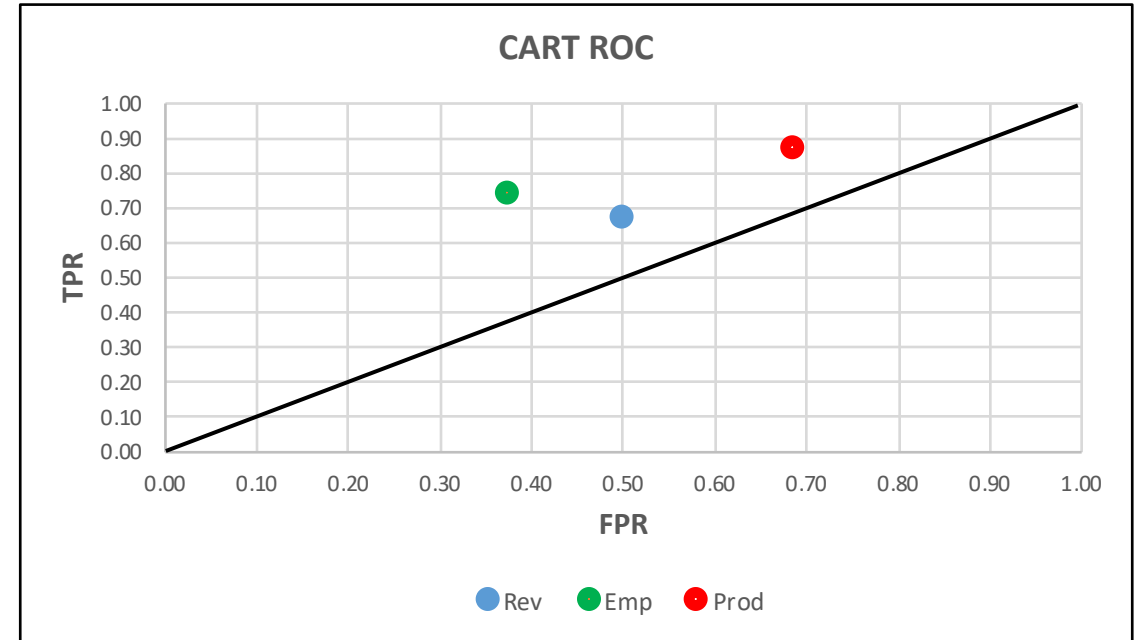
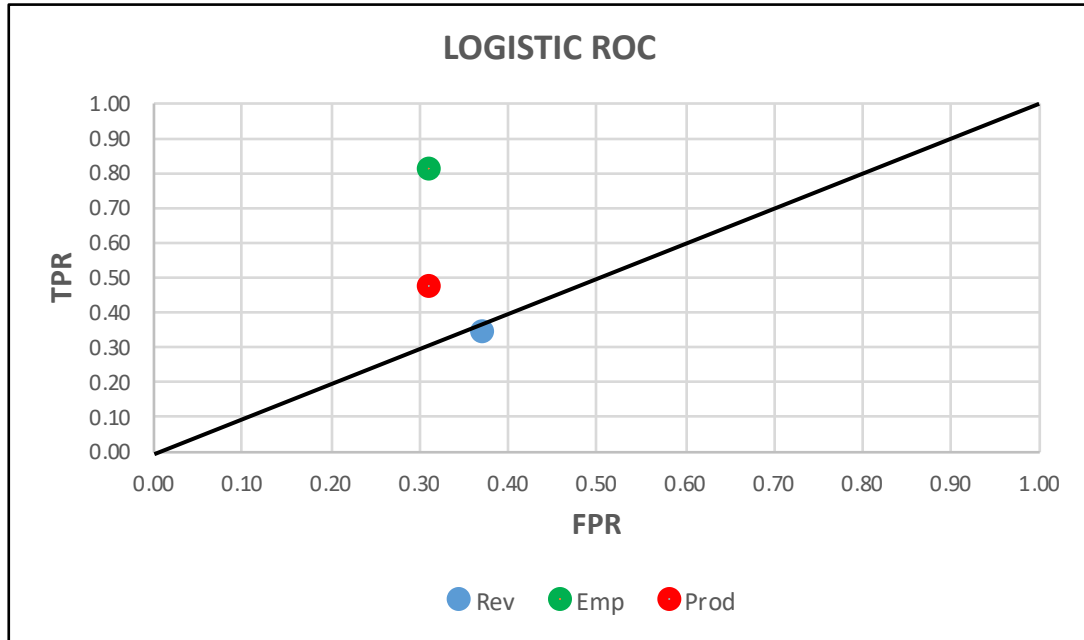
Logistic Regression (Linear)

Employee Category			
Regression Statistics			
Chi Square	11.68		
Residual Dev.	31.26		
# of iterations	6		
Observations	31		
	Coefficients	Standard Error	P-value
Intercept	-1.49	2.87	0.60
Survey Goals	-1.50	0.98	0.12
Survey Risk	2.96	1.25	0.02
Survey Delegation	-0.63	0.99	0.53
Survey Adoption	0.41	1.35	0.76
		Probability	
	2.23	0.903	
Survey Goals	3.0		
Survey Risk	3.0		
Survey Delegation	3.0		
Survey Adoption	3.0		

CART (Non-Linear)



Leave-One-Out Cross-Validation - ROC Curves



LOOCV Results

Target Variable	Models	Optimal Threshold	FPR (x)	TPR (y)	Classification Accuracy	Euclidean Distance	LOG/CART %
Revenue Growth	Logistic Regression	0.58	0.38	0.33	0.48	0.76	
	CART	0.60	0.50	0.67	0.58	0.60	27.29%
Employee Growth	Logistic Regression	0.46	0.31	0.80	0.74	0.37	
	CART	0.30	0.38	0.73	0.68	0.46	-19.37%
Productivity	Logistic Regression	0.52	0.31	0.47	0.58	0.70	
	CART	0.03	0.69	0.87	0.58	0.62	13.29%

Conclusions

- Three of the four behavioral patterns are moderately strong predictors for revenue growth, employee count growth, and productivity
- Adoption of new technologies/processes does not seem to be a strong predictor for target variables
- Our findings for risk, delegation, and goals support past research; behavioral management patterns are associated with business performance.
 - However, the associations are better captured through non-linear models than through linear models

Limitations & Future Research

- More observations!
- Because our dataset is limited to 31 observations, we do not control for the age of the company or company industry in this research
- There seems to be a difference between adoption for the purpose of advancement versus the adoption for mere survival
- Control for changes in behavioral management patterns over time

Thank You!

Questions?

Supporting Slides

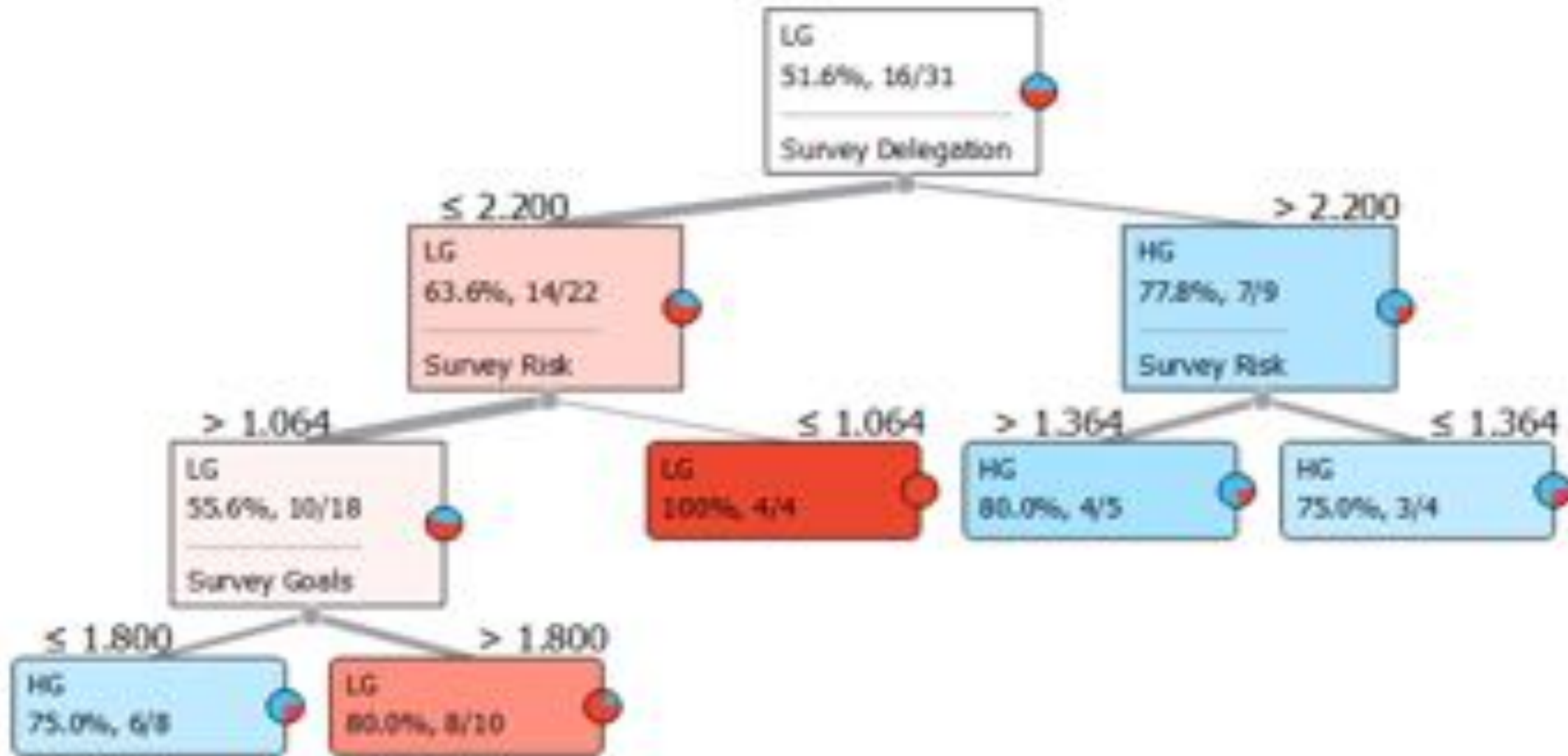
Revenue Logistic Regression

Revenue Category			
Regression Statistics			
Chi Square	3.373369206		
Residual Dev.	39.56949233		
# of iterations	5		
Observations	31		
	Coefficients	Standard Error	P-value
Intercept	-3.07462625	2.422325552	0.204338733
Survey Goals	-0.716418508	0.831790552	0.389074619
Survey Risk	0.806668627	0.791060597	0.307856287
Survey Delegation	0.325326925	0.897425605	0.716969979
Survey Adoption	1.208752052	1.269036788	0.340845658
		Probability	
	1.79836104	0.857949308	
Survey Goals	3.0		
Survey Risk	3.0		
Survey Delegation	3.0		
Survey Adoption	3.0		

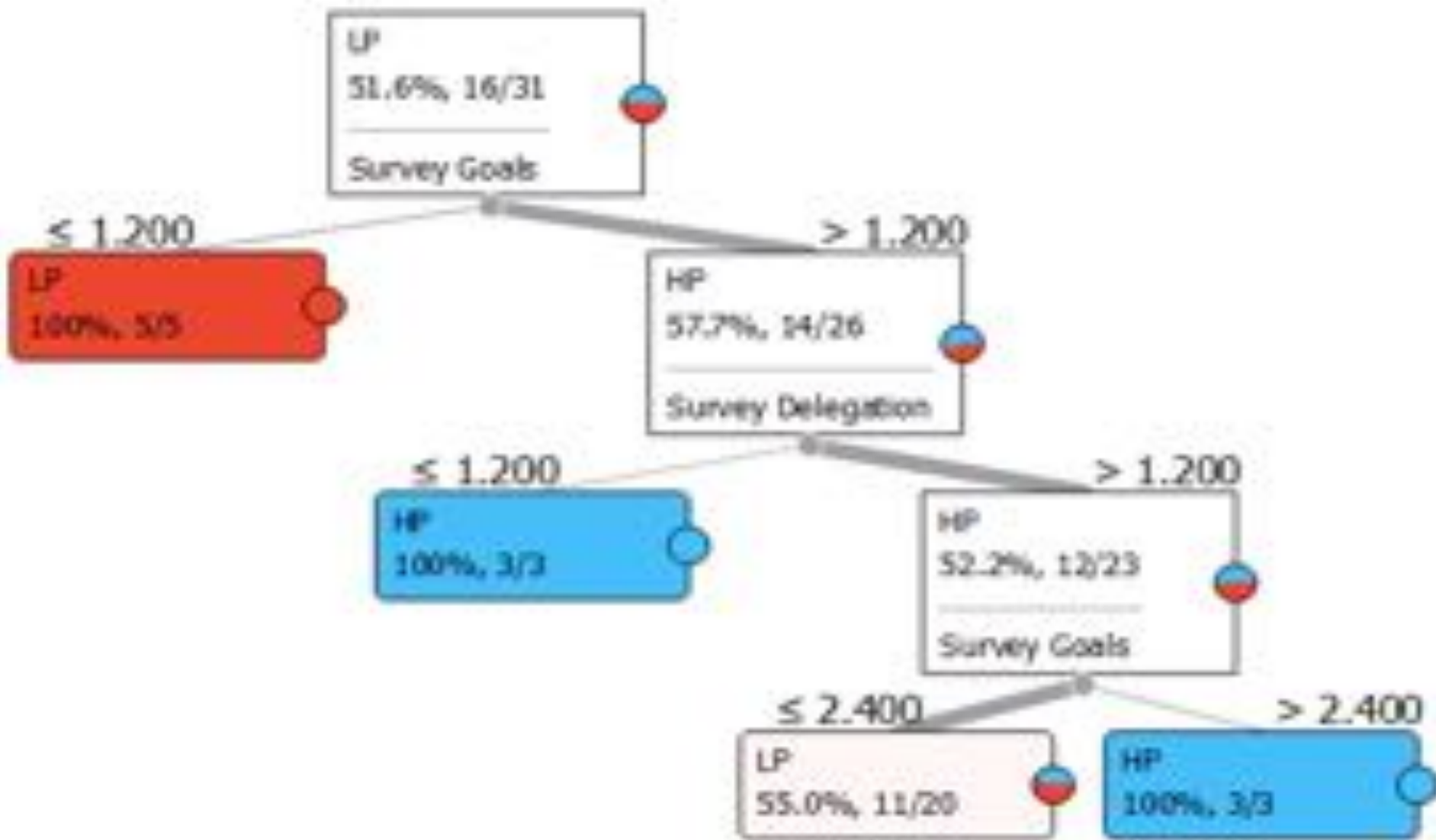
Productivity Logistic Regression

Productivity Category			
Regression Statistics			
Chi Square	4.192290153		
Residual Dev.	38.75057138		
# of iterations	5		
Observations	31		
	Coefficients	Standard Error	P-value
Intercept	-1.9285871	2.467121116	0.434381723
Survey Goals	1.631416512	0.896730081	0.068866443
Survey Risk	0.08610581	0.761274602	0.909945389
Survey Delegation	-0.249786431	0.916803033	0.785273143
Survey Adoption	-0.436927569	1.259454406	0.728652825
		Probability	
	1.163837865	0.762029375	
Survey Goals	3.0		
Survey Risk	3.0		
Survey Delegation	3.0		
Survey Adoption	3.0		

Revenue Decision Tree



Productivity Decision Tree



Risk Examples

- Assume that if you buy a lottery ticket, you will have a 10% chance of winning \$1,000 USD. If you had exactly \$1,000 USD in your savings account, how much would you be willing to pay for the lottery ticket? (Personal)
- Your family member wants to start a business and needs a total of \$1,000 USD to start. They are asking for your help and have promised to pay you back in 6 months. Assuming you had exactly \$1,000 USD in your savings account, how much money would you be willing to lend your family member? (Close Relationship)
- Assume one of your long-time customers' needs a new order worth \$500 USD and has asked you to ship it today if possible. This customer has not yet paid the invoice from the last order worth \$500 USD that you shipped them four weeks ago, but they promise that they will pay both invoices in full in 30 days. Would you be willing to ship the new order today? (Business Relationship)