BUILDING BUSINESS CAPABILITY

"WHY" and "WHAT-IF" Buttons for Business Decision Management

Dr. JACOB FELDMAN, OpenRules Inc., CTO

Specification Lead for JSR-331

jacobfeldman@openrules.com

www.OpenRules.com

www.JSR331.org

Business Needs WHY-Button

"*Ultimate goal for #BusinessRules: Always knowing exactly why you get the results you do in everyday business operations*"

Ron Ross, 2016

"*Imagine you had a **Why Button** handy whenever you encountered some disconnect in day-to-day business operations. Hit the Why Button and presto — answers appear in the form of relevant business rules.*"

Ron Ross, 2013

Business Also Needs WHAT-IF Buttons

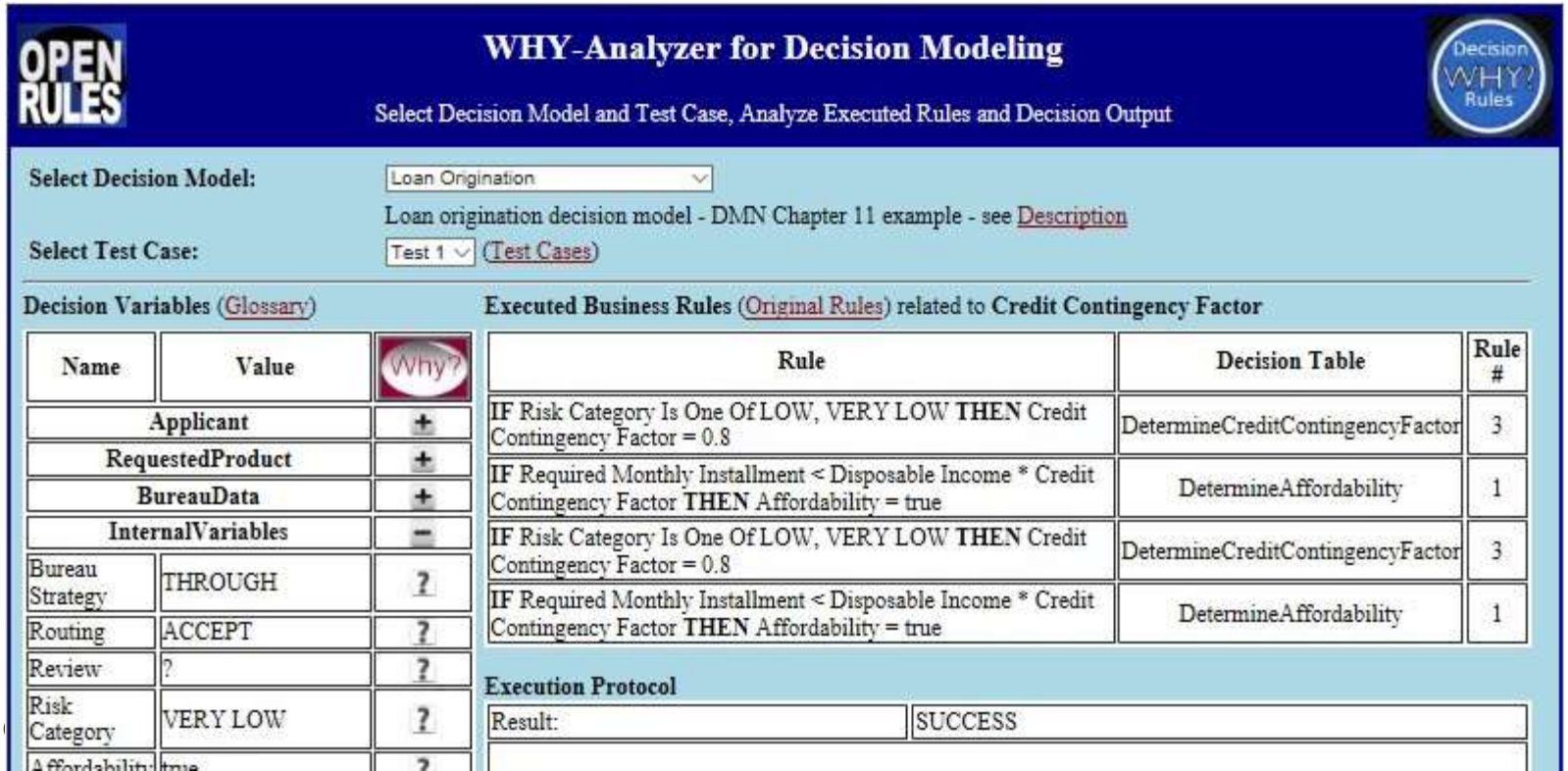
- People, who maintain decision models in day-to-day operational environments, want to deactivate some rules, define and activate new rules, and immediately see the impact of these actions on key decision variables
- Practical decision modeling requires WHAT-IF Buttons, which support *continuous change* in decision models

Presentation Outline

- We will explore new business-oriented (!) web interfaces for Decision Modeling that include:
  - **WHY** buttons to explain why a decision was made and which rules were actually executed
  - **WHAT-IF, ACTIVATE, NAVIGATE, OPTIMIZE** and other buttons allowing business analysts to analyze and modify their decision models by activating/deactivating business rules, comparing resulting decisions, and even recommending those decisions that optimize certain business objectives.

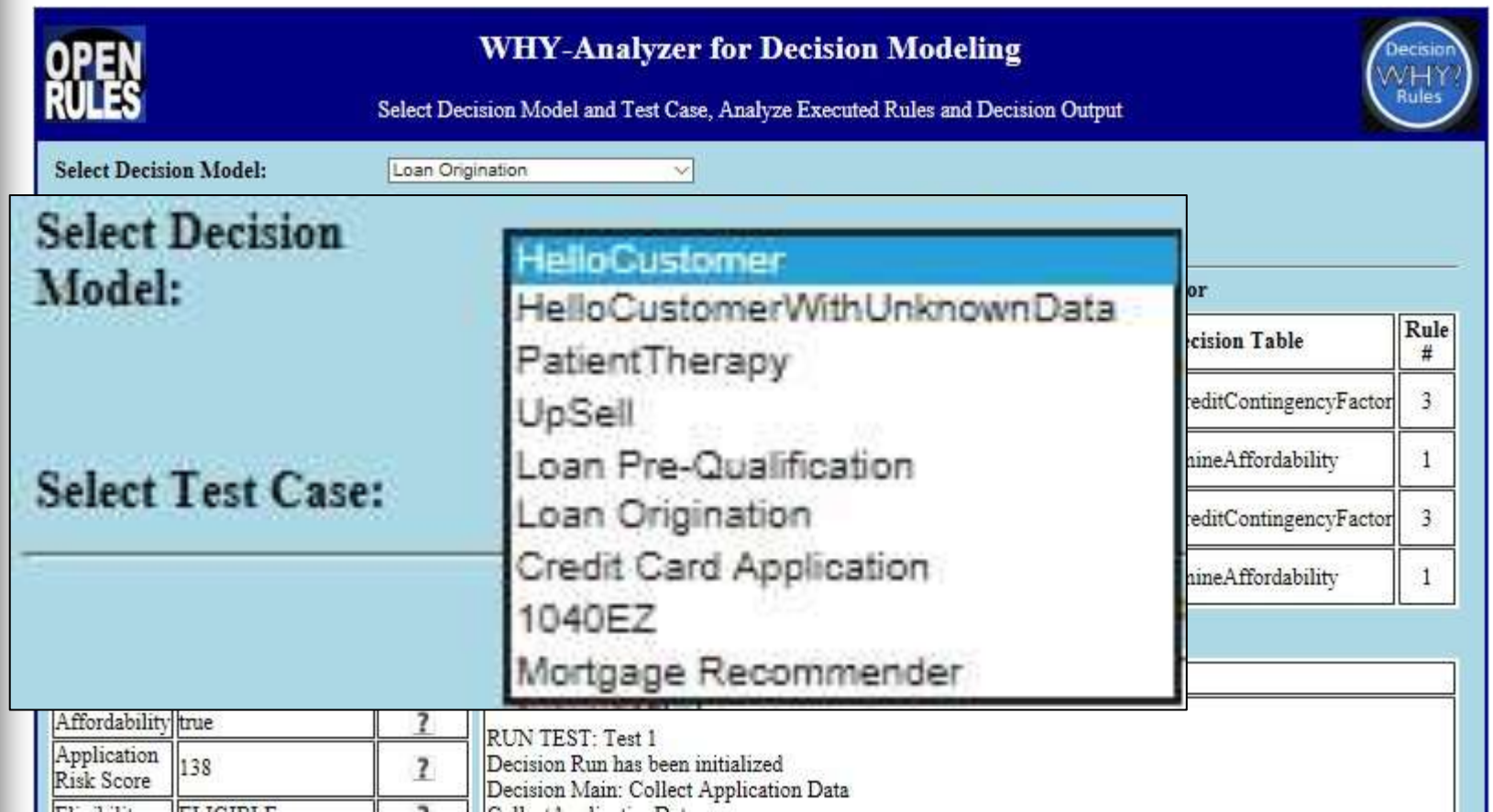
Introducing "Why Analyzer"

- OpenRules has developed a new graphical tool "**Why Analyzer for Decision Modeling**"
- It is oriented to business analysts who create and maintain DMN-based decision models



Selecting Decision Model

- A user may select a decision model from the list of decision models already added to the Why-Analyzer:



Test Cases

- Business user who creates business rules also creates test cases for them directly in Excel:

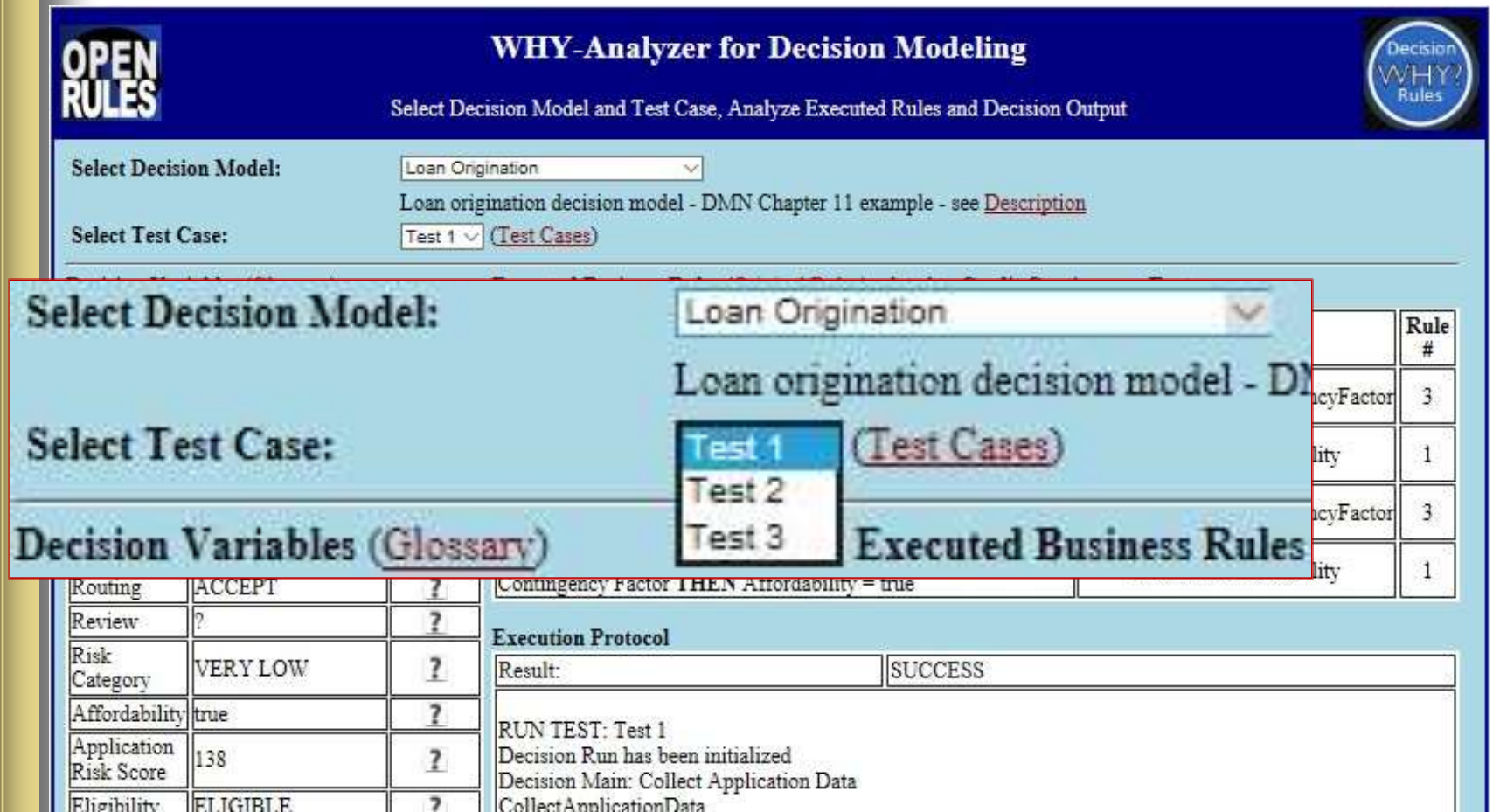
DecisionTableTest testCases					
#	ActionUseObject	ActionUseObject	ActionExpect	ActionExpect	ActionExpect
Test ID	**Customer**	**LoanRequest**	**Income Validation Result**	**Debt Research Result**	**Loan Qualification Result**
Test 1	:= customers[0]	:= loanRequests[0]	SUFFICIENT	High	QUALIFIED
Test 2	:= customers[1]	:= loanRequests[1]	SUFFICIENT	Low	NOT QUALIFIED
Test 3	:= customers[2]	:= loanRequests[2]	SUFFICIENT	High	QUALIFIED

Data Customer customers						
Borrower Full Name	**Borrower SSN**	**Monthly Income**	**Monthly Debt**	**Mortgage Holder**	**Outside Credit Score**	**Loan H**
Peter N. Johnson	157-82-5344	5000	2300	Yes	720	N
Mary K. Brown	056-45-8233	4300	2800	No	620	N
Robert Cooper Jr.	241-56-9082	6400	2800	Yes	735	Ye

Data LoanRequest loanRequests						
Loan Amount	**Loan Purpose**	**Loan Term**	**Icome Validation Result**	**Debt Research Result**	**Loan Qualification Result**	
30000	Home Improvement	72	?	?	?	
15000	Education	36	?	?	?	
55000	Education	24	?	?	?	

Selecting Test Cases

- Then a user may select a test case from the list of test cases for the selected decision model:



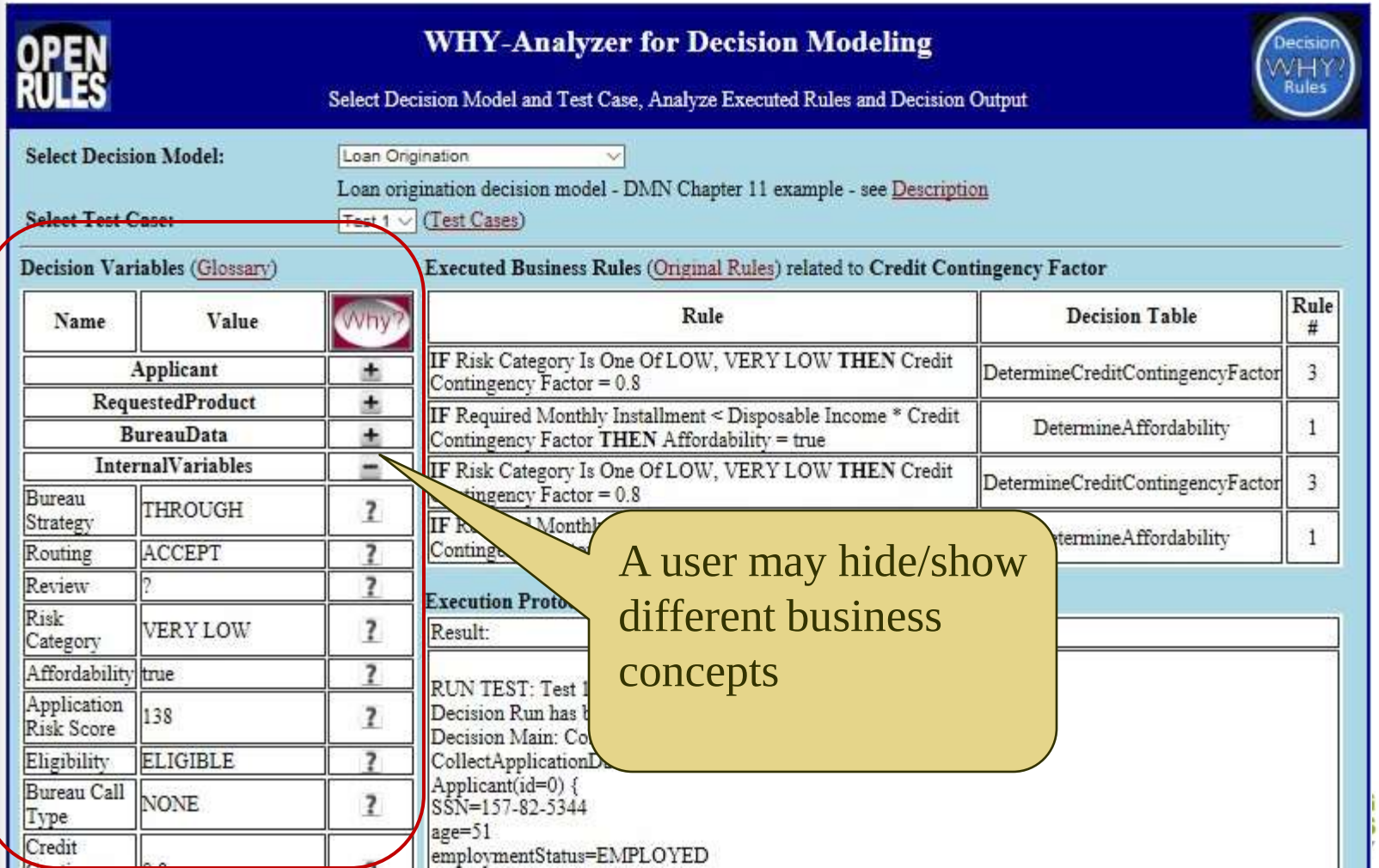
Business Glossary

- All decision variables are described in the Glossary:

Glossary glossary			
Variable	**Business Concept**	**Attribute**	**Domain**
Monthly Income	Applicant	monthlyIncome	0-5000000
Monthly Repayments		monthlyRepayments	0-5000000
Monthly Expenses		monthlyExpenses	0-5000000
Age		age	1-150
Marital Status		maritalStatus	SINGLE,MARRIED,OTHER
Employment Status		employmentStatus	EMPLOYED. UNEMPLOYED,RETIRED,OTHER
Existing Customer		existingCustomer	TRUE,FALSE
Product Type	RequestedProduct	productType	STANDARD LOAN, SPECIAL LOAN
Amount		amount	1000-5000000
Rate		rate	0.0 - 25.0
Term		term	36-360
Loan Origination Result		loanOriginationResult	DECLINE,ACCEPT
Bankrupt	BureauData	bankrupt	TRUE,FALSE
Credit Score		creditScore	0-999
Bureau Strategy		bureauStrategy	DECLINE,BUREAU,THROUGH
Routing		routing	DECLINE,REFER,ACCEPT
Review		review	DECLINE,ACCEPT
Risk Category		riskCategory	DECLINE,HIGH,MEDIUM,LOW,VERY LOW

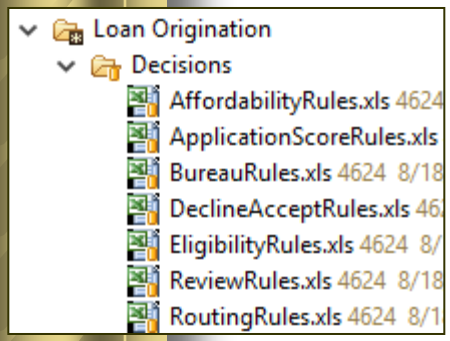
Showing Decision Variables with Current Values

- All variables are shown with their current values:



Business Rules

- Business Rules are defined in Excel files in the DMN style:



DecisionTable DetermineCreditContingencyFactor

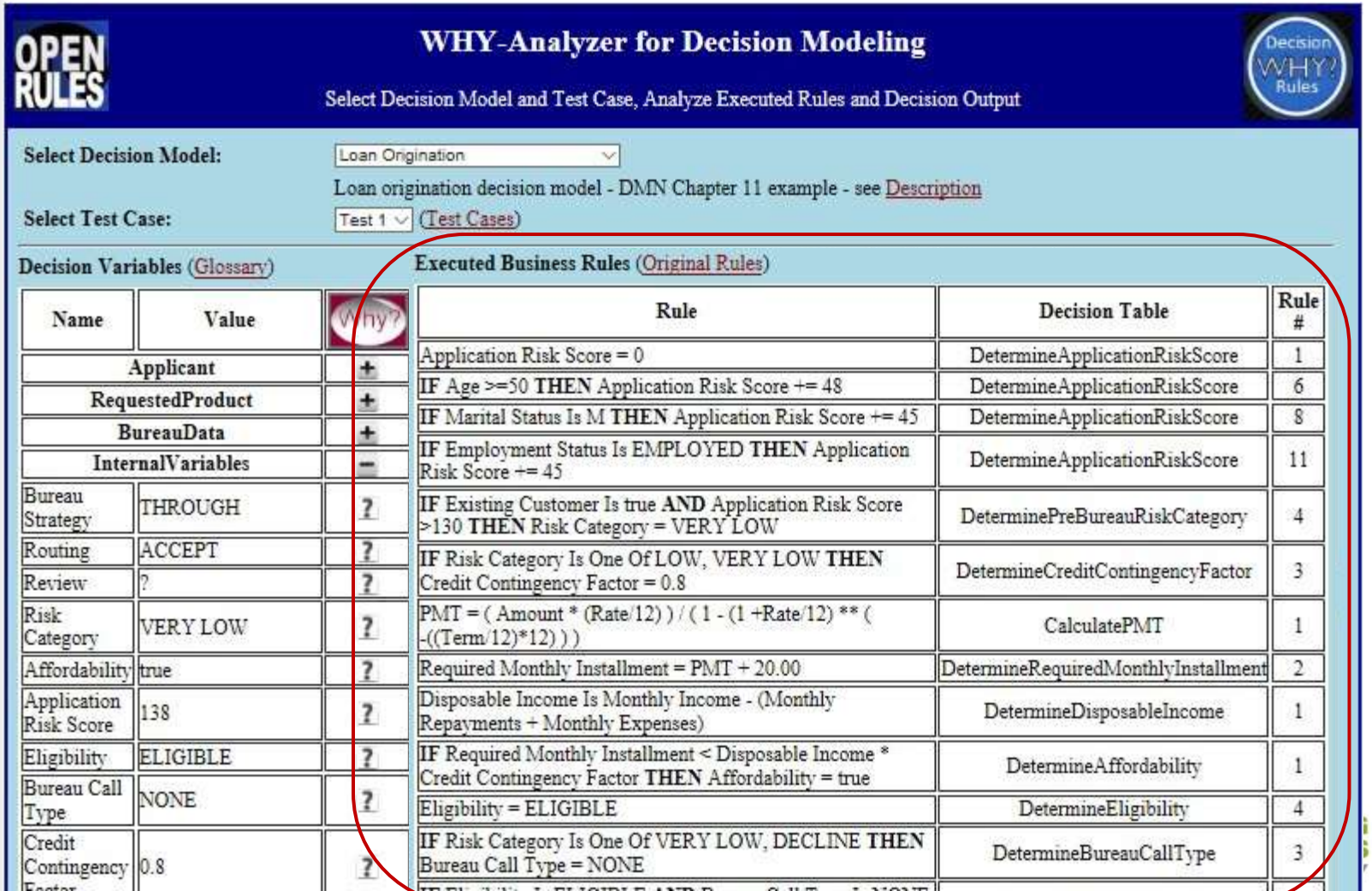
Condition		Action
Risk Category		**Credit Contingency Factor**
Is One Of	HIGH,DECLINE	0.6
Is	MEDIUM	0.7
Is One Of	LOW, VERY LOW	0.8

DecisionTableMultiHit DetermineApplicationRiskScore

If	Condition		Condition		Conclusion	
Age	**Marital Status**		**Employment Status**		**Application Risk Score**	
					=	0
[18..21]					+=	32
[22..25]					+=	35
[26..35]					+=	40
[36..49]					+=	43
>=50					+=	48
	Is	S			+=	25
	Is	M			+=	45
			Is	UNEMPLOYED	+=	15
			Is	STUDENT	+=	18
			Is	EMPLOYED	+=	45
			Is	SELF-EMPLOYED	+=	36

Showing Executed Rules

- All actually executed rules are shown:



WHY-Analyzer for Decision Modeling

Select Decision Model and Test Case, Analyze Executed Rules and Decision Output

Select Decision Model: Loan Origination

Loan origination decision model - DMN Chapter 11 example - see Description

Select Test Case: Test 1 (Test Cases)

Decision Variables (Glossary)

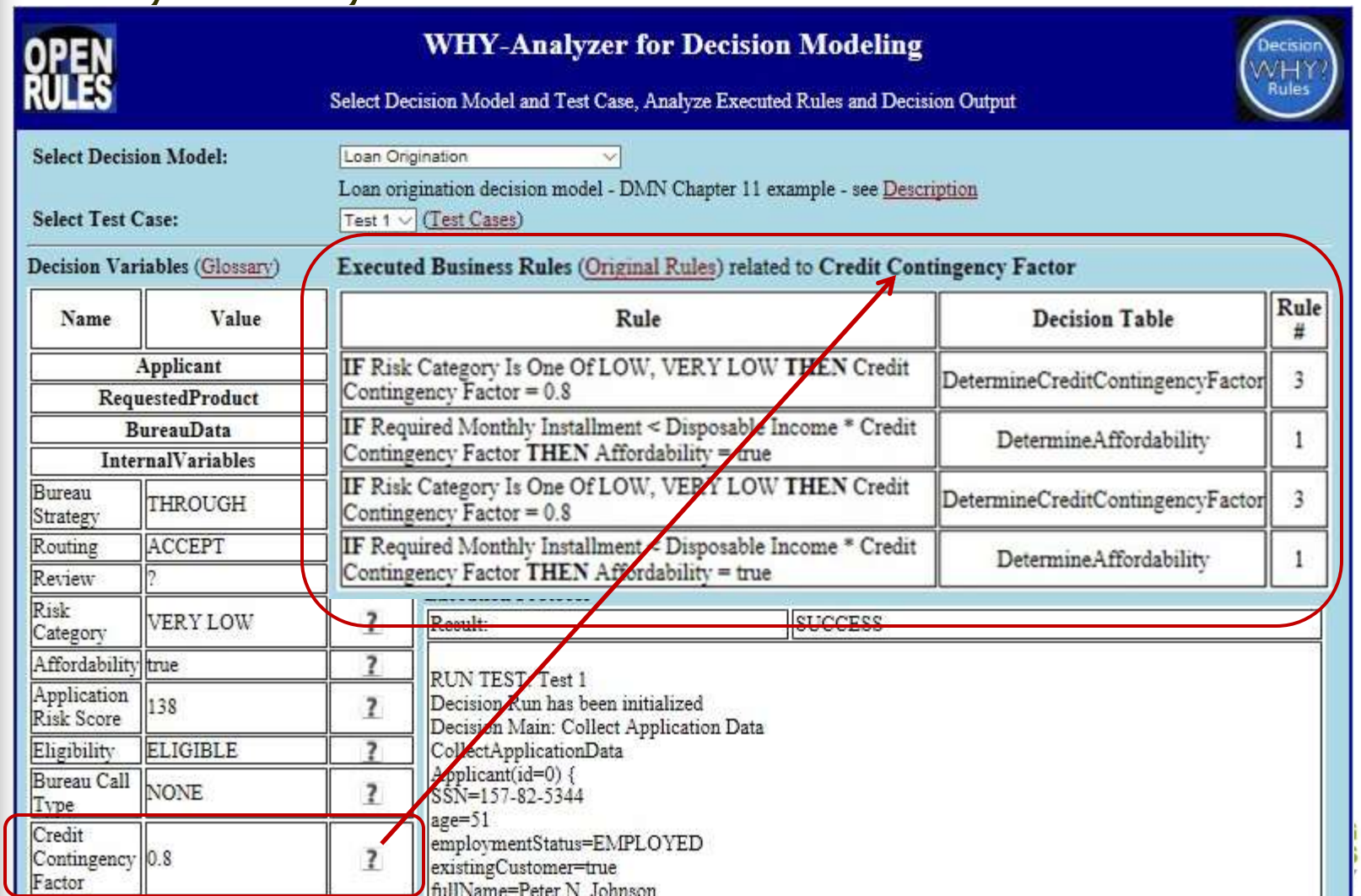
Name	Value	Why?
Applicant		+
RequestedProduct		+
BureauData		+
InternalVariables		−
Bureau Strategy	THROUGH	?
Routing	ACCEPT	?
Review	?	?
Risk Category	VERY LOW	?
Affordability	true	?
Application Risk Score	138	?
Eligibility	ELIGIBLE	?
Bureau Call Type	NONE	?
Credit Contingency Factor	0.8	?

Executed Business Rules (Original Rules)

Rule	Decision Table	Rule #
Application Risk Score = 0	DetermineApplicationRiskScore	1
IF Age >=50 **THEN** Application Risk Score += 48	DetermineApplicationRiskScore	6
IF Marital Status Is M **THEN** Application Risk Score += 45	DetermineApplicationRiskScore	8
IF Employment Status Is EMPLOYED **THEN** Application Risk Score += 45	DetermineApplicationRiskScore	11
IF Existing Customer Is true **AND** Application Risk Score >130 **THEN** Risk Category = VERY LOW	DeterminePreBureauRiskCategory	4
IF Risk Category Is One Of LOW, VERY LOW **THEN** Credit Contingency Factor = 0.8	DetermineCreditContingencyFactor	3
PMT = (Amount * (Rate/12)) / (1 - (1 +Rate/12) ** (-((Term/12)*12)))	CalculatePMT	1
Required Monthly Installment = PMT + 20.00	DetermineRequiredMonthlyInstallment	2
Disposable Income Is Monthly Income - (Monthly Repayments + Monthly Expenses)	DetermineDisposableIncome	1
IF Required Monthly Installment < Disposable Income * Credit Contingency Factor **THEN** Affordability = true	DetermineAffordability	1
Eligibility = ELIGIBLE	DetermineEligibility	4
IF Risk Category Is One Of VERY LOW, DECLINE **THEN** Bureau Call Type = NONE	DetermineBureauCallType	3

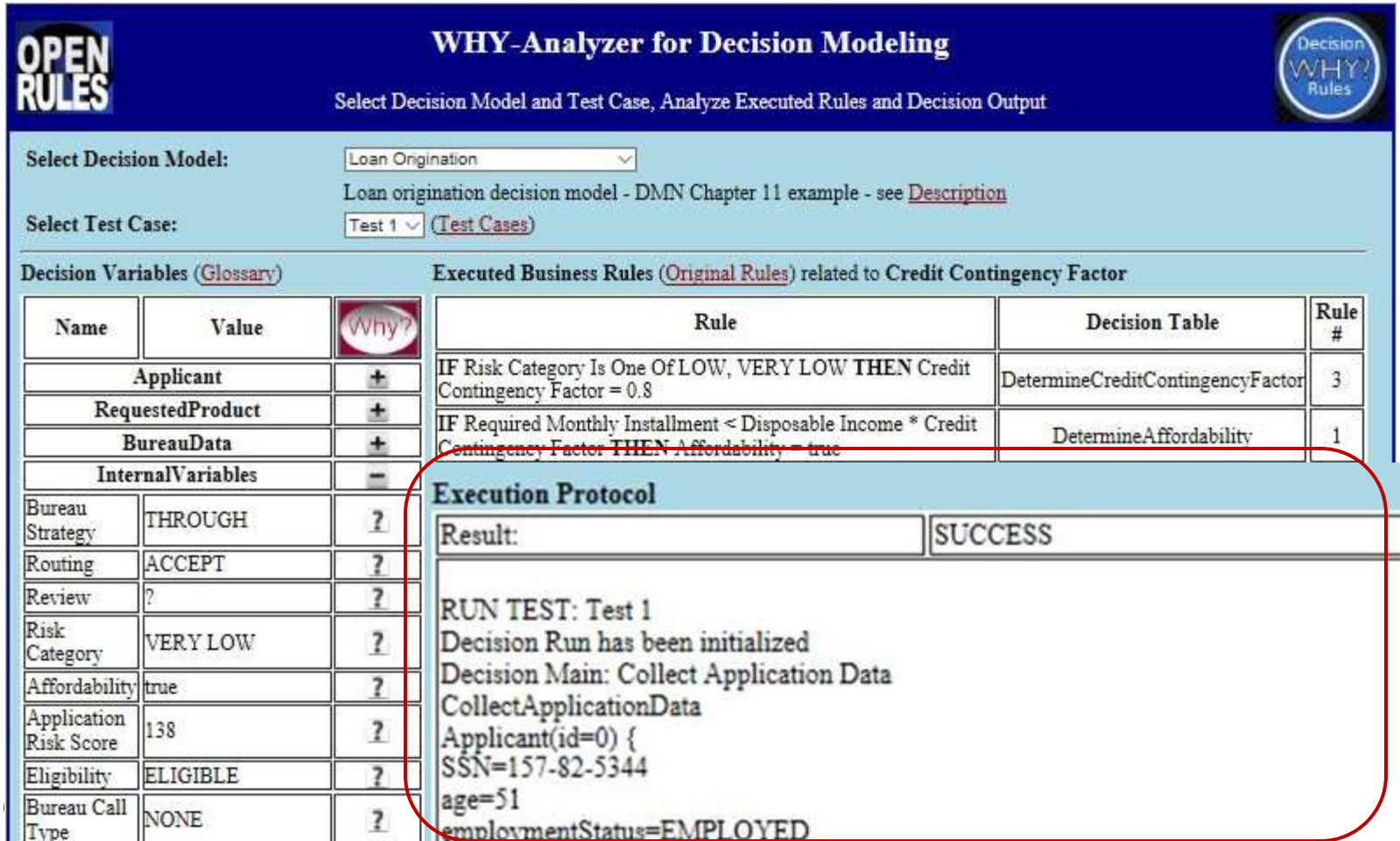
Show Only Executed Rules Related to Certain Variable

- Only actually executed rules are shown:



Showing Execution Protocol

- Execution protocol shows ALL executed actions in the actual execution order:



WHY-Analyzer for Decision Modeling

Select Decision Model and Test Case, Analyze Executed Rules and Decision Output

Select Decision Model: Loan Origination

Loan origination decision model - DMN Chapter 11 example - see Description

Select Test Case: Test 1 (Test Cases)

Decision Variables (Glossary)

Name	Value	Why?
Applicant		+
RequestedProduct		+
BureauData		+
InternalVariables		−
Bureau Strategy	THROUGH	?
Routing	ACCEPT	?
Review	?	?
Risk Category	VERY LOW	?
Affordability	true	?
Application Risk Score	138	?
Eligibility	ELIGIBLE	?
Bureau Call Type	NONE	?

Executed Business Rules (Original Rules) related to **Credit Contingency Factor**

Rule	Decision Table	Rule #
IF Risk Category Is One Of LOW, VERY LOW **THEN** Credit Contingency Factor = 0.8	DetermineCreditContingencyFactor	3
IF Required Monthly Installment < Disposable Income * Credit Contingency Factor **THEN** Affordability = true	DetermineAffordability	1

Execution Protocol

Result:	SUCCESS

RUN TEST: Test 1
Decision Run has been initialized
Decision Main: Collect Application Data
CollectApplicationData
Applicant(id=0) {
SSN=157-82-5344
age=51
employmentStatus=EMPLOYED

Showing Execution Protocol

Here is an example of the execution protocol for a simple decision model "Hello Customer":

Execution Protocol

Result:	SUCCESS

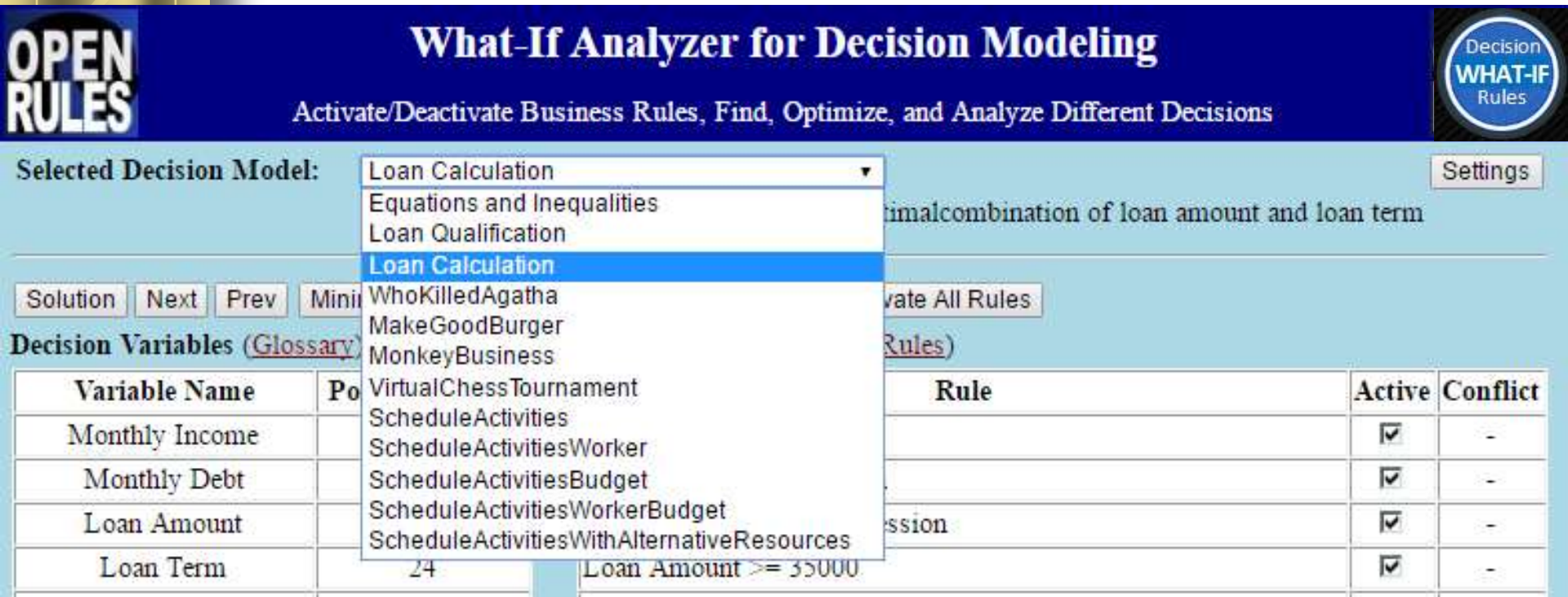
```
RUN TEST: Test 1
Decision Run has been initialized
Decision DetermineCustomerGreeting: Show Customer
Customer(id=0) {
name=Robinson
age=0
currentHour=20
dob=Mon Jan 15 12:02:14 GMT-05:00 1990
gender=Female
isChild=false
maritalStatus=Married
}
Decision DetermineCustomerGreeting: Define Current Time
Conclusion: Current Hour Is 20 [20]
Decision DetermineCustomerGreeting: Define Greeting Word
Assign: Greeting = Good Evening [Good Evening]
Decision DetermineCustomerGreeting: Define Age
Assign: Age = 26 [26]
Decision DetermineCustomerGreeting: Define Child
Decision DetermineCustomerGreeting: Define Salutation Word
Assign: Salutation = Mrs. [Mrs.]
Decision DetermineCustomerGreeting: Define Result
Assign: Result = Good Evening, Mrs. Robinson! [Good Evening, Mrs. Robinson!]
Decision DetermineCustomerGreeting: Show Result
Good Evening, Mrs. Robinson!
Decision has been finalized
Validating results for the test
Test 1 was successful
```

Live Demo

Why-Analyzer for Decision Modeling

Introducing "What-If Analyzer"

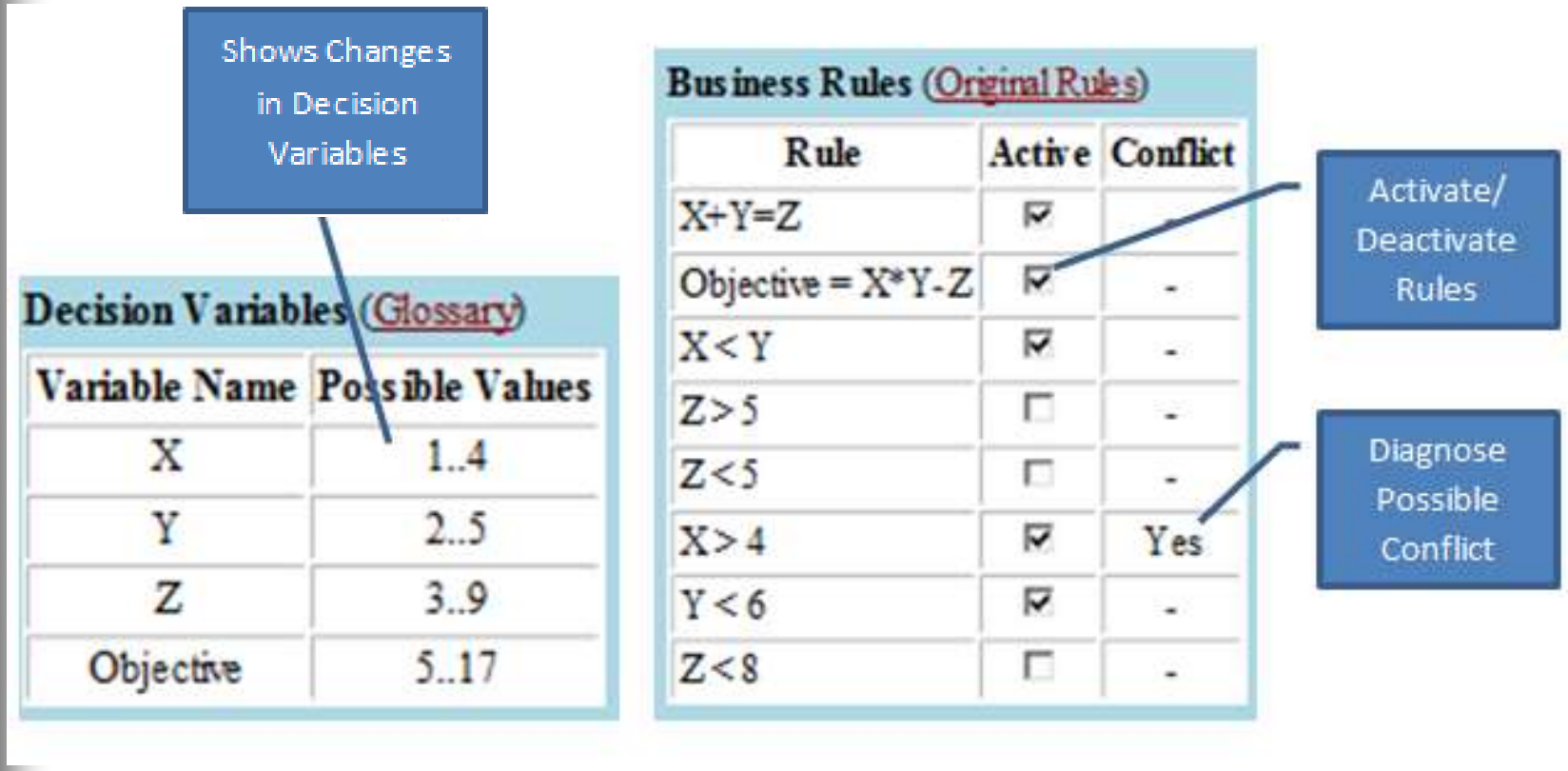
- OpenRules has also developed another graphical tool "**What-If Analyzer for Decision Modeling**"
- It is oriented to business analysts who create and maintain DMN-based decision models



What-If Analyzer Key Features

- Activation/Deactivation of different rules and with an immediate propagation of these actions
- Finding One Solution
- Navigating through Multiple Feasible Solutions
- Finding Optimal Solutions that minimize/maximize a user-defined business objective

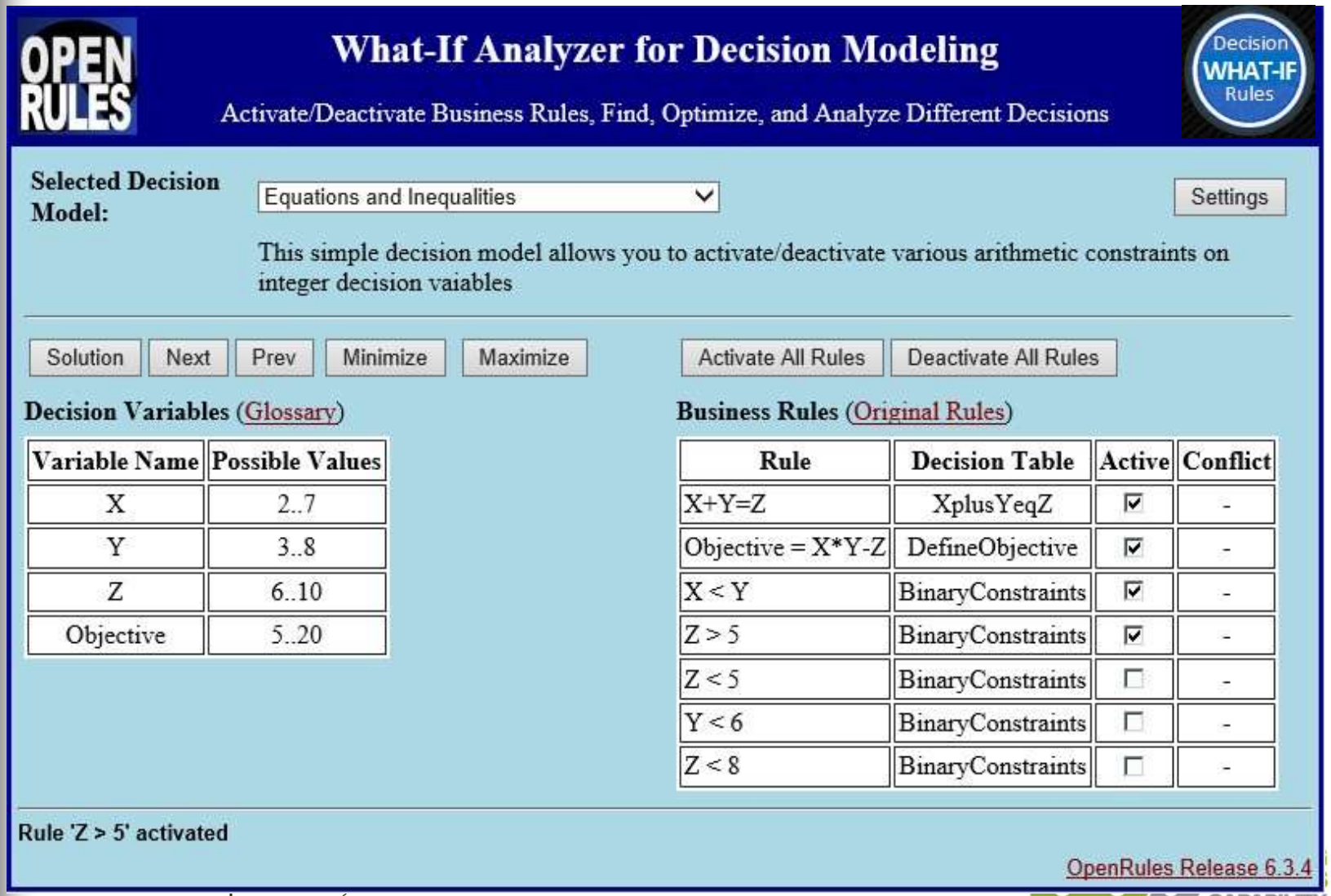
What-If Analyzer: Major Features



Decision Model "Simple Arithmetic Problem"

- There are 3 variables X, Y, and Z defined from 0 to 10
- Constraints:
  - **X < Y**
  - **X + Y = Z**
- Variable "Objective" is defined from 5 to 20:
  - **Objective = X*Y - Z**
- Find values of X, Y and Z that maximize or minimize Objective

Decision Model "Simple Arithmetic Problem"



Live Demo

What-If Analyzer

for

Decision Modeling

Decision Model "Loan Calculation"

- In real-world you do not want to lose a potential customer by simply rejecting the loan application
- Your decision model should offer the best possible loan amount and loan term when the application still will be accepted

Loan Application

- **Given**
  - **Loan Amount (35K- 75K)**
  - **Loan Term (24, 36, 72 months)**
- **Don’t reject**
  - **Recommend acceptable Amounts and Terms**

Loan Approval Application

Solution | Next | Prev | Minimize | Maximize | Activate All Rules | Deactivate All Rules

Decision Variables (Glossary)

Variable Name	Possible Values
Monthly Income	4100
Monthly Debt	2600
Loan Amount	50000
Loan Term	24
Total Income	98400
Total Debt	62400
Accumulated Debt	112400
Income Validation Result	UNSUFFICIENT

Loan Amount $50,000 produces UNSUFFICENT Income Validation Result

Business Rules (Original Rules)

Rule	Active	Conflict
Total Debt = expression	☑	-
Total Income = expression	☑	-
Accumulated Debt = expression	☑	-
Loan Amount = 50000	☑	-
Loan Amount >= 35000	☑	-
Loan Amount <= 75000	☑	-
Loan Amount >= 40000	☐	-
Loan Amount >= 50000	☐	-
Loan Amount >= 60000	☐	-
Loan Term = 24	☑	-
Loan Term = 36	☐	-
Loan Term = 72	☐	-
Loan Term <= 36	☐	-
IF Total Income > Accumulated Debt THEN Income Validation Result = SUFFICIENT	☑	-
IF Total Income <= Accumulated Debt THEN Income Validation Result = UNSUFFICIENT	☑	-
Income Validation Result = SUFFICIENT	☑	Yes

Rule 'Loan Amount = 50000' activated (with errors)

Decision Model "Loan Calculation"

Decision Variables (Glossary)

Variable Name	Possible Values
Monthly Income	4100
Monthly Debt	2600
Loan Amount	35000..35999
Loan Term	24
Total Income	98400
Total Debt	62400
Accumulated Debt	97400..98399
Income Validation Result	SUFFICIENT

Business Rules (Original Rules)

Rule	Active	Conflict
Total Debt = expression	☑	-
Total Income = expression	☑	-
Accumulated Debt = expression	☑	-
Loan Amount >= 35000	☑	-
Loan Amount = 50000	☐	-
Loan Amount <= 75000	☑	-
Loan Amount >= 40000	☐	-
Loan Amount >= 50000	☐	-
Loan Amount >= 60000	☐	
Loan Term = 24	☑	
Loan Term = 36	☐	
Loan Term = 72	☐	
Loan Term <= 36	☐	
IF Total Income > Accumulated Debt THEN Income Validation Result = SUFFICIENT	☑	
IF Total Income <= Accumulated Debt THEN Income Validation Result = UNSUFFICIENT	☑	
Income Validation Result = SUFFICIENT	☑	

Rule 'Loan Amount = 50000' deactivated

Decision Variables (Glossary)

Variable Name	Possible Values
Monthly Income	4100
Monthly Debt	2600
Loan Amount	53999
Loan Term	36
Total Income	147600
Total Debt	93600
Accumulated Debt	147599
Income Validation Result	SUFFICIENT

Maximized solution #2 found

Decision Model "Make a Good Burger"

- Offered as a DMCommunity.org Challenge
- Burger ingredient list:

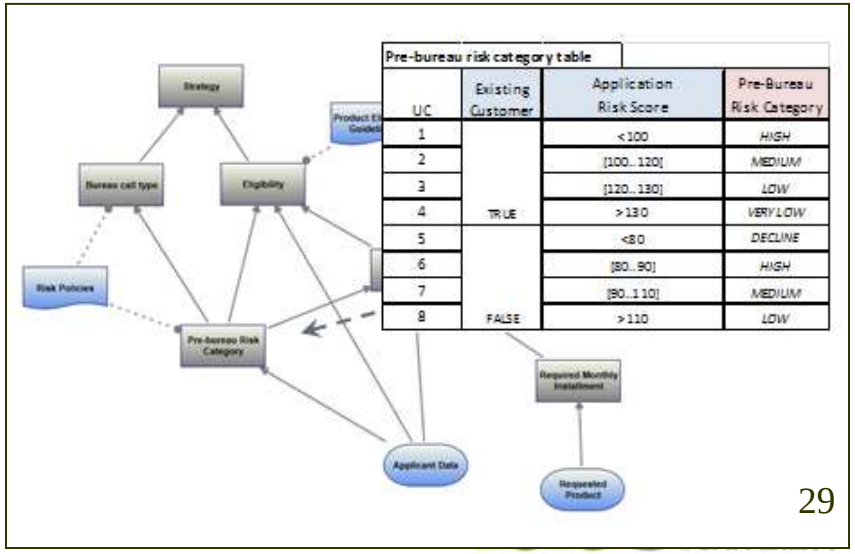
Item	Sodium(mg)	Fat(g)	Calories	Item cost($)
Beef Patty	50	17	220	$0.25
Bun	330	9	260	$0.15
Cheese	310	6	70	$0.10
Onions	1	2	10	$0.09
Pickles	260	0	5	$0.03
Lettuce	3	0	4	$0.04
Ketchup	160	0	20	$0.02
Tomato	3	0	9	$0.04

Good Burger Constraints

- Health requirements:
  - Total sodium < 3000 mg
  - Total fat < 150 grams
  - Calories < 3000
- Taste quality standards:
  - keep the servings of ketchup and lettuce the same
  - keep the servings of pickles and tomatoes the same.
- **Question:** What is the most or least expensive burger you can make?

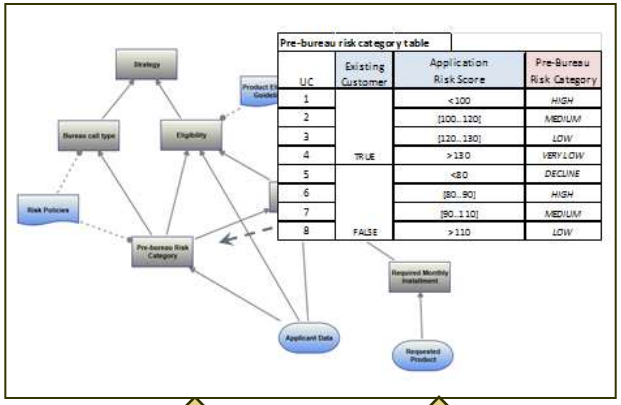
DMN - the OMG Standard for Decision Model and Notation

- Specifies key concepts and constructs for business decision modeling
- Available since Sep-2013
- Latest Release 1.1 published this year
- Many BR and BPM vendors announced their DMN support



Importing DMN Decision Models to Business Analyzers

Decision Model in DMN Interchange Format



Pre-bureau risk category table

UC	Existing Customer	Application Risk Score	Pre-Bureau Risk Category
1		<100	HIGH
2		[100..120[	MEDIUM
3		[120..130]	LOW
4	TRUE	>130	VERY LOW
5		<80	DECLINE
6		[80..90]	HIGH
7		[90..110]	MEDIUM
8	FALSE	>110	LOW

Why Analyzer

What-If Analyzer

BUILDING BUSINESS CAPABILITY

Conclusion

- The described **Why** and **What-If Analyzers** provide practical tools oriented to Business Analysts who want to analyze and tune-up their decision models
- They bring us closer to the implementation of the “Buttons” that Ron Ross correctly considers as a necessity for real-world business rules and decision management systems

QnA

Dr. JACOB FELDMAN, OpenRules Inc., CTO

jacobfeldman@openrules.com

www.OpenRules.com

"WHY" and "WHAT-IF" Buttons for Business Decision Management