Decision Modelling

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Decision Logic and Decision Task

(Ross 2011, p. 152f)
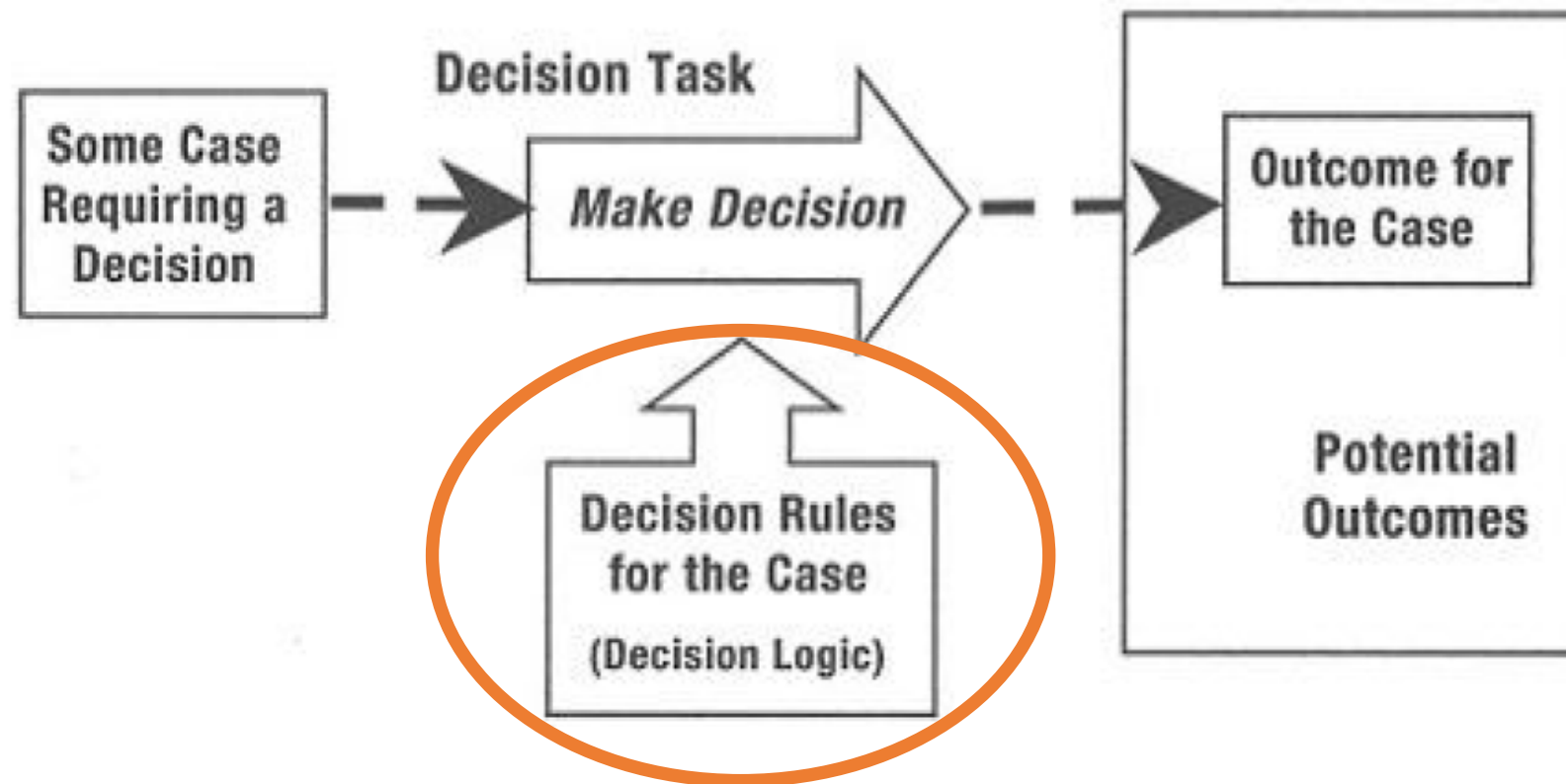
Modeling Decision Logic

- There are two well-known modeling notations for Decision Logic
  - The Decision Model
    - Based on a book from Barbara von Halle and Larry Goldberg
  - Decision Model and Notation DMN
    - A new standard from OMG

Decision Model and Notation (DMN)
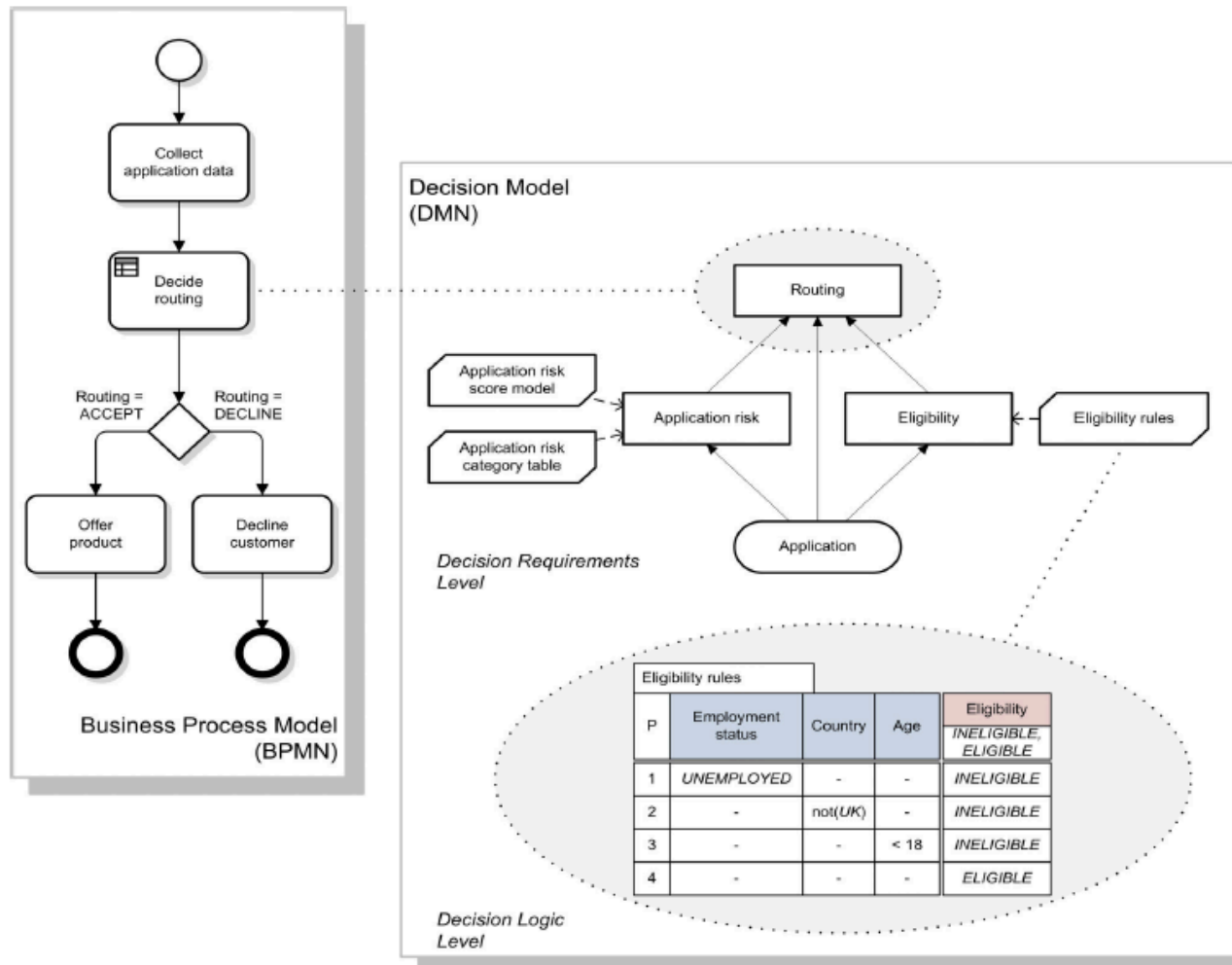
Two Different Perspectives

- Decision-making is addressed from two different perspectives by existing modeling standards:
  - Business process models (e.g., **BPMN**) can describe the coordination of decision-making within business processes by defining specific tasks or activities within which the decision-making takes place
  - Decision logic (e.g., PRR, PMML) can define the specific logic used to make individual decisions, for example as business rules, decision tables, or executable analytic models.
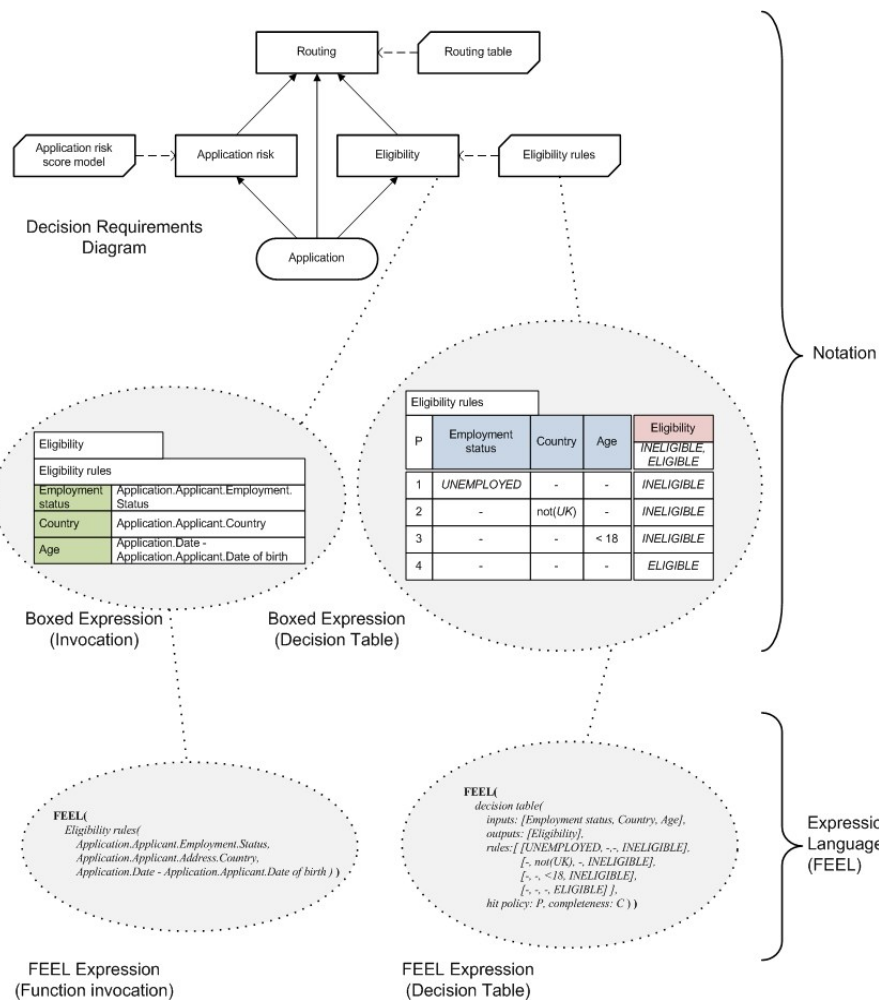
Decision Requirements Diagram

DMN will provide a third perspective – **the Decision Requirements Diagram** – forming a bridge between business process models and decision logic models:

- Business process models will define tasks within business processes where decision-making is required to occur

- Decision Requirements Diagrams will define the decisions to be made in those tasks, their interrelationships, and their requirements for decision logic

- Decision logic will define the required decisions in sufficient detail to allow validation and/or automation
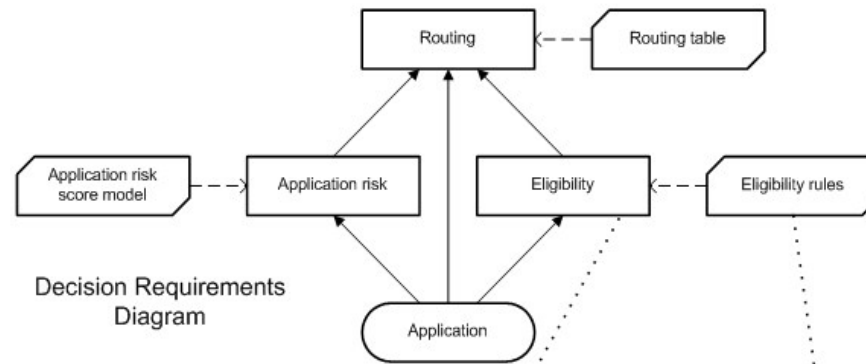
Aspects of Modelling

Decision Model and Notation (DMN)

Decision Requirements Diagram

Notation

Boxed Expression (Invocation)

Boxed Expression (Decision Table)

Expression Language (FEEL)

FEEL Expression (Function invocation)

FEEL Expression (Decision Table)

- The Decision Model and Notation is a new standard from the OMG

- It is currently published in its version 1.0

- Purpose of DMN: provide the constructs that are needed to model decision, so that organizational decision-making can be
  - readily depicted in diagrams
  - accurately defined by business analysts
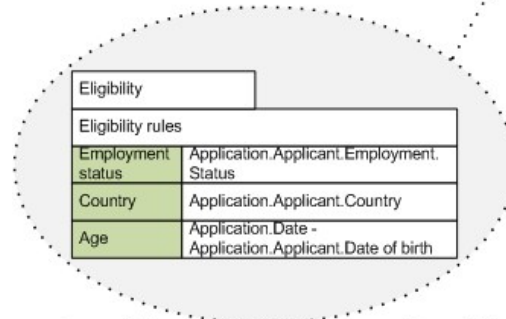 - (optionaly) automated

DMN

It defines the concept of a Decision Requirements Graph (DRG) comprising a set of elements and their connection rules, and a corresponding notation: the Decision Requirements Diagram (DRD)

It defines Decision Logic via Value expression and/or decision table

It provides a language called FEEL for defining and assembling decision tables, calculations, if/then/else logic, simple data structures, and externally defined logic from Java and PMML into executable expressions with formally defined semantic

Decision Requirements Diagram

Boxed Expression (Invocation)

Boxed Expression (Decision Table)

FEEL Expression (Function invocation)
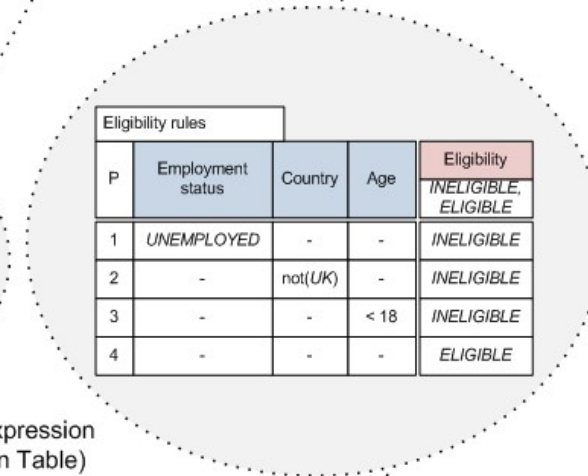
FEEL Expression (Decision Table)

Notation

Expression Language (FEEL)

Scope and Uses of DMN

- Decision modeling is carried out by business analysts in order to understand and define the decisions used in a business or organization.

- Such decisions are typically operational decisions made in day-to-day business processes, rather than the strategic decision-making for which fewer rules and representations exist.

- Three uses of **DMN** can be discerned in this context:
  - For modeling human decision-making
  - For modeling the requirements for automated decision-making
  - For implementing automated decision-making

Main Concepts of DMN
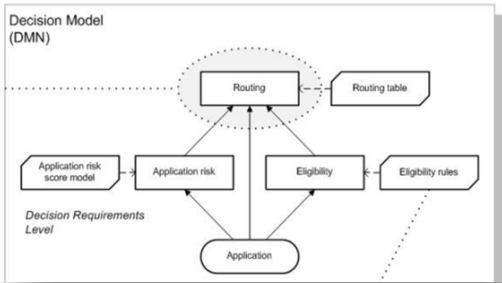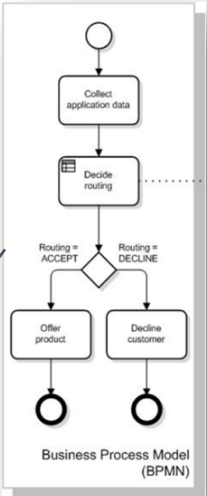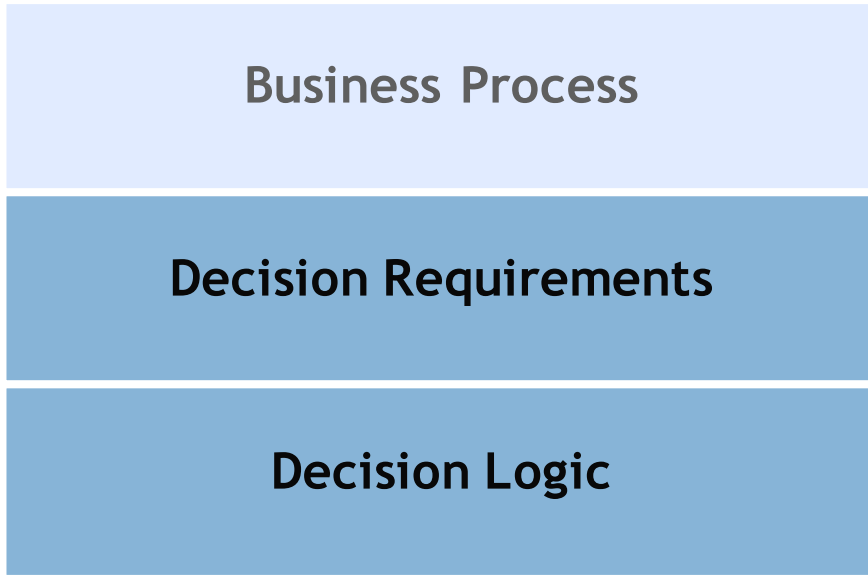
Business Process

Decision Requirements

Decision Logic

More details

(Coenen 2013)

Basic Concepts – Decision Requirements Level

- A **decision** is the act of determining an **output** value (the chosen option), from a number of **input** values, using logic defining how the output is determined from the inputs
- **Decision logic** may include one or more **business knowledge models** which encapsulate business know-how
- A decision may require multiple business knowledge models, and a business knowledge model may require multiple other business knowledge models
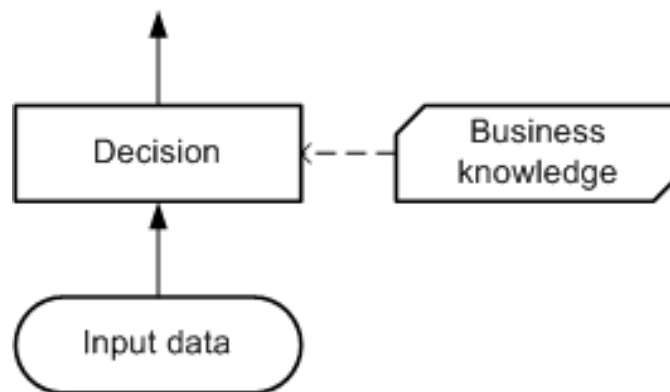
Basic Concepts – Decision Requirements Level

- Decisions can be decomposed into sub-decisions. Top level decisions can be thought of as selecting an answer from a range of possible answers. Lower level decisions often will simply provide input to other decisions

- Decisions may therefore be connected in a network called a **Decision Requirements Graph (DRG)**, which may be drawn as a **Decision Requirements Diagram** (**DRD**)
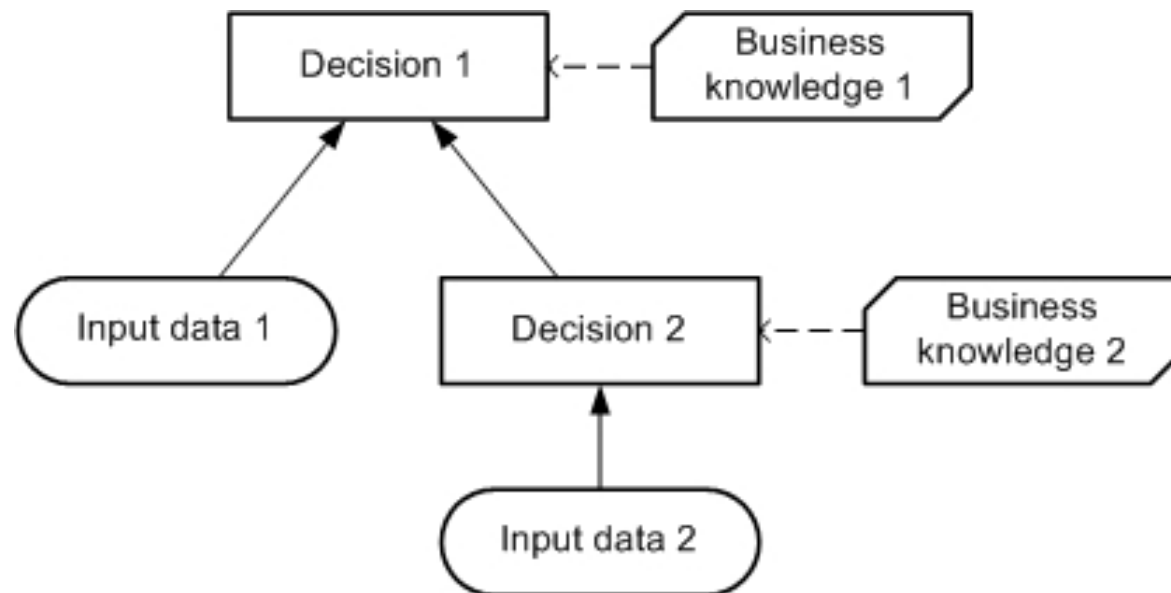
Basic Concepts – Decision Requirements Level

- A decision may require multiple business knowledge models, and a business knowledge model may require multiple other business knowledge models
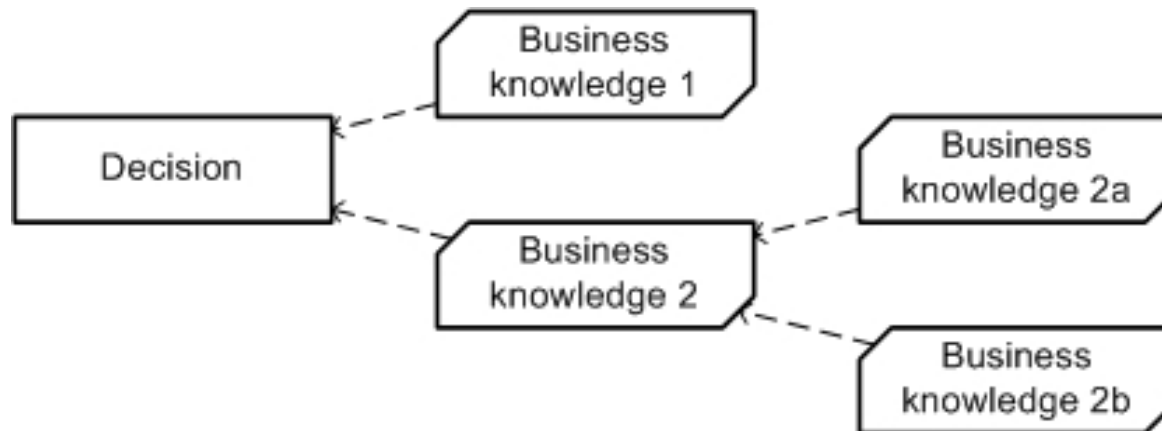
Basic Concepts – Decision Logic Level

- Using decision logic, the same components described at decision requirements level may be specified in greater detail, to capture :
  - a complete set of **business rules and calculations**
  - **(if desired) to allow the decision-making to be fully automated**

Decision and corresponding value expression

- At the decision logic level, every decision in a DRG is defined using a **value expression** which specifies how the decision's output is determined from its inputs

- The decision is considered to *be* the evaluation of the expression

- The value expression may be notated using a **boxed expression**
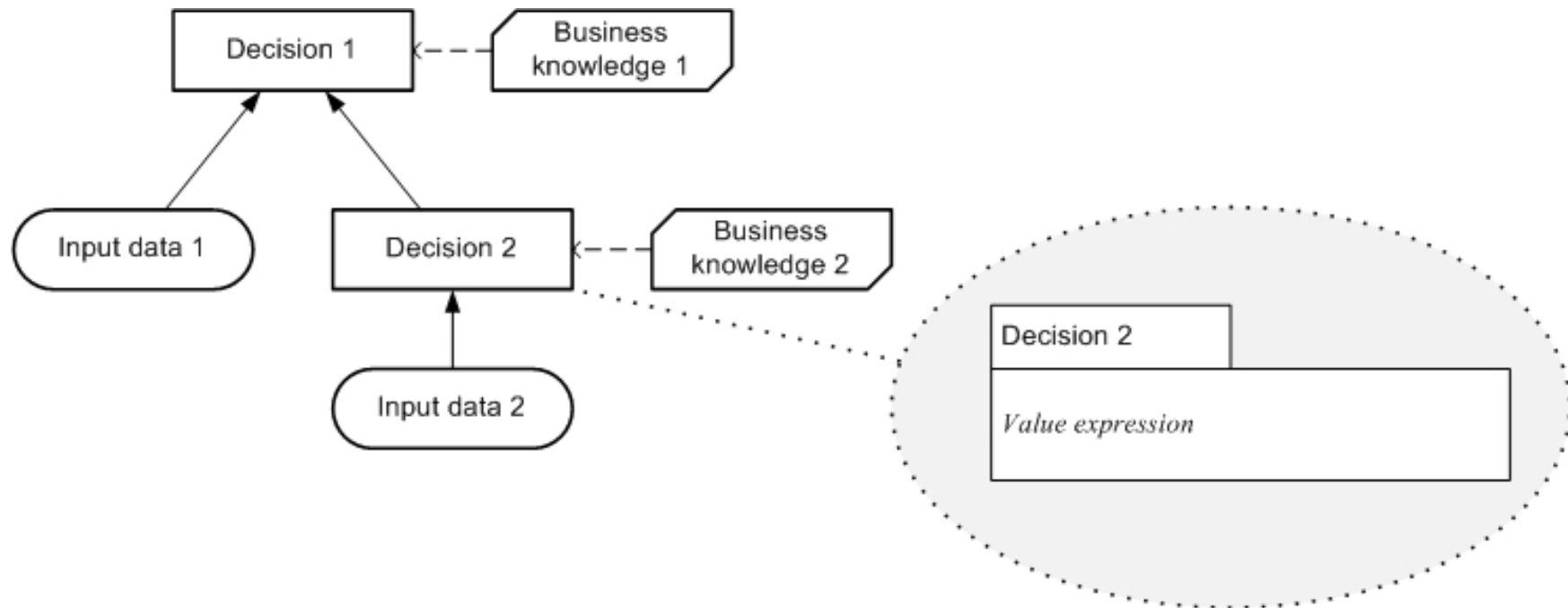
Business knowledge model and corresponding value expression

- At the decision logic level, a business knowledge model is defined using a value expression that specifies how an output is determined from a set of inputs

- Value expressions may be encapsulated as functions, which may be invoked from decisions' value expressions
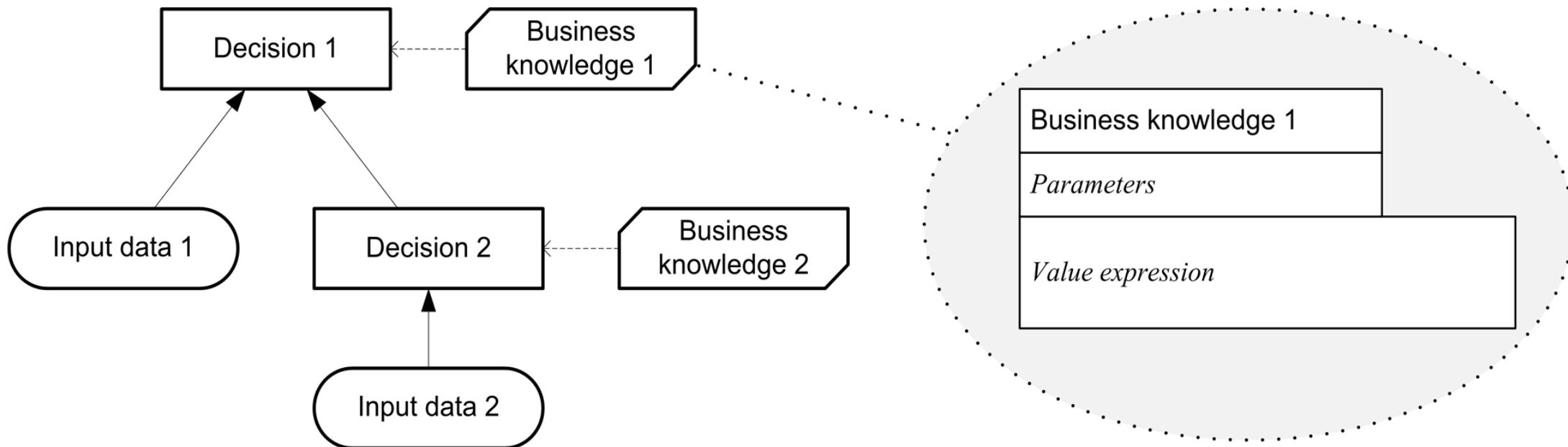
Business knowledge model and corresponding decision table

- A business knowledge model may contain any decision logic which is capable of being represented as a function

- This will allow the import of many existing decision logic modeling standards (e.g., for business rules and analytic models) into **DMN**

- An important format of business knowledge, specifically supported in **DMN**, is the Decision Table

- Such a business knowledge model may be notated using a **Decision Table**
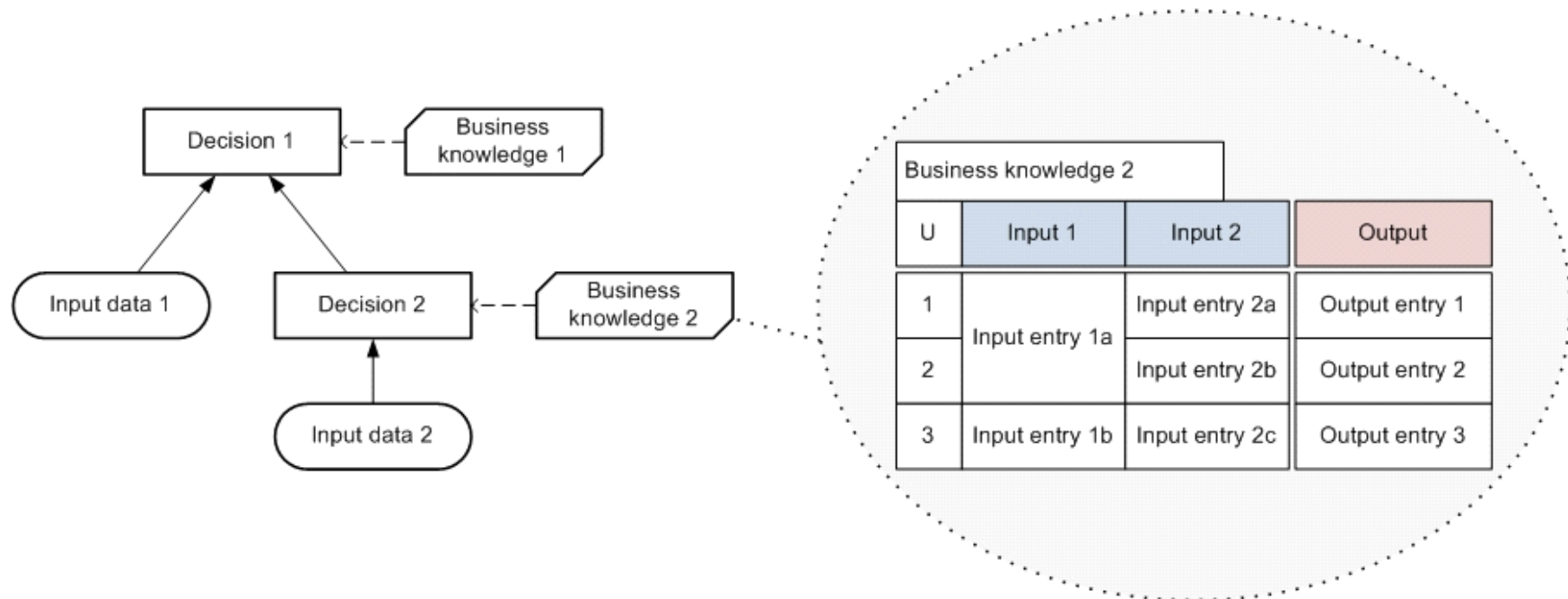
Main concepts – Decision Requirements Level

- Business concepts only

- Business decisions

- Areas of business knowledge

- Sources of business knowledge

Decision Requirements

(Coenen 2013)
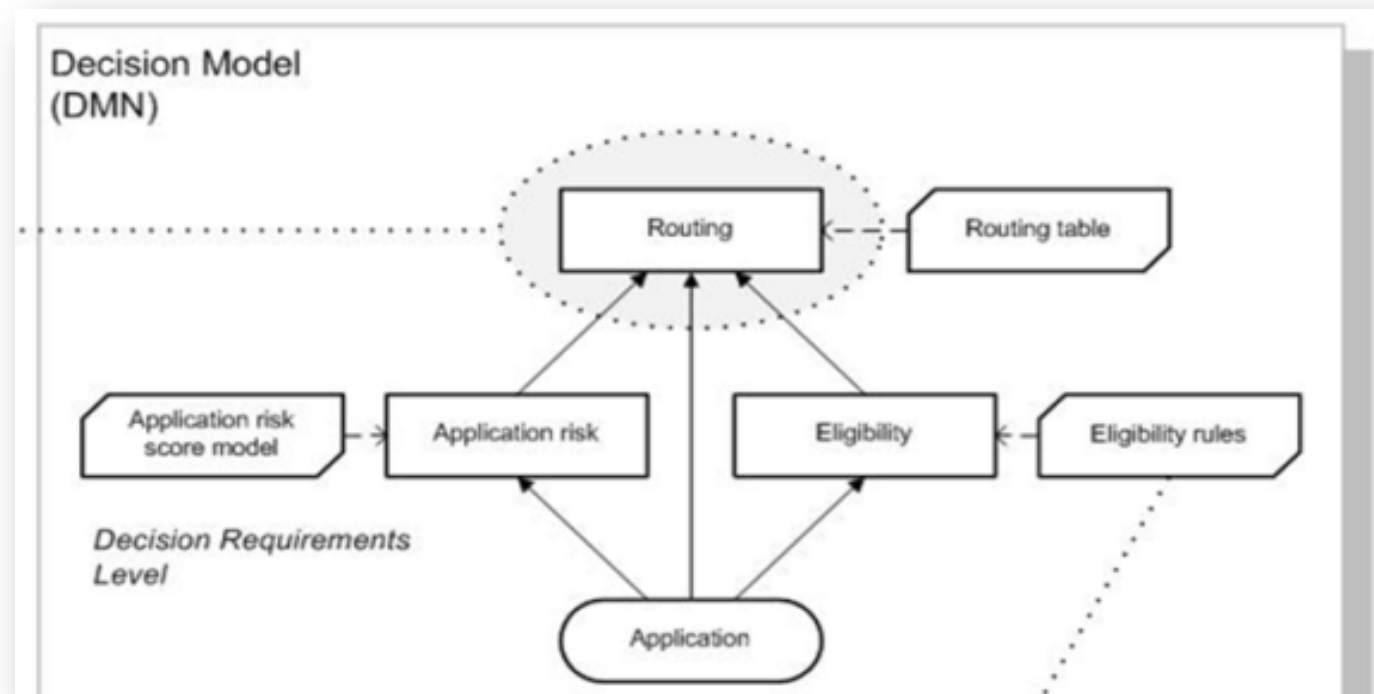
DRD Elements
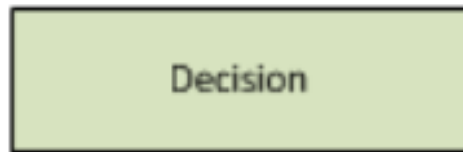
Decision	The determination of an output from a number of inputs, using decision logic, which may reference one or more Business Knowledge Models
Business Knowledge Model	A function encapsulating knowledge, such as a decision table
Input Data	Information used as an input to one or more decisions. Provides the parameters for a Business Knowledge Model
Knowledge Source	Has authority for a Business Knowledge Model or Decision
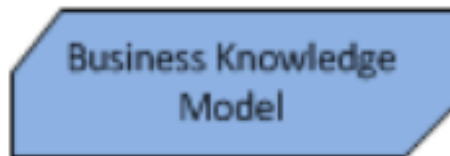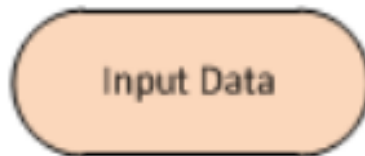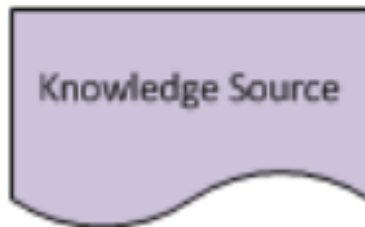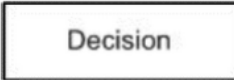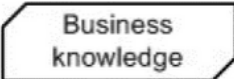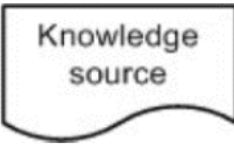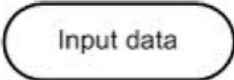
Constructs of a Decision Requirements Model

Construct	DMN Notation	Description
ELEMENTS		
Decision	Decision	The act of determining an output from a number of inputs, using decision logic which may reference one or more business knowledge models.
Business Knowledge Model	Business knowledge	A function encapsulating business knowledge, in the form of business rules, decision table or analytic model. Some of the tool may not support this element. In such case the decision logic is directly linked to the Decision rather than the business knowledge model.
Knowledge Source	Knowledge source	The authority for a business knowledge model or decision.
Input Data	Input data	Information used as an input by one or more decisions. It also denotes the parameters of a Business Knowledge Model.
REQUIREMENTS		
Information Requirement	⟶	Information – input data or decision output – required for a decision.
Knowledge Requirement	--------→	The invocation of a business knowledge model.
Authority Requirement	--------●	Showing the knowledge source of an element or the dependency of a knowledge source on input data.

Decision
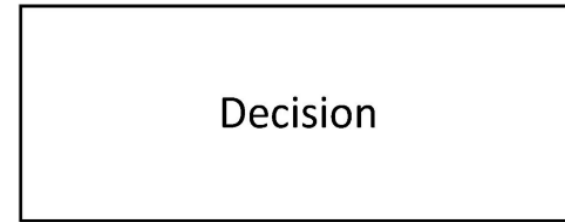
Decision

- A **decision** is the act of determining an **output** value (the chosen option), from a number of **input** values, using logic defining how the output is determined from the inputs

- Two properties should be captured for every decision:
  - Question: A natural language statement that represents the decision in the form of a question. This should be specific and detailed.
  - Allowed Answers: A natural language description of the possible answers to this question.

- For action-oriented decisions, the allowed answers represent the responses that the process must handle when the decision model is invoked by a business rule task

Business Knowledge Models

Business Knowledge
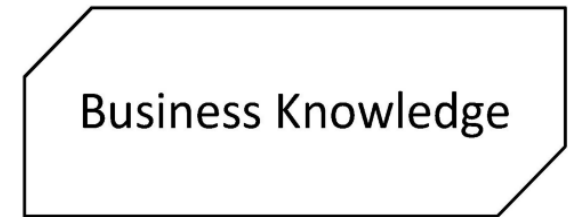
- Business knowledge models represent functions that encapsulate reusable decision making logic. The logic they encapsulate might be a set of business rules, a decision tree, a decision table, or an analytic model.

- The specifics of knowledge representation involved need not be displayed on the diagram but could be.

- The decision logic that can be specified in a business knowledge model can also be linked directly to a decision, but encapsulating it in a business knowledge model allows it to be reused, parameterized and displayed on a Decision Requirements Diagram

Input Data

Input Data

- Decisions require inputs, and many of these are input data, which is data that is input to the decision making from outside the decision context.

- Input data elements typically represent business entities that are being used in the decision making, such as Policy or Customer. However, sometimes they can represent any information element at any level of detail.

- Each input data element can be described in terms of a hierarchical information model that specifies exactly what information elements comprise the input data.

Decision with the Listed Input Data option

Input Data drawn as elements

Input Data listed on Decisions
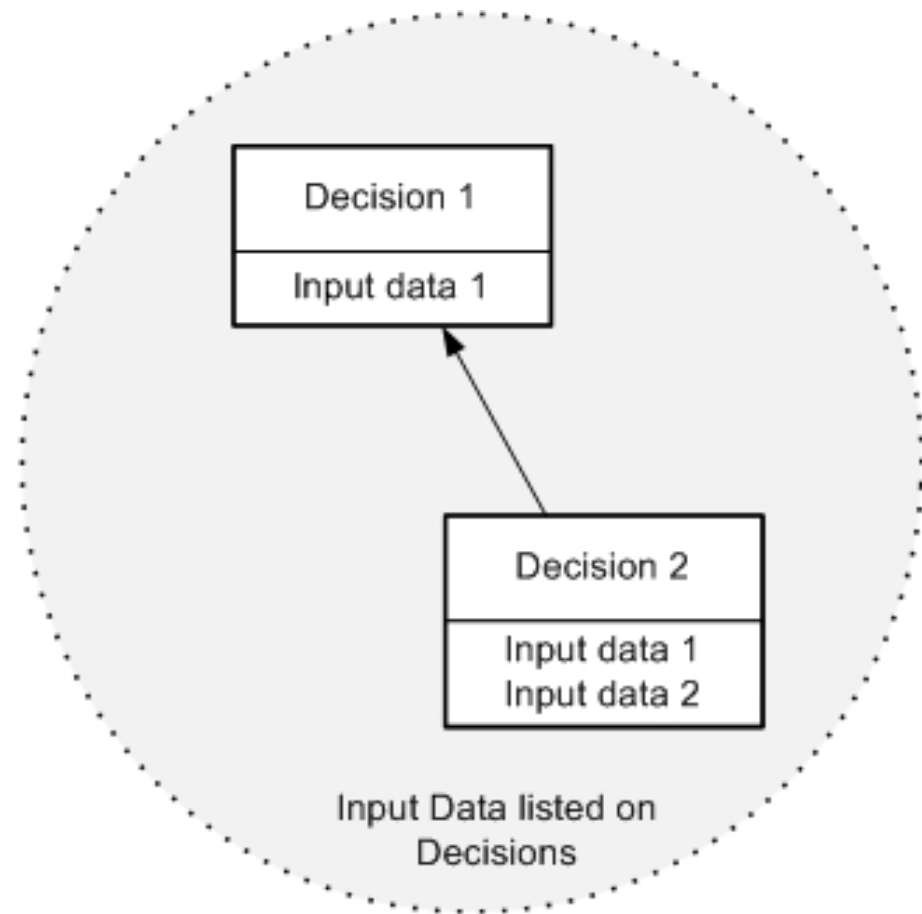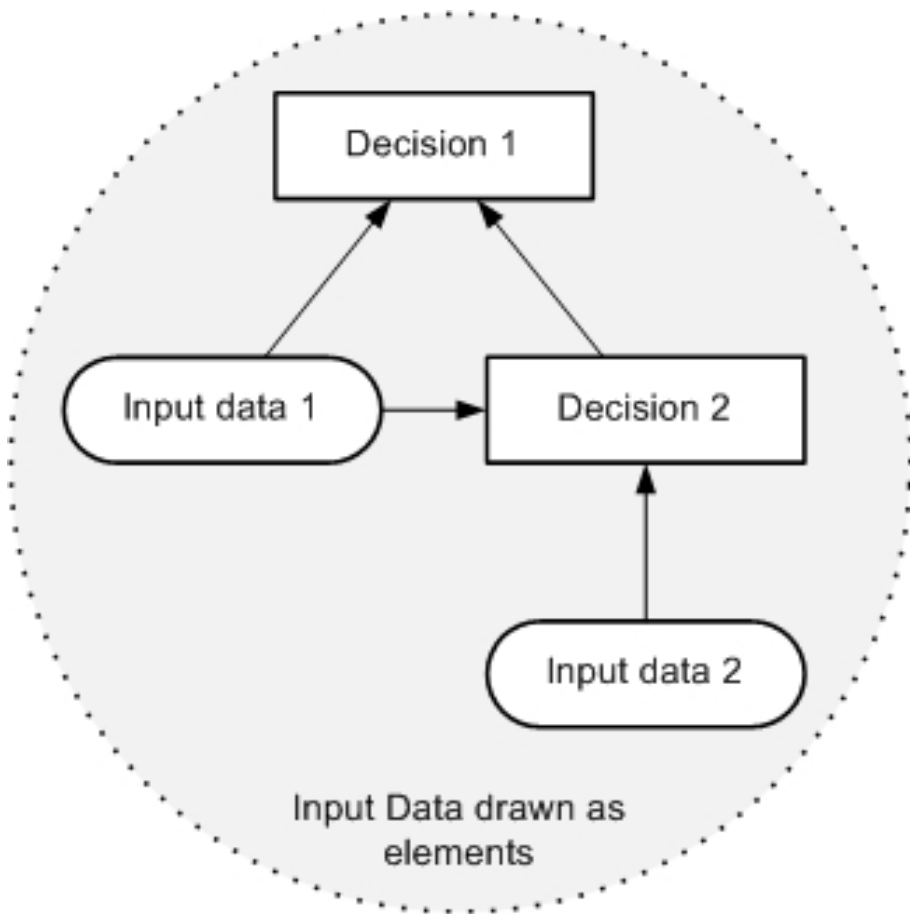
Knowledge Source
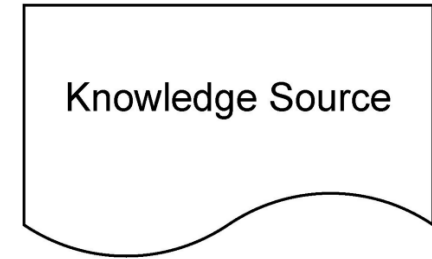
Knowledge Source

- Knowledge sources represent the source of know-how for making a decision

- This could be:
  - **Regulations or policies** about how a decision must be made, best practices or expertise on how it should be made
  - **Analytic knowledge** on how it might be made more accurate

Knowledge Sources representing authorities

- Knowledge sources are the authorities for a decision and typically refer to some external document or source that contains detailed guidance
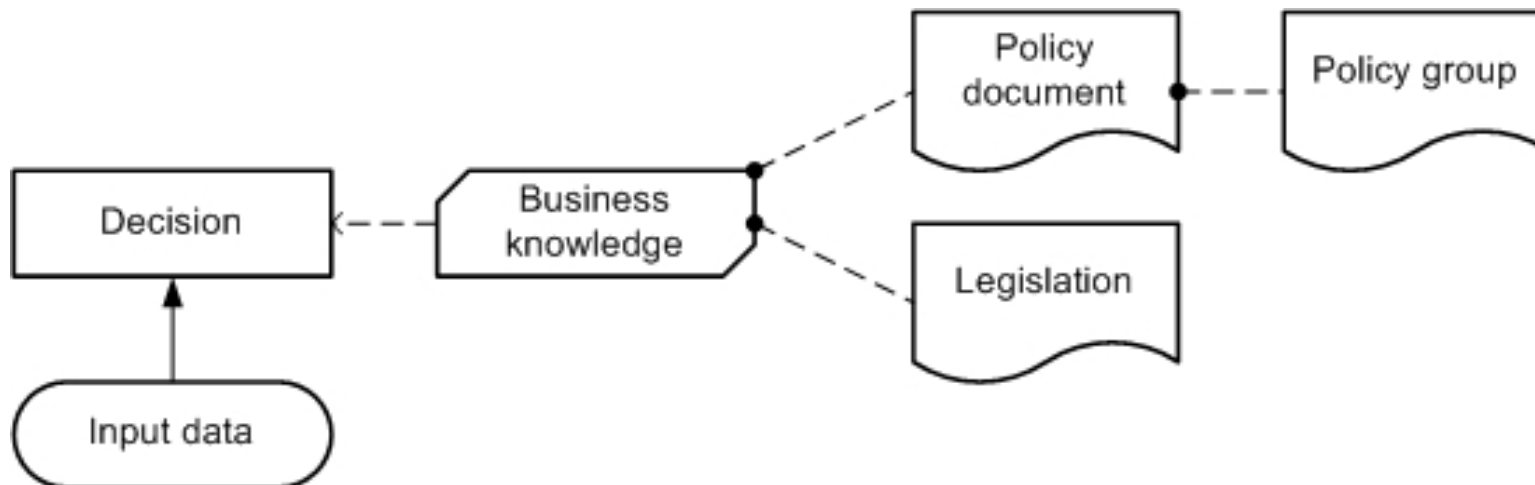
Knowledge source representing predictive analytics

- They may be drawn from **Input Data** and **Decisions to Knowledge Sources**, where, in conjunction with use (a), they represent the derivation of Business Knowledge Models from instances of Input Data and Decision results, using analytics
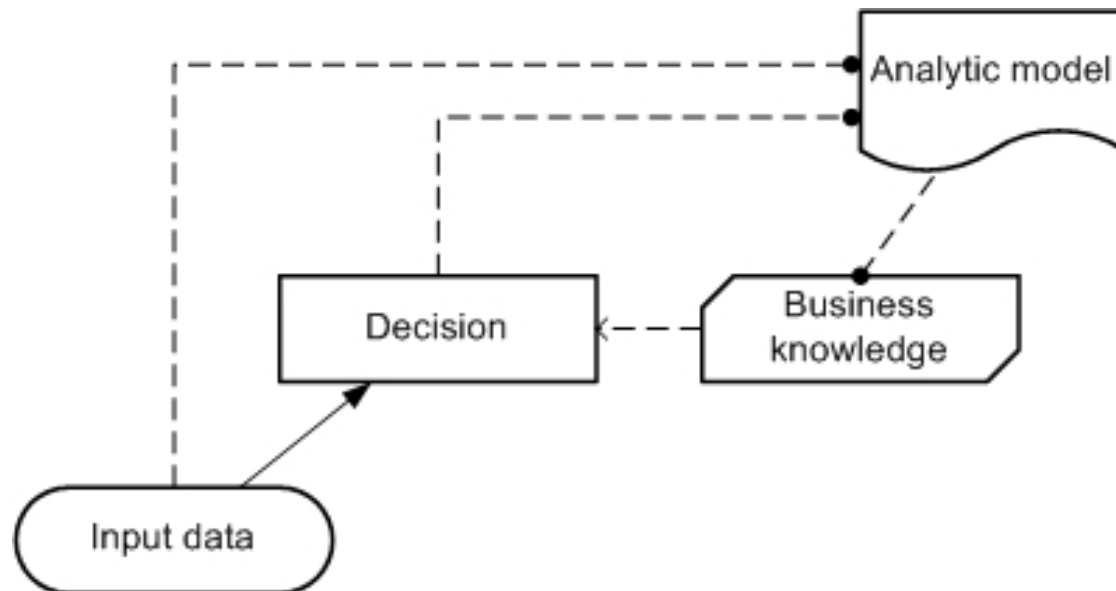
DRD Requirements

Shows that Input Data or Decision output is required as an input by another Decision

Shows that a Business Knowledge Model is invoked by a Decision or another Business Knowledge Model
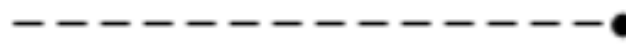
Shows the dependency of a DRD Element on a Knowledge Source

Elements and Allowed Relationships of the Requirements Graph

Decision 1 → Decision 2

Decision 1 is **used as input** for decision 2

Input data → Decision

Input data is **used as input** for decision

Decision --- Knowledge Source

Decision **depends on** Knowledge Source

Input data --- Knowledge Source

Input data **depends on** Knowledge Source

Business Knowledge --→ Decision

Business Knowledge **invokes** a Decision

Knowledge Source --- Decision

Knowledge Source **depends on** Decision

Business Knowledge 1 --→ Business Knowledge 2

Business Knowledge 1 **invokes** Business Knowledge 2

Knowledge Source --- Business Knowledge

Knowledge Source **depends on** Business Knowledge

Knowledge Source 1 --- Knowledge Source 2
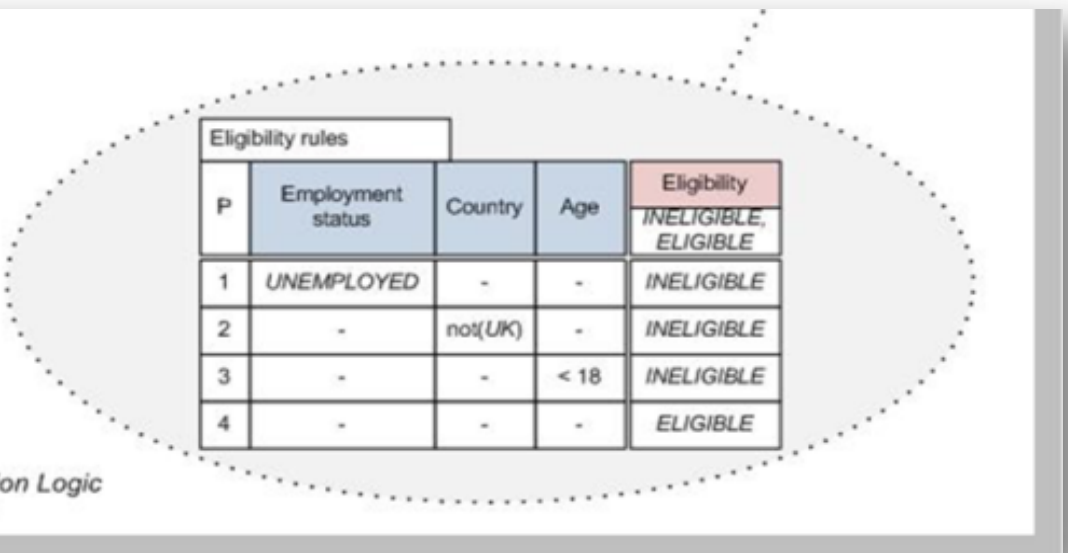
Knowledge Source1 **depends on** Knowledge Source2

(Coenen 2013)
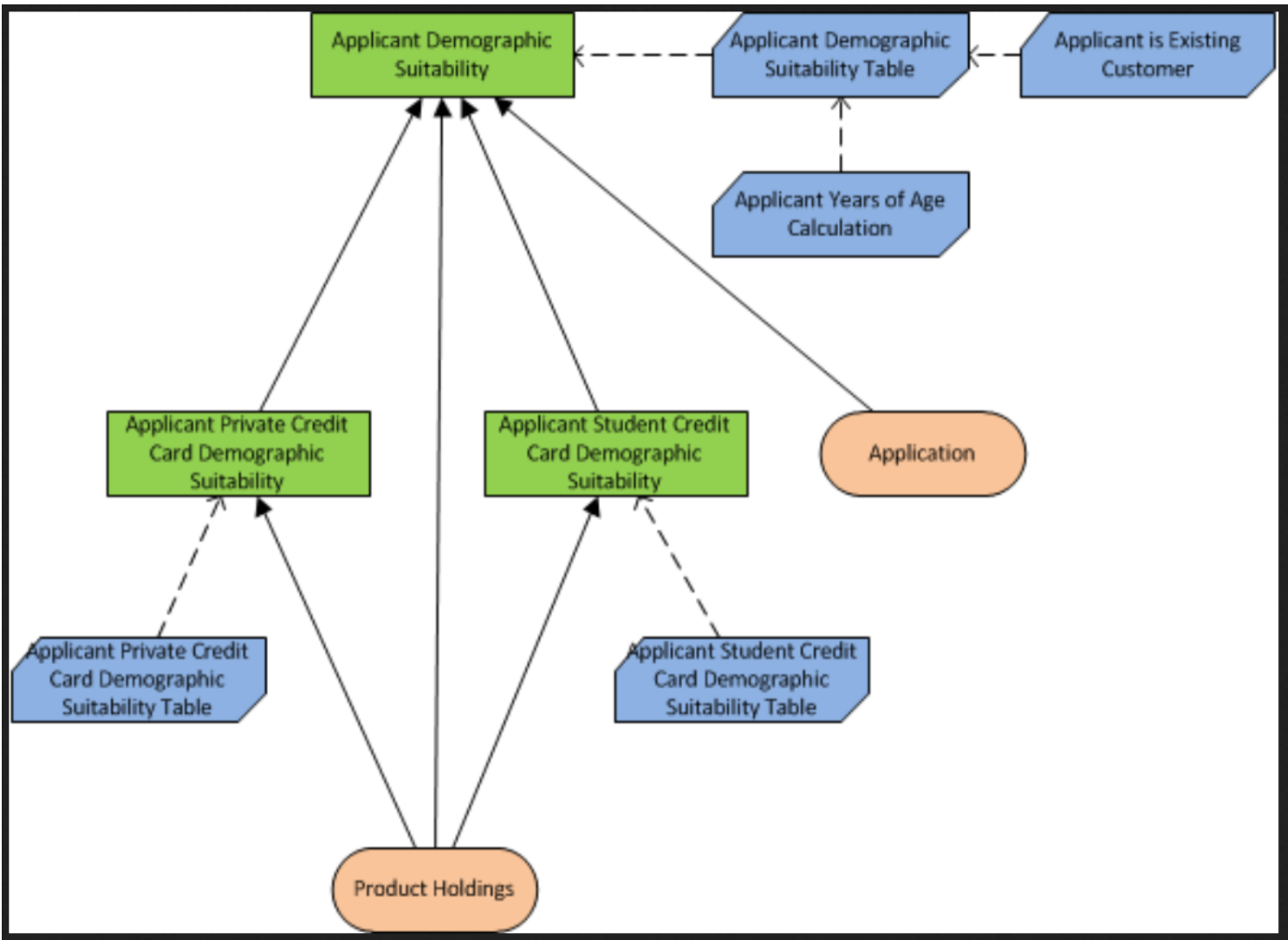
Main concepts – Decision Logic

- Greater detail
- Business rules
- Calculations
- Automated
- Display

(Coenen 2013)

Modeling Decision Logic

Text/SBVR

Supported by DMN
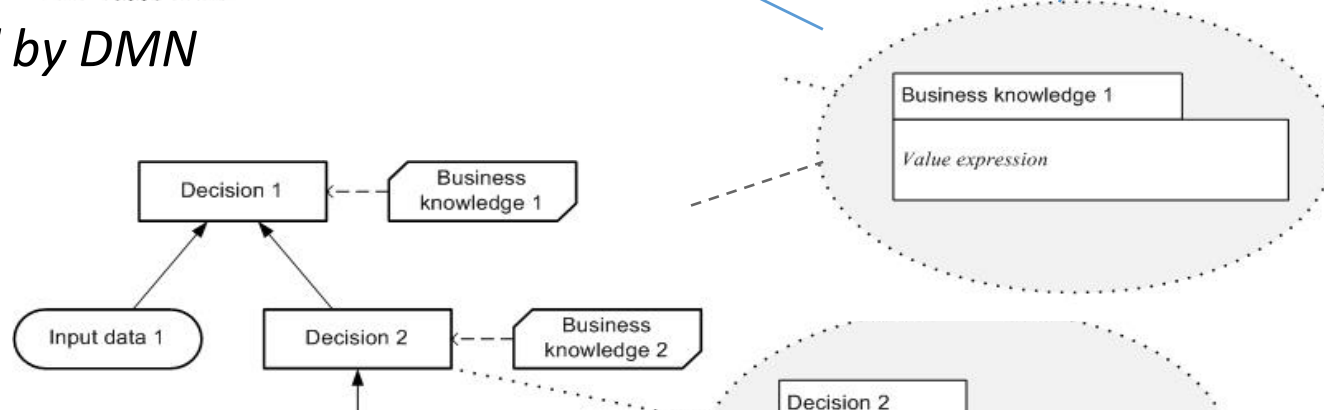
"This will allow the import of many existing decision logic modeling standards (e.g. for business rules and analytic models) into DMN"

(Coenen 2013)

"I'm here because my boss said we should use more decisions tables for our project. What types of decision tables do you sell?"

Boxed Expression

The notation for decision logic is **boxed expressions** which decompose the decision logic model into small pieces that are associated with elements of Decision Requirements Diagram
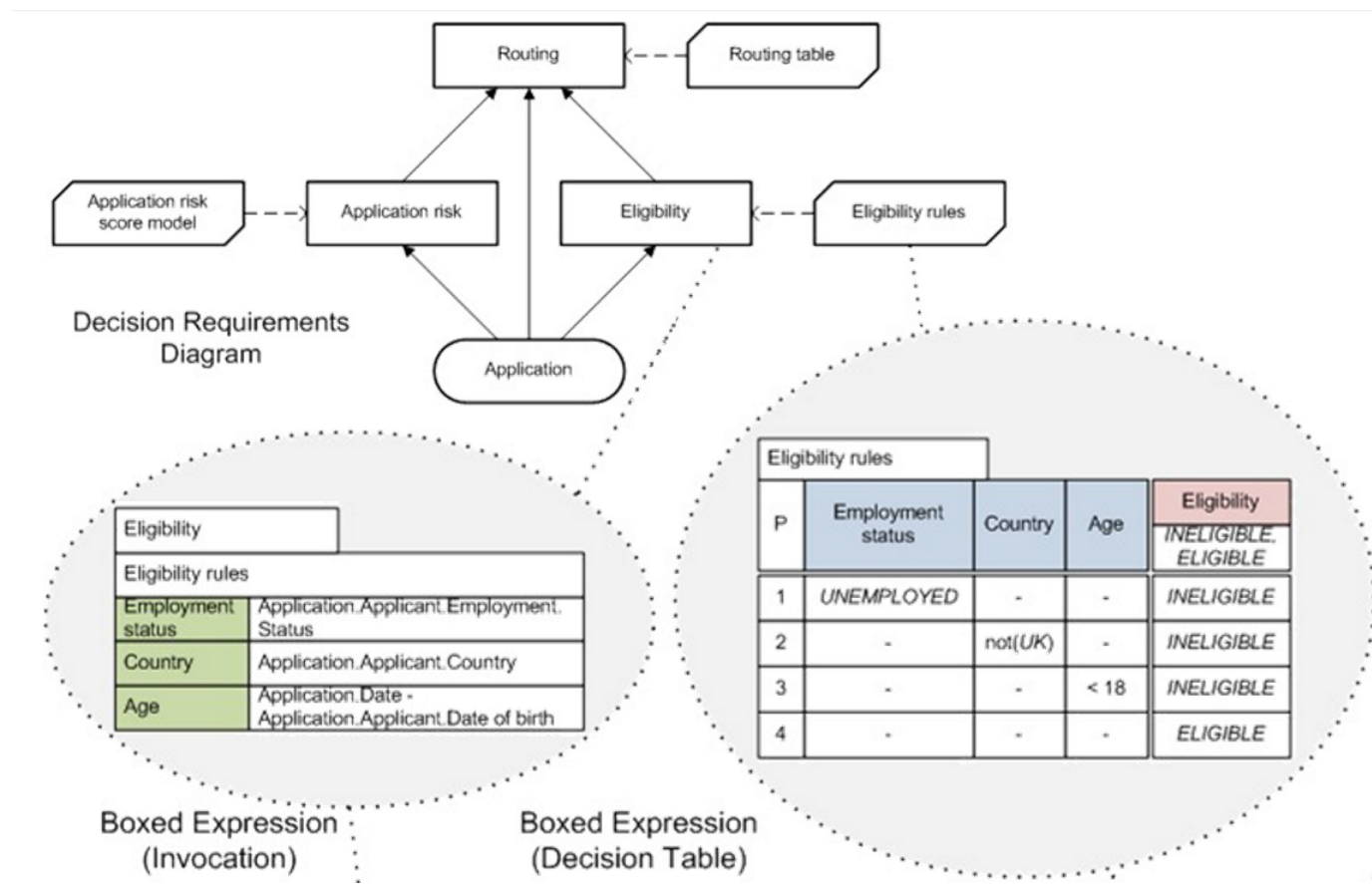
Structure of a Decision Table in DMN

Hit policy

Completeness indicator

Name of Decision Table

Set of Inputs

Output(s)
Multiple output columns allowed

Decision name			
HC	Input expression 1	Input expression 2	Output name
	value 1a, value 1b	*value 2a, value 2b*	*value 3a, value 3b*
1	value 1a	value 2a	value 3a
2	value 1b	value 2b	value 3b

Rule number

Lists of expected values (optional)

Double line between inputs section and outputs section, and between inputs/outputs headers and the rule entry cells.

Decision Tables

Employee appropriateness score

C	Region of employee = Region of customer	Claims Expenditure (estimated)	Experience of employee	Number of open claims of employee	Score
	yes/no	Number	low/medium/high	Number	Number
1	yes				100
2		[1000..10000]	low		-100
3		> 10000	low		-1000
4		> 10000	medium		-100
5				[10..20]	-100
6				[20..30]	-500
7				> 30	-1000
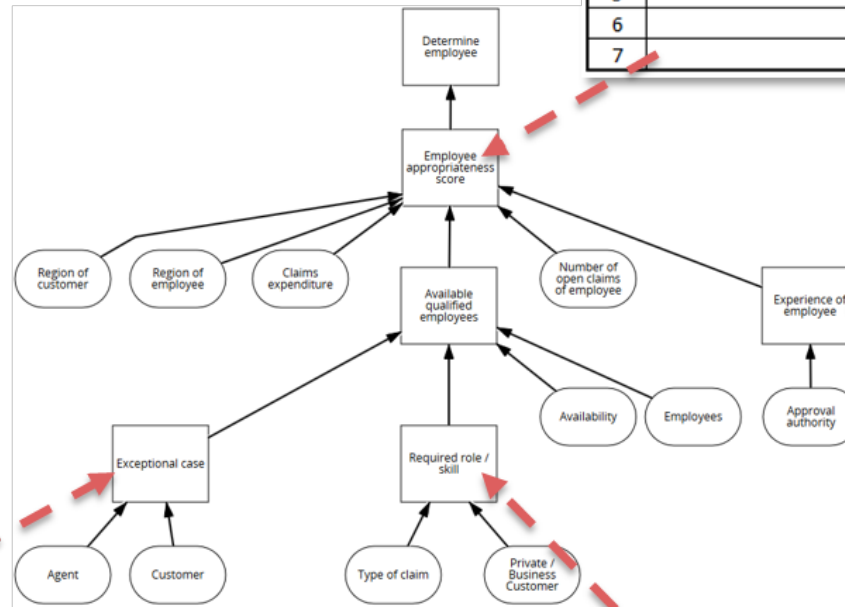
Experience of Employee

	Approval Authority	Experience
1	< 1000	low
2	[1000..10000]	medium
3	> 10000	high

Exceptional Case

	Agent Id	Customer Frame Contract Id	Required Role	Special Employee
1	4711		Special Customer Task Force Berlin	
2		0815	Special Customer Task Force Berlin	
3		camunda		Mr. Important
4	...	...	...	...

Required Skill / Role

	Type of Claim	Private/Business Customer?	Required Role	Required Skill
1	Third Party Liability	Private	Service Center	
2	Third Party Liability	Business	Service Center	Business Law Qualification
3	Accident	Private	Service Center	
4	Accident	Business	Business Accident Team	
5	...	...	...	

Decision Modeling

Hit Policies (1)

- The hit policy specifies what the result of the decision table is, if there are multiple matches for a given set of inputs.
- The hit policy indication is mandatory and is summarized using a single character in a particular decision table cell.

Single Hit Policies:

Hit Policy	Description
Unique	This is the default policy. All rules are exclusive and only a single rule is matched.
Any	Multiple matching rules, all matching rules with the same output. Any of these outputs can be used.
Priority	Multiple matching rules with different outputs. Returns the matching rule with the highest output priority which is specified in an ordered list of values, e.g. the list of expected output values.
First	Multiple matching rules with different outputs. First hit by rule order is returned. Once there is a hit, the evaluation stops (and ignore the rest of the rules). The matching has a dependency on the order of the rules. The last rule is often the *catch-remainder* rule. **This type of policy is hard to validate manually and must be used with care.**

Hit Policies (2)

Multiple Hits Policies for Single Output

Hit Policy	Description
No order	Returns all hits in a unique list in arbitrary order.
Output order	Returns all hits in decreasing priority order. Output priorities are specified in an ordered list of values.
Rule order	Returns all hits in rule order, i.e. dependency on the order of the rules.

Aggregation for Multiple Hits Policy

Aggregation	Description
Collect	The result of the decision table is the list of all the outputs, ordered or unordered per the hit policy.
Sum	The result of the decision table is the sum of all the outputs.
Min	The result of the decision table is the smallest value of all the outputs.
Max	The result of the decision table is the largest value of all the outputs.
Count	The result of the decision table is the number of outputs.
Average	The result of the decision table is the average value of all the outputs, defined as the sum divided by the count.

FEEL = Friendly Enough Expression Language

FEEL is a script language for decision tables
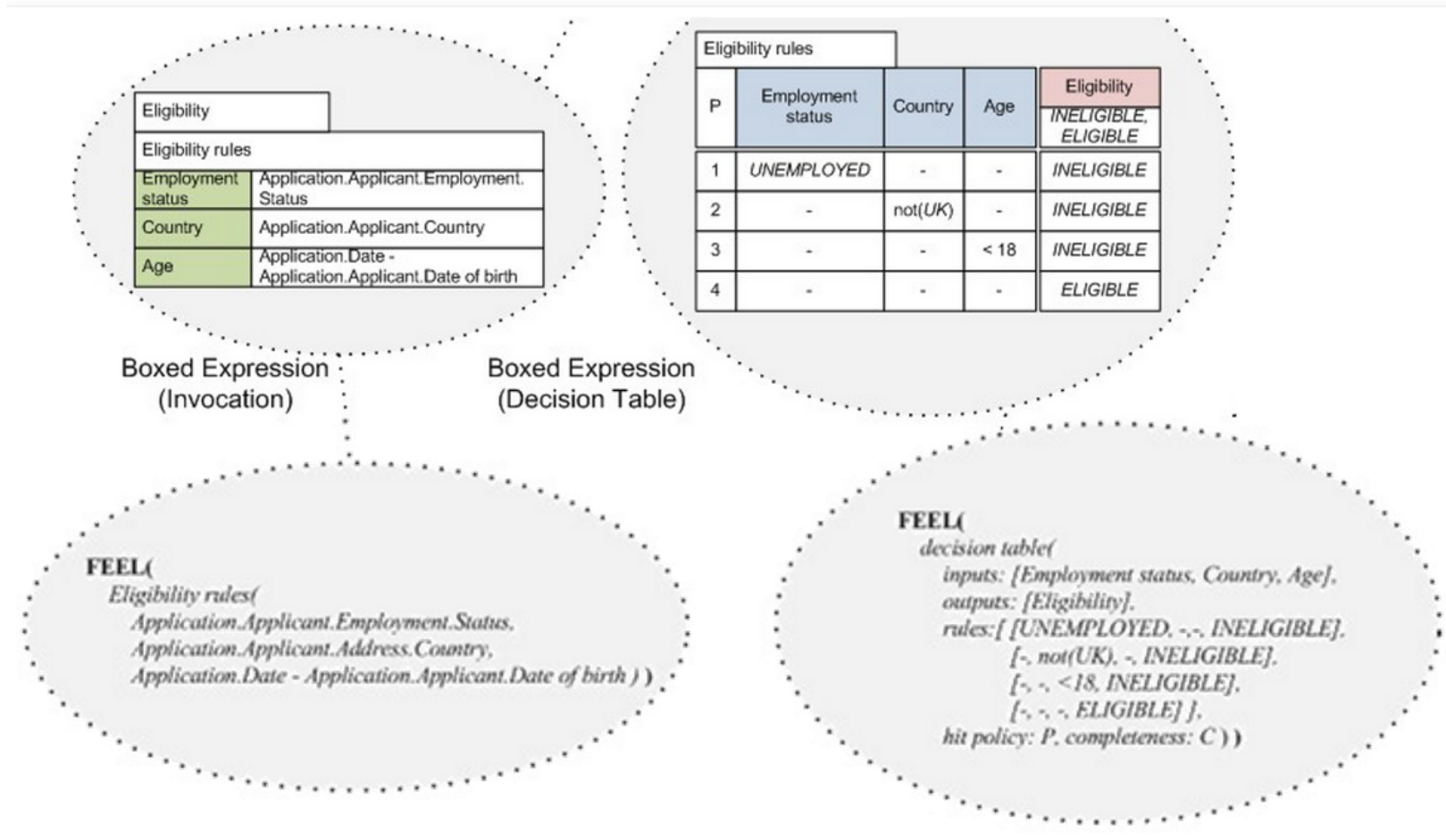
Orientation of Rules in a DMN Decision Table

Rules as Rows:

table name			
HC	**input expression 1**	**input expression 2**	**Output name**
	value 1a, value 1b	*value 2a, value 2b*	*value 1a, value 1b*
1	input entry 1a	input entry 2a	output entry 1a
2		input entry 2b	output entry 1b
3	input entry 1b	-	output entry 1a

Rules as Columns:

table name				
input expression 1	*value 1a, value 1b*	input entry 1a		input entry 1b
input expression 2	*value 2a, value 2b*	input entry 2a	input entry 2b	-
Output name	*value 1a, value 1b*	output entry 1a	output entry 1b	output entry 1a
HC		1	2	3

Rules as Crosstabs:

table name			input expression 1	
Output name			input entry 1a	input entry 1b
input expression 2	input entry 2a		output entry 1a	output entry 1a
	input entry 2b		output entry 1b	output entry 1a
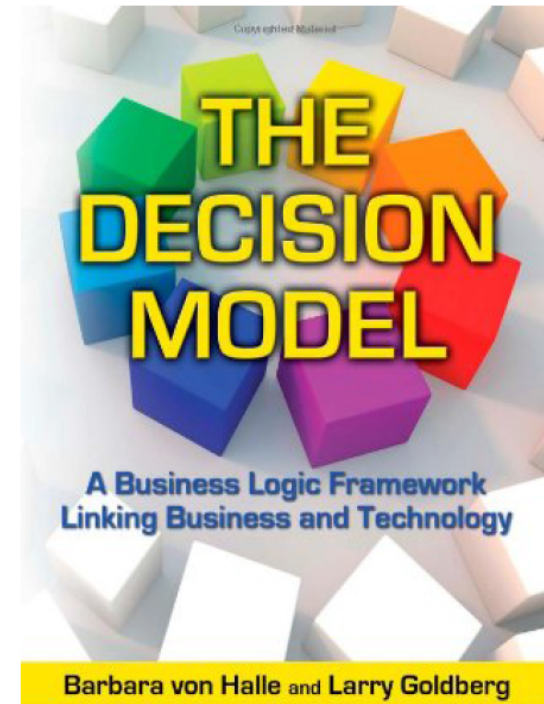
The Decision Model

Von Halle, B., & Goldberg, L. (2010). *The Decision Model: A Business Logic Framework Linking Business and Technology*. CRC Press Auerbach Publications.

The Decision Model

- The Decision Model was developed by Barbara von Halle and Larry Goldberg (2010)
- Objective:
  - a rigorous, repeatable, and technology-independent model of busine simple to create, interpret, modify, and automate
- The Decision Model is a template for perceiving, organizing, and managing the business logic behind a business decision.
- It is a declarative representation of decision logic
  - *specifies* the conditions on which a decision is made
  - does *not specific* how the conditions are tested, in particular it does not specify the order in which conditions are tested
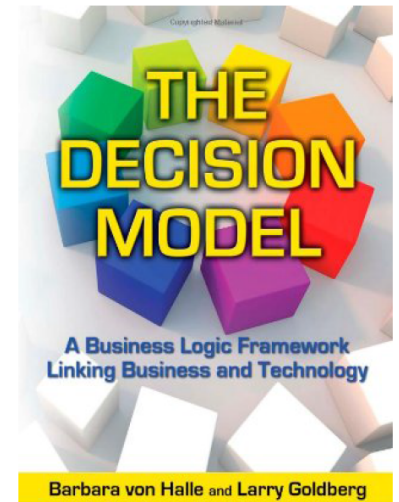
Decision Model Elements

A Decision Model has two different kinds of diagrams:

Decision Model Diagram
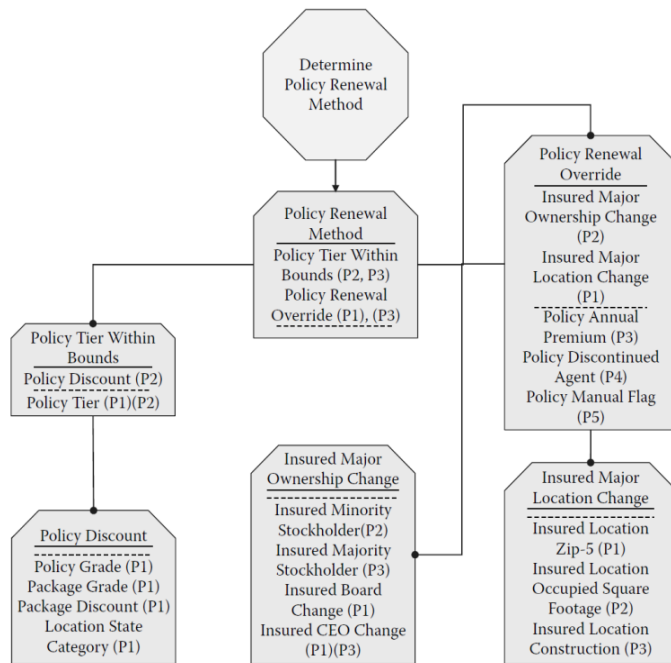
Rule Family Table

Conditions						Conclusion	
Person Student Loans		Person Business Loans		Person Customer Status		Person Miscellaneous Loans Assessment	
Is	Yes			Is not	Current customer	Is	Medium Risk
		Is	Yes	Is not	Current customer	Is	High Risk
Is	Yes			Is	Current customer	Is	Low Risk
		Is	Yes	Is	Current customer	Is	Medium Risk

Decision Model Diagrams
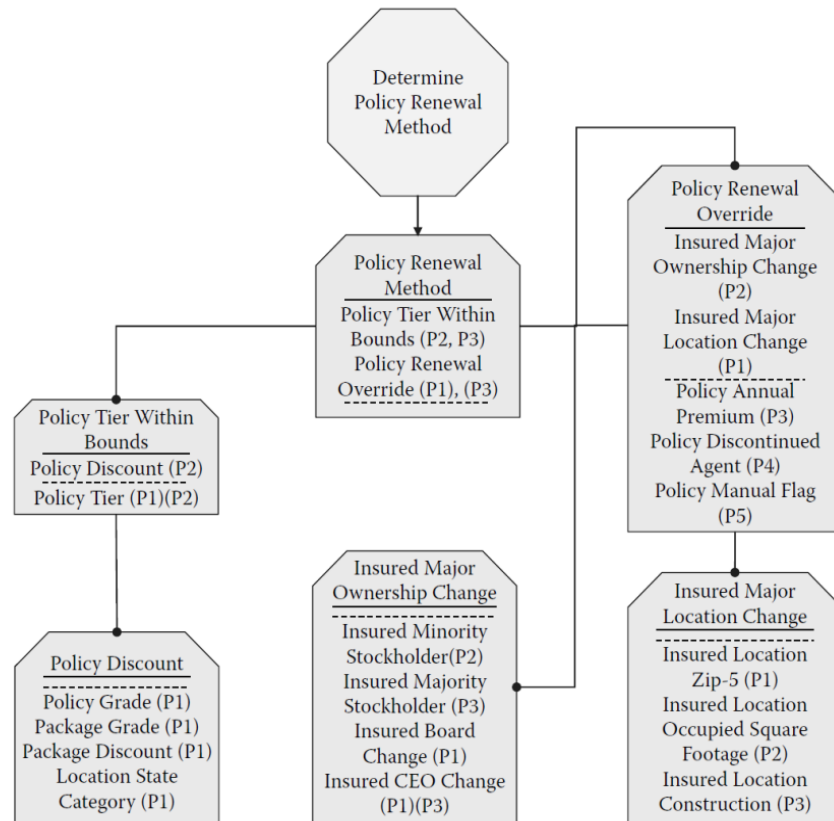
- The root of a Decision Model diagram (its start) is an octagonal shape that represents the entire business decision
  - It is this shape that relates to tasks within business process models.
- The other nodes in the Decision Model diagram represent Rule Families

(von Halle & Goldberg 2010, p. 26f)

Decision Model Diagram

The Decision Model Diagram represents Rule Family Tables.

Decision

Determine Policy Renewal Method

Rule Family

Policy Renewal Method
_____
Policy Tier Within Bounds (P2, P3)
Policy Renewal Override (P1), (P3)

Rule Family Table

	Conditions				Conclusion	
	Manual Policy Override		Policy Tier Within Bounds		Policy Renewal Method	
is	Yes				is	Manual Renewal Process
		is	No		is	Manual Renewal Process
is	No	is	Yes		is	Automatic Renewal Process
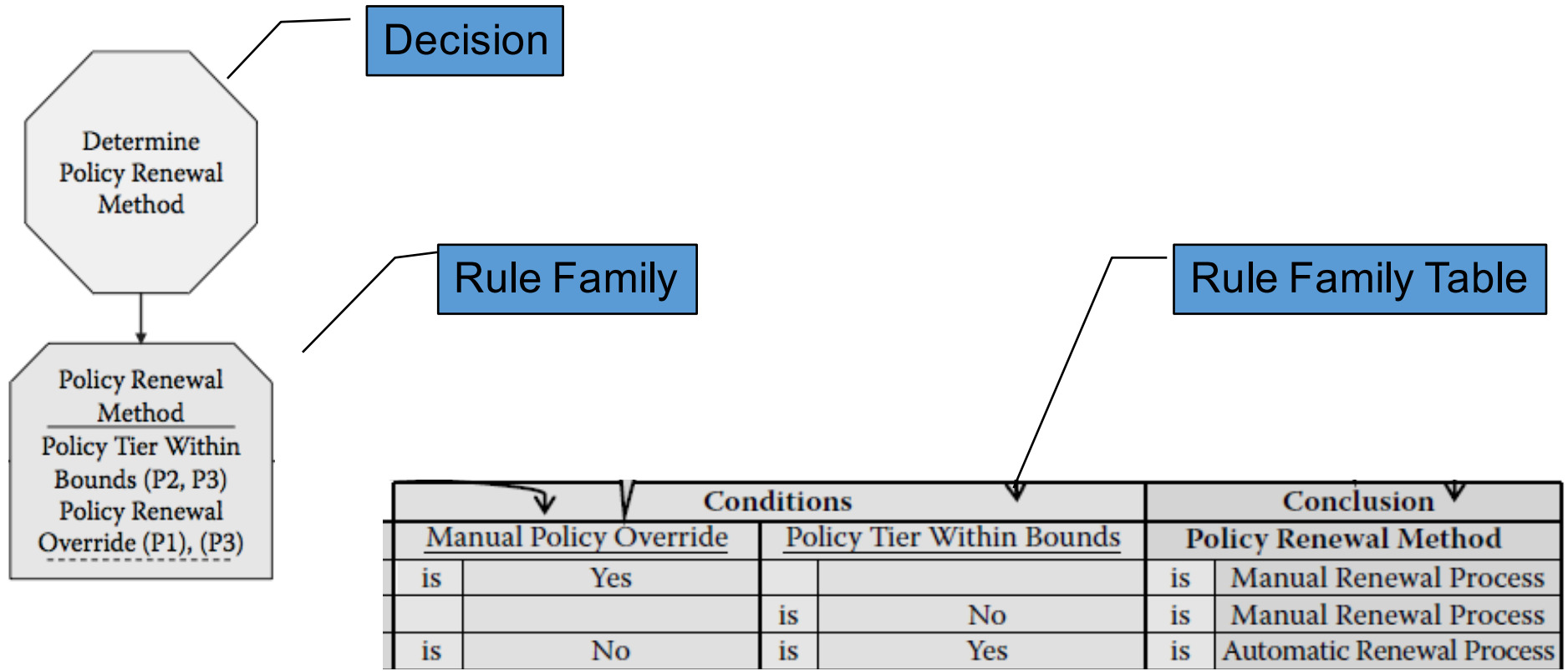
(von Halle & Goldberg 2010, p. 29)

Rule Family: Basic Element of the Decision Model

- Rule Family is a two-dimensional table relating conditions to one—and only one—corresponding conclusion.

Column headings: names of facts being tested

name of conclusion being reached

Conditions			Conclusion
Person Employment History	Person Mortgage Situation	Person Miscellaneous Loans Assessment	Person Likelihood of Defaulting on a Loan
Is　Poor	Is　Poor	Is　High	Is　High

operator

value of column heading

condition
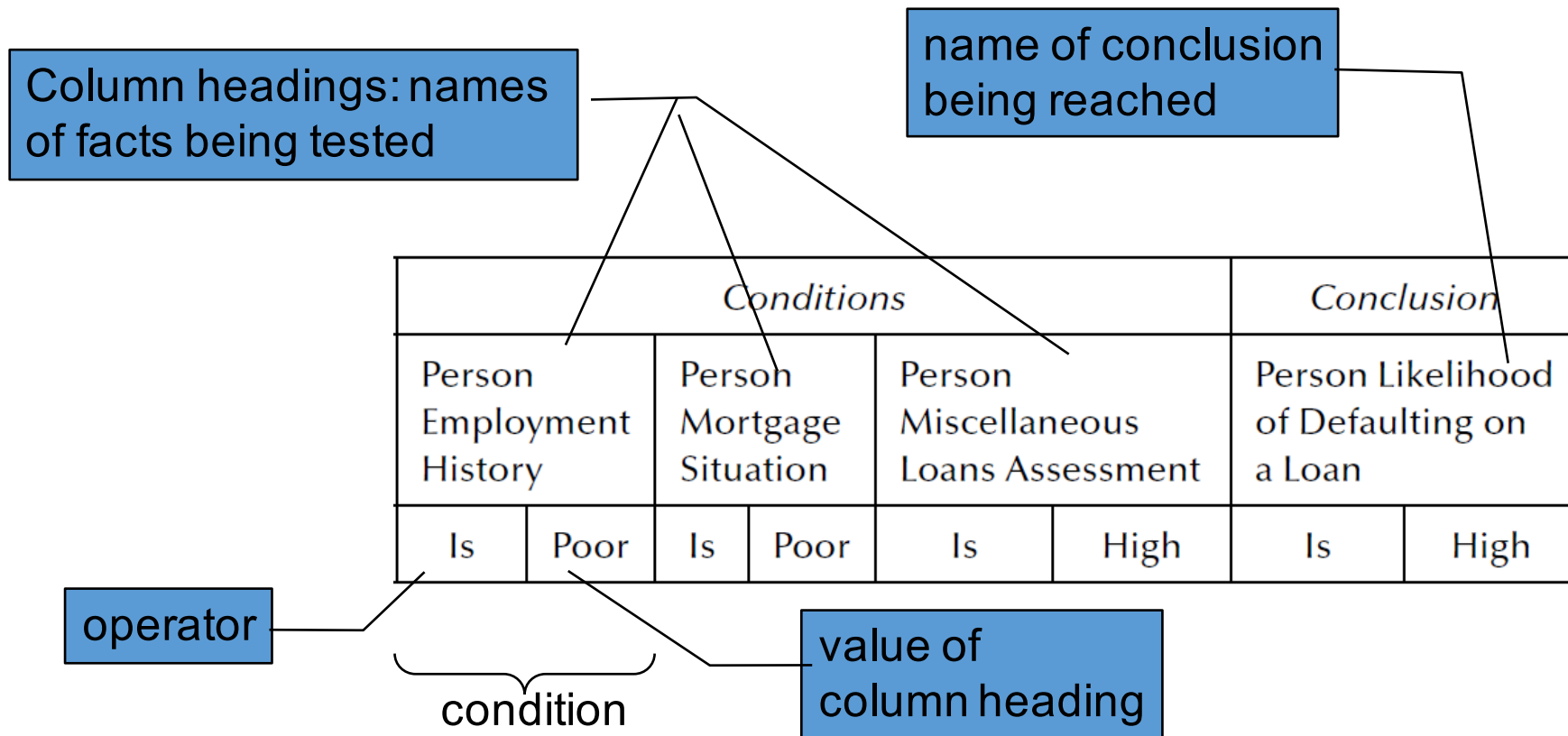
(von Halle & Goldberg 2010, p. 18f)

Rule Family Tables are Decision Tables

- A Rule Family table is a kind of decision table
  - In a Rule Family Table each row represents a rule
  - In a decision table each column represents a rule

- A Decision Model is a structured collection of decision tables

- There are some specialties:
  - A Rule Family must only have one conclusion column
  - Inferential relationships between Rule Family are made explicit in a Decision Model diagram

(von Halle & Goldberg 2010, p. 25)

Rule Family: Basic Element of the Decision Model

- A Rule Family node has three parts:
  - The name is the conclusion of the Rule Family
  - Inferred conditions: There are Rule Families with these names
  - Basic conditions: There are no Rules Families with theses names

Person Likelihood of Defaulting on a Loan
Person Employment History
Person Mortgage Situation
Person Miscellaneous Loans Assessment

	Conditions			Conclusion	
Person Employment History		Person Mortgage Situation		Person Miscellaneous Loans Assessment	Person Likelihood of Defaulting on a Loan
Is	Poor	Is	Poor	Is	High	Is	High

(von Halle & Goldberg 2010, p. 18f)

Determine Policy Renewal Method

This Condition column is part of a logical expression interpreted as "If/when the Policy Renewal Override is Yes"

The conclusion column is part of a logical expression interpreted as "then the Policy Renewal Method is Automatic"

Policy Renewal Method
Policy Tier Within Bounds (P2, P3)
Policy Renewal Override (P1)

A discrete business logic instance is a single row in the Rule Family table

Pattern	Conditions			Conclusion	
	Manual Policy Override		Policy Tier Within Bounds	Policy Renewal Method	
1	is	Yes		is	Manual Renewal Process
2			is No	is	Manual Renewal Process
3	is	No	is Yes	is	Automatic Renewal Process

This condition column is also part of a logical expression interpreted as "If/when the Policy Tier Within Bounds is Yes"

(von Halle & Goldberg 2010, p. 29)

Translating a Rule Family into Natural Language

- It is possible to convert each row in a Rule Family into a sentence that sounds natural to a business audience

Rule Pattern	Conditions						Conclusion	
	Person Employment History		Person Mortgage Situation		Person Miscellaneous Loans Assessment		Person Likelihood of Defaulting on a Loan	
1	Is	Poor	Is	Poor	Is	High	Is	High

- **Possible Conversions**

  - ♦ If/when Person Employment History is Poor and Person Mortgage Situation is Poor and Person Miscellaneous Loans Assessment is High, then the Person Likelihood of Defaulting on a Loan is High.

  - ♦ A Person with Poor Employment History and Poor Mortgage Situation and High Miscellaneous Loans Assessment has a High Likelihood of Defaulting on a Loan.

  - ♦ It is obligatory that the Person Likelihood of Defaulting on a Loan *is* **High** if the Person Employment History *is* **Poor** and the Person Mortgage Situation *is* **Poor** and the Person Miscellaneous Loans Assessment *is* **High**

Decision Modeling

(von Halle & Goldberg 2010, p. 20)

A Rule Family represents all Rules for one Conclusion

The Decision Model has only one Rule Family for each type of conclusion column, i.e. all rules for a conclusion are in one table.
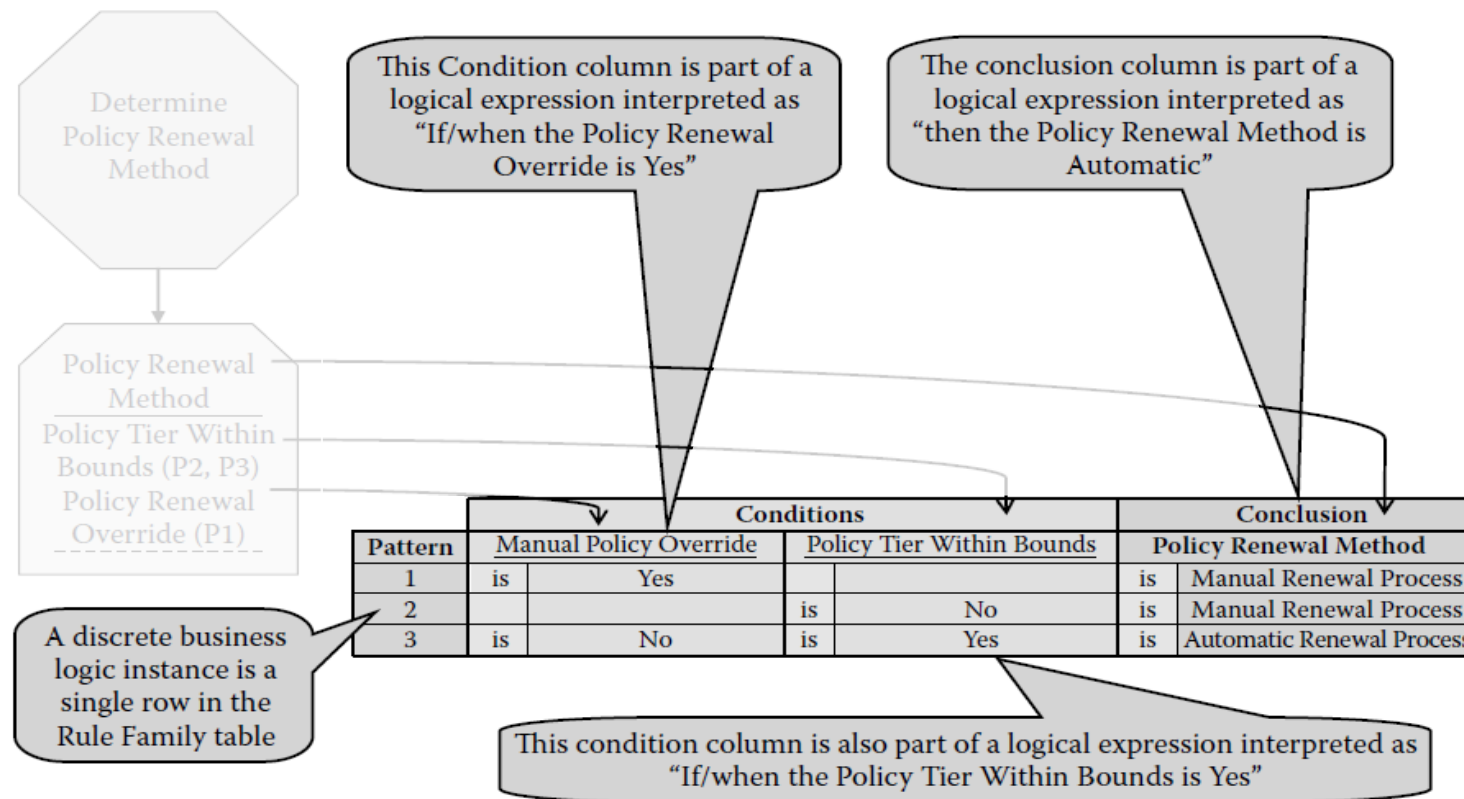
(von Halle & Goldberg 2010, p. 29)

Rule Pattern

- A set of Rule Family rows with a common set of populated condition cells is called a Rule Pattern.

- The following Rule Family represents two rule patterns

Rule Pattern	Conditions						Conclusion	
	Person Student Loans		Person Business Loans		Person Customer Status		Person Miscellaneous Loans Assessment	
1	Is	Yes			Is not	Current customer	Is	Medium Risk
2			Is	Yes	Is not	Current customer	Is	High Risk
1	Is	Yes			Is	Current customer	Is	Low Risk
2			Is	Yes	Is	Current customer	Is	Medium Risk

1. The 1st and 3rd rule have conditions for the fact types "Person Student Loans" and "Person Customer Status"

2. The 2nd and 4th rule have conditions for the fact types "Person Business Loans" and "Person Customer Status"

(von Halle & Goldberg 2010, p. 24)

Two dependend Rule Families

- Conditions of one rule family can depend on another rule family
- Example: Person Employment History in the first rule family depends on
  - Person Years at Current employer &
  - Person Number of Jobs in Past Five Years

Rule Pattern	Conditions								Conclusion	
	Person Employment History		Person Mortgage Situation		Person Miscellaneous Loans Assessment		Person Outside Credit Rating		Person Likelihood of Defaulting on a Loan	
1	Is	Poor	Is	Poor	Is	High	?	?	Is	High
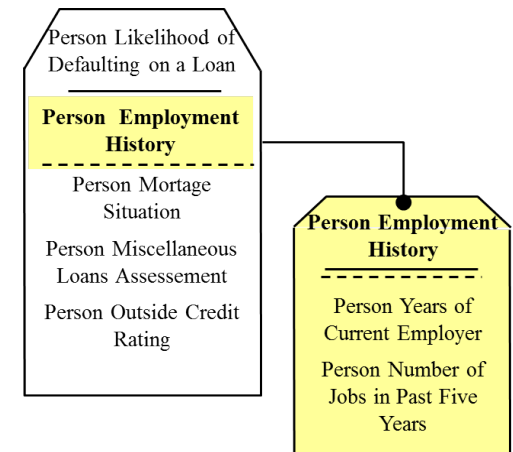
Rule Pattern	Conditions		Conclusion
	Person Years at Current Employer	Person Number of Jobs in Past Five Years	**Person Employment History**

(von Halle & Goldberg 2010, p. 23)

Decision Model Diagram (1/3)
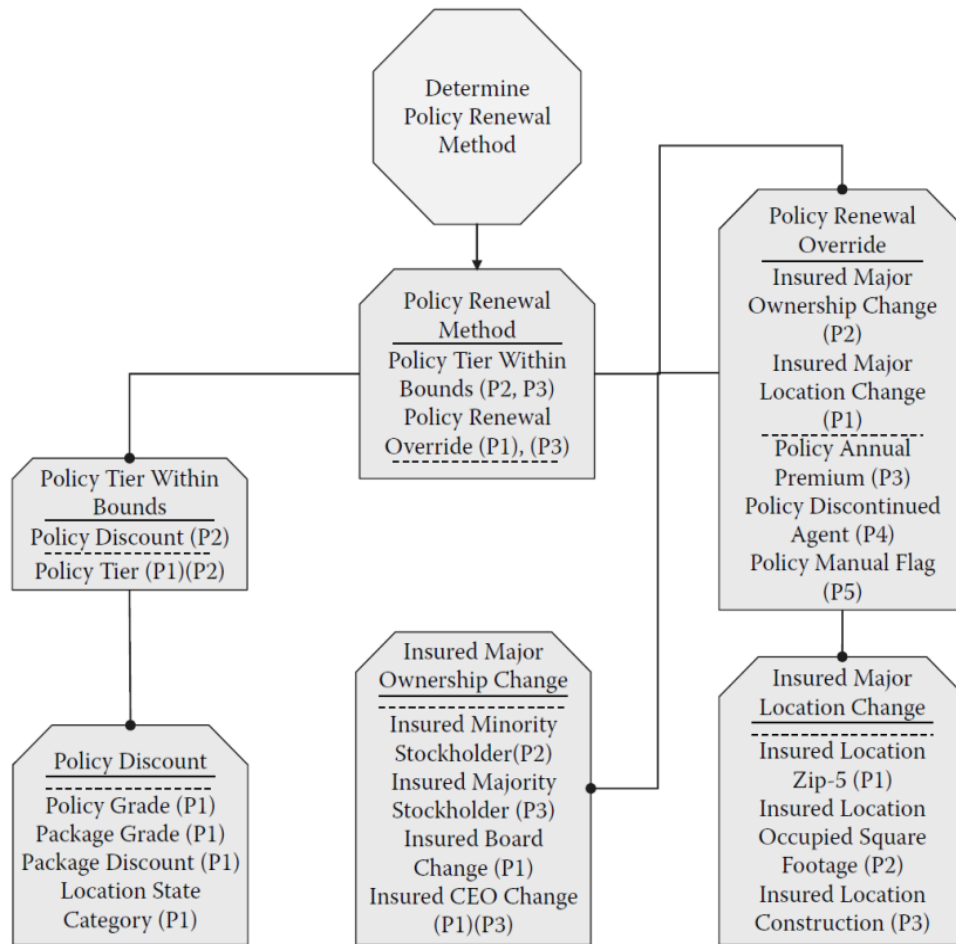
(von Halle & Goldberg 2010, p. 26f)

Decision Model Diagram (2/3)

A Decision Model diagram begins with an octagonal shape that represents the entire business decision

The other shapes in the Decision Model diagram represent Rule Families. This diagram has 6 Rule Families.

The Rule family directly connected to the business decision shape is called the " Decision Rule Family", its conclusion is the conclusion sought by the entire Decision Model.

Determine Policy Renewal Method

Inferring value for the Second Condition of Decision Rule Family

Policy Renewal Override
Insured Major Ownership Change (P2)
Insured Major Location Change (P1)

Inferred Conditions

Conclusion

Policy Renewal Method
Policy Tier Within Bounds (P2, P3)
Policy Renewal Override (P1), (P3)

Conditions

The Decision Rule family

Inferring value for the first Condition of the Decision Rule Family

Policy Tier Within Bounds
Policy Discount (P2)
Policy Tier (P1)(P2)

Policy Annual Premium (P3)
Policy Discontinued Agent (P4)
Policy Manual Flag (P5)

Conditions based on facts

Policy Discount
Policy Grade (P1)
Package Grade (P1)
Package Discount (P1)
Location State Category (P1)

Insured Major Ownership Change
Insured Minority Stockholder(P2)
Insured Majority Stockholder (P3)
Insured Board Change (P1)
Insured CEO Change (P1)(P3)

Insured Major Location Change
Insured Location Zip-5 (P1)
Insured Location Occupied Square Footage (P2)
Insured Location Construction (P3)

The name of each Rule Family is its conclusion column heading.

Decision Modeling

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(von Halle & Goldberg 2010, p. 28)

The Decision Model Diagram (3/3)

The solid line terminated by the **dot** connects Rule Families that have an inferential relationship: The conclusion of one Rule Family is used as a condition in another.

Determine Policy Renewal Method

Policy Renewal Override

Policy Renewal Method
Policy Tier Within Bounds (P2, P3)
Policy Renewal Override (P1), (P3)

Insured Major Ownership Change (P2)
Insured Major Location Change (P1)
Policy Annual Premium (P3)
Policy Discontinued Agent (P4)
Policy Manual Flag (P5)

The solid line:
The conditional columns are shown below the solid line and above the dotted line.

Inferred Conditions

Conditions based on facts

Inferred Conditions

The dotted line:
The labels below the dotted line denote condition column headings that do not serve as a conclusion column heading in another Rule Family.
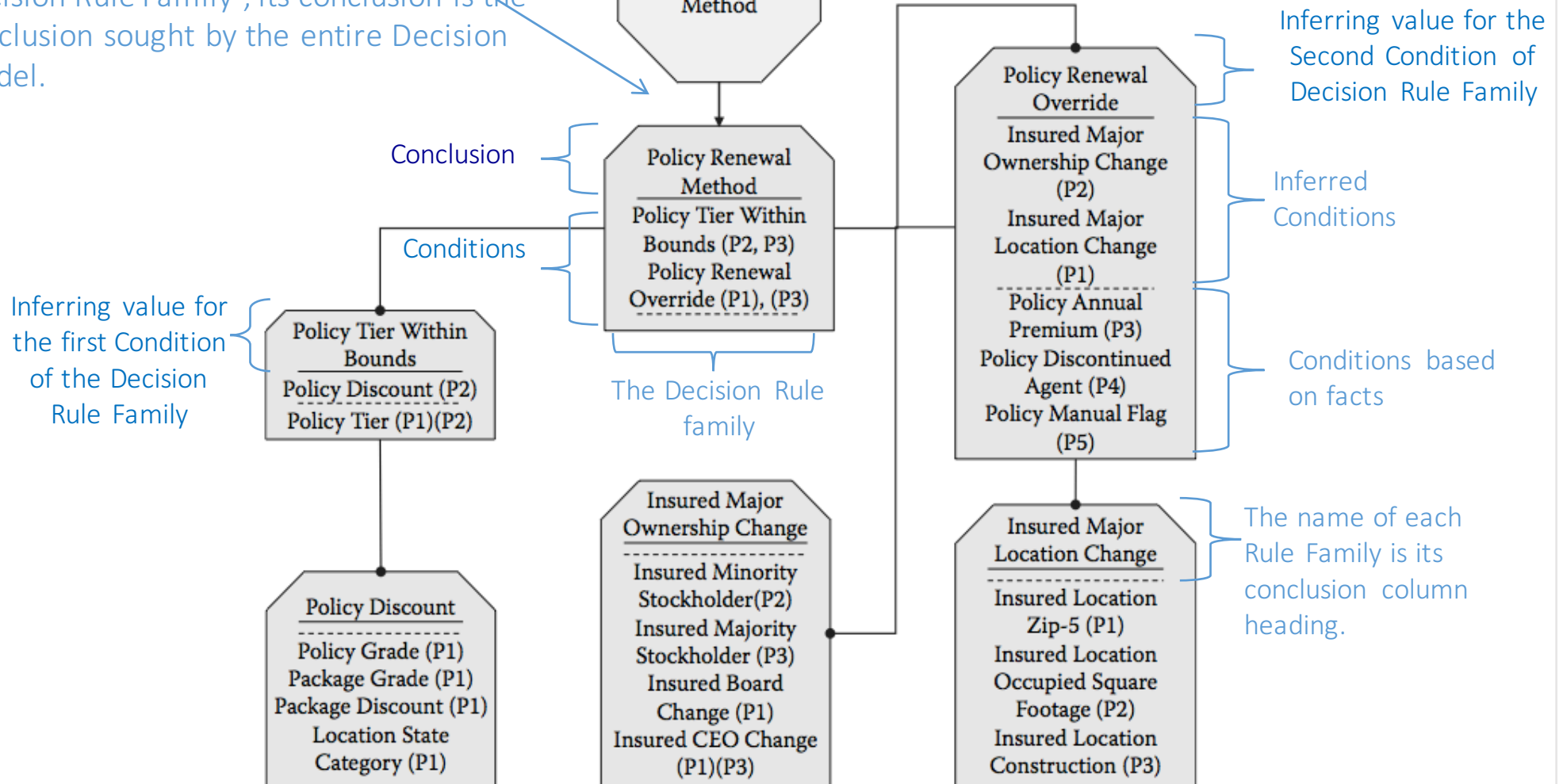
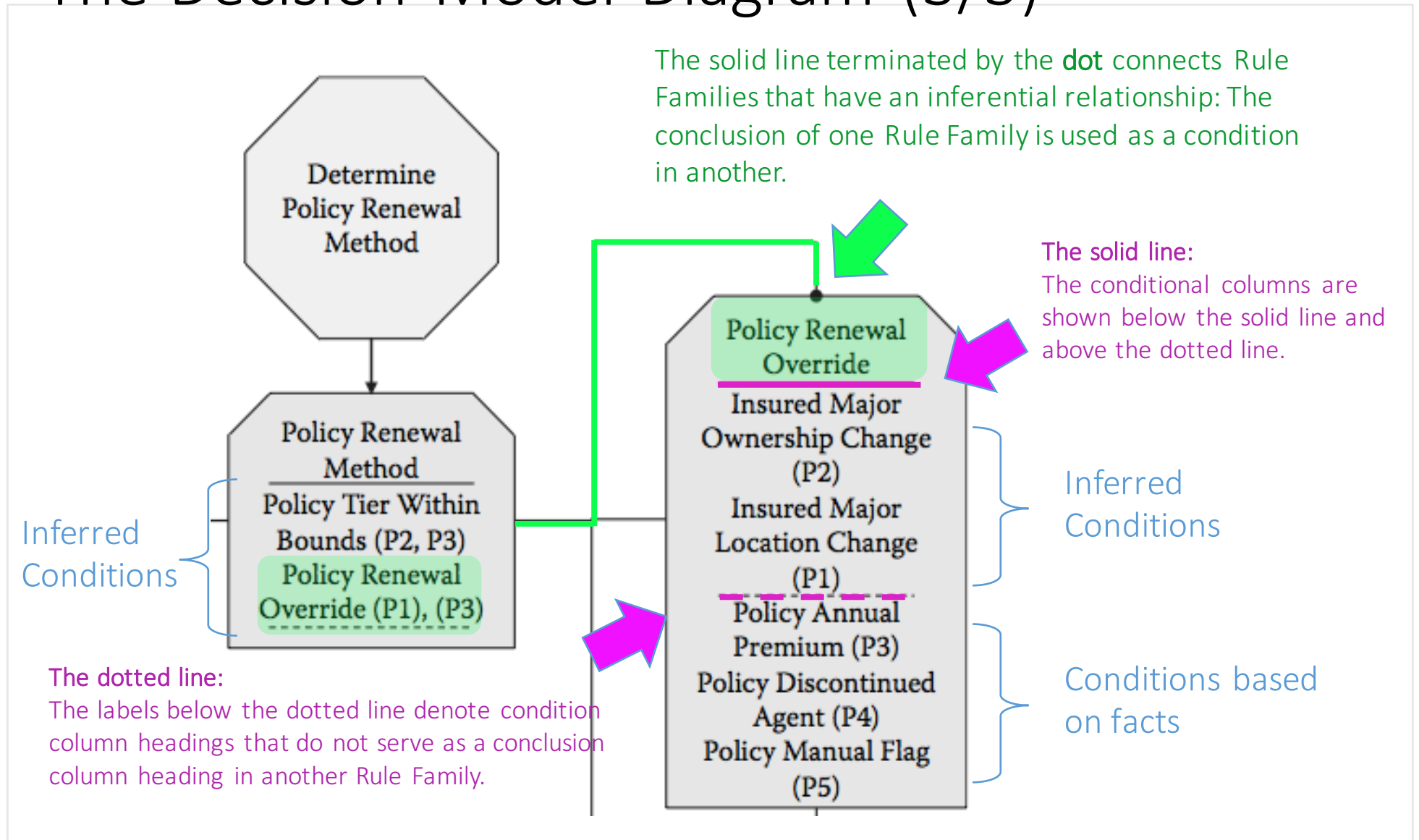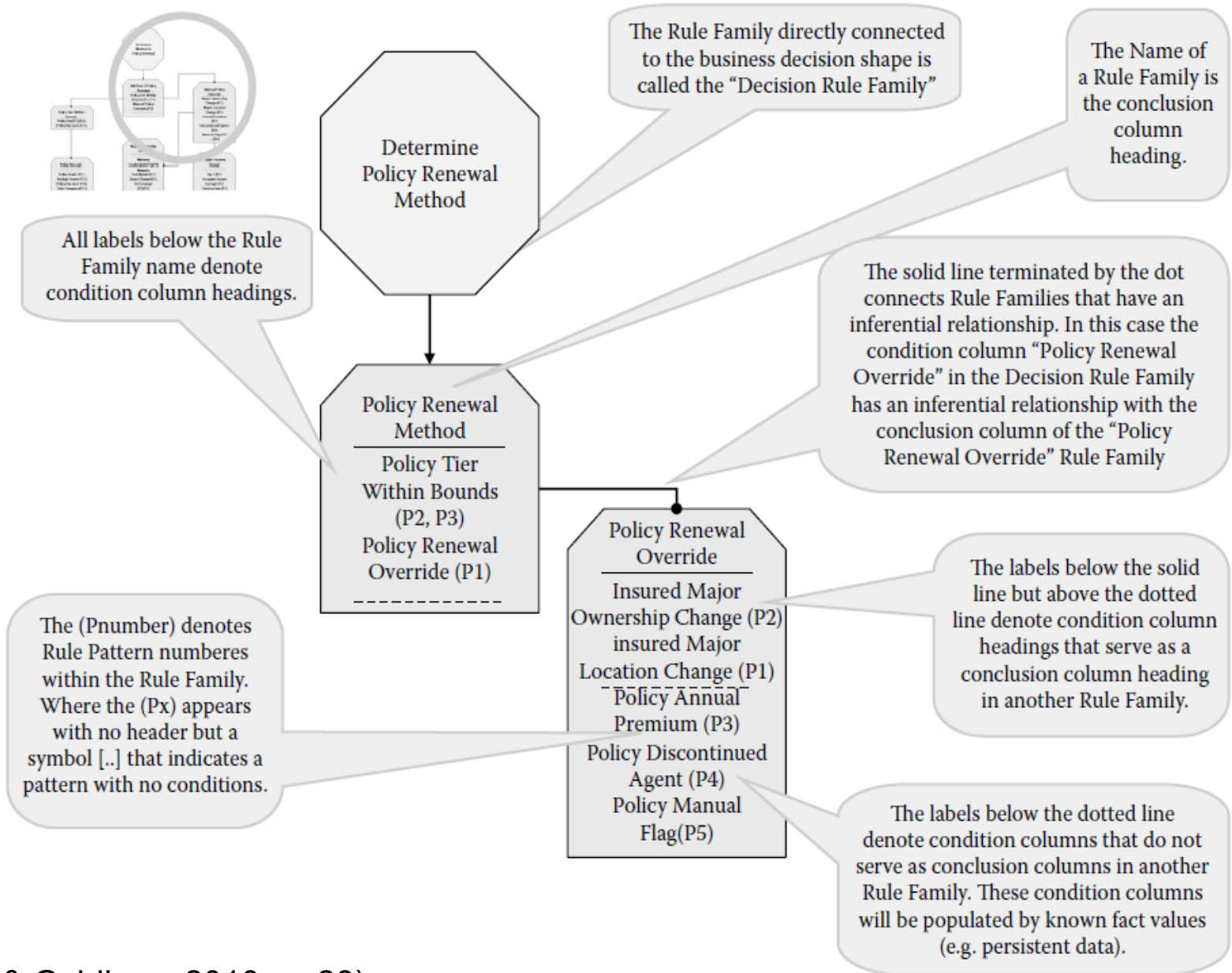(von Halle & Goldberg 2010, p. 28)

Determine Policy Renewal Method

The Rule Family directly connected to the business decision shape is called the "Decision Rule Family"

The Name of a Rule Family is the conclusion column heading.

All labels below the Rule Family name denote condition column headings.

Policy Renewal Method
Policy Tier
Within Bounds (P2, P3)
Policy Renewal Override (P1)
- - - - - - - - - - -

The solid line terminated by the dot connects Rule Families that have an inferential relationship. In this case the condition column "Policy Renewal Override" in the Decision Rule Family has an inferential relationship with the conclusion column of the "Policy Renewal Override" Rule Family

Policy Renewal Override
Insured Major Ownership Change (P2)
insured Major Location Change (P1)
Policy Annual Premium (P3)
Policy Discontinued Agent (P4)
Policy Manual Flag(P5)

The labels below the solid line but above the dotted line denote condition column headings that serve as a conclusion column heading in another Rule Family.

The (Pnumber) denotes Rule Pattern numberes within the Rule Family. Where the (Px) appears with no header but a symbol [..] that indicates a pattern with no conditions.

The labels below the dotted line denote condition columns that do not serve as conclusion columns in another Rule Family. These condition columns will be populated by known fact values (e.g. persistent data).
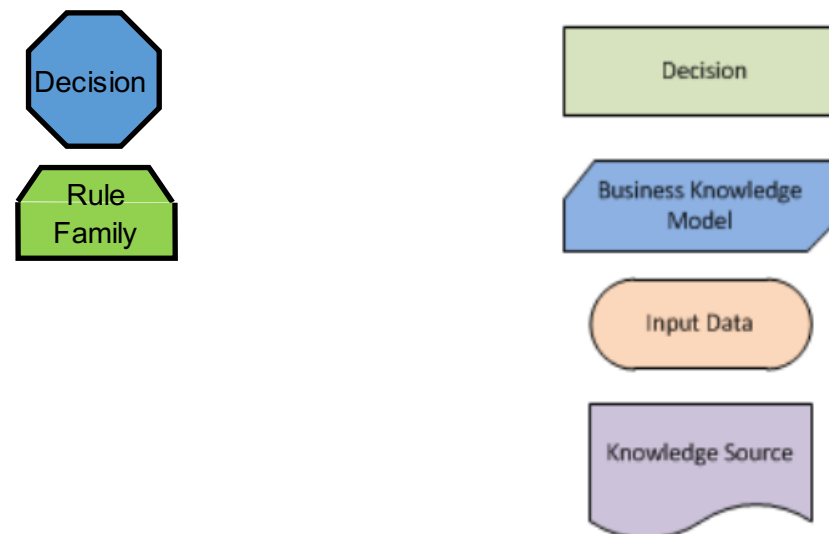
(von Halle & Goldberg 2010, p. 28)

The Decision Model vs. DMN: Diagrams

- On the graphical level, the Decision Model Diagram is a subset of DMN's Decision Requirements Diagram
  - Decision is in both diagrams
  - Rule Family corresponds to Business Knowledge Model
- DMN is more expressive; compared to the Decision Model Diagram contains Input data and Knowledge Sources

The Decision Model vs. DMN: Decision Tables

- Decision Model and DMN use decision tables to represent the decision logic.

- The main structural differences are down to the split cell versus single cell convention for the operator and operand.

- The semantics of decision tables in DMN is more expressive: It can return multiple values and can specify, how multiple values are aggregated

Source: http://blog.maxconsilium.com/2014/09/introduction-to-decision-model-notation.html

Decision Tables in DMN and TDM

DMN Decision Table

Student Course Eligibility Table			
A	Student Total Courses Enrolled Count	Course Total Students Currently Subscribed	Student Course Eligibility
			Eligible, Ineligible
1	<= 4	< Course Subscription Threshold	"Eligible"
2	> 4	-	"Ineligible"
3	-	>= Course Subscription Threshold	"Ineligible"

Key Features
Single-hit decision table (returns a single value)
Hit-Policy: **Any** (signified by the 'A' in the top-left corner)
Possible domain values are provided optionally underneath the name of the expression
No specific order of reading

TDM Rule Family View

		Conditions				Conclusion	
Row ID	Rule Pattern	Student Total Courses Enrolled Count		Course Total Students Currently Subscribed		Student Course Eligibility	
1	1	is less than or equal to	4	is less than	Course Subscription Threshold	is	Eligible
2	2	is greater than	4			is	Ineligible
3	3			is greater than or equal to	Course Subscription Threshold	is	Ineligible

Key Features
Conclusion Fact Type: Regular (returns a single value)
A RFV has no concept of a hit-policy per se; any row can always be hit
The Rule Pattern denotes the pattern of cells populated. There are three different patterns in this RFV
No specific order of reading
The operator is spelled out in words - this is not mandatory, but is designed to be more business-friendly

Literatur

- Von Halle, B., & Goldberg, L. (2010). *The Decision Model: A Business Logic Framework Linking Business and Technology*. CRC Press Auerbach Publications.

- BPM Professional, 2014, Introduction to Decision Model & Notation (DMN), http://blog.maxconsilium.com/2014/09/introduction-to-decision-model-notation.html

- Ross, R. G., & Lam, G. S. W. (2011). *Building Business Solutions: Business Analysis with Business Rules*. Business Rule Solutions Inc.

- Alcedo Coenen (2013). Decision Model & Notation (DMN) 1.0 – a new OMG Standard. http://de.slideshare.net/alcedocoenen/intro-dmn-10

- OMG (2014). Decision Model and Notation, Beta 1, http://www.omg.org/spec/DMN/

- Broom, N., 2014. *The Decision Model and Notation (DMN) standard - A worked example*. A web version is on http://visionalysis.co.uk/2014/01/08/going-dmn-tal/

- Broom, N., 2014, *Next stop, [DMN/TDM] Interchange*, http://visionalysis.co.uk/2014/11/24/next-stop-dmntdm-interchange/