Decision-aware Business Processes

Knut Hinkelmann
Distinguishing Process Logic and Business Logic

**Process Logic**

- The process model contains the process logic
- Business logic can be assigned to tasks in the process model:
  - knowledge-intensive tasks

**Business Logic**

- The business logic can occur in different forms
  - implicit in head of people
  - as text (e.g. guidelines)
  - as business rules
  - as decision model
  - coded in an application
Decision Tasks in Business Processes

A **decision task** is a task in which some decision is made.

The business logic that is used for decision making is called **decision logic**.

Two kinds of decision tasks:

- Decision tasks deriving values for data
- Decision tasks providing data for gateways
  - At the gateway only the result of the decision should be tested (for the selection of the path) not the criteria for the decision.

**Decision: Is the applicant eligible?**

**Decision: what is the amount of the insurance premium in this case?**
Basic Elements of Operational Business Decisions

■ A decision is characterized by a question, for example:
  ♦ Should the insurance claim be accepted, rejected or examined for fraud?
  ♦ Which resource should be assigned to this task?
  ♦ Which service should be used to ship this package?

■ A potential outcome is some result, conclusion, or answer that might be deemed appropriate for a case. Examples:
  ♦ some form of yes/no (e.g. eligible/non-eligible)
  ♦ some quantities (e.g. dollar amounts)
  ♦ some categories (e.g. silver, gold, or platinum customer)
  ♦ some real-world instances (e.g. software product to be purchased)
  ♦ some course of action (e.g. on-site visit, teleconference, email)

■ A case is some particular matter or situation arising in a day-to-day business activity and requiring consideration

■ The outcome is the result, conclusion, or answer for a given case

■ The business logic that is used for decision making is called decision logic (the set of all decision rules selecting a decision outcome)
Example for a Business Decision: Data for Gateway

- Process: Handling auto insurance applications
- Decision Task: Check Eligibility of Applicant
- Potential outcomes: "yes" and "no" (i.e. eligible/non-eligible)
- Decision Logic: Terms of insurance

**Case:** John Smith applies for an auto insurance

**Decision Task:** Check Eligibility

**Outcome:** John Smith is eligible for auto insurance

(Ross 2011, p. 152f)
Example for a Business Decision:

- Process: Handling auto insurance applications
- Decision Task: Determine insurance premium
- Potential outcomes: amount of premium (i.e. amount)
- Decision Logic: Calculations for premiums

Case: John Smith applies for an auto insurance

Decision Task: Determine insurance premium

Outcome: John Smith has to pay CHF 700 per year

(Ross 2011, p. 152f)
Representation of Decision Rules

There are a variety of ways to represent decision rules, e.g.

- **Semi-formal description**
  
  - *The reimbursement is 90% if the patient visited a doctor's office and the physician was present*

- **Decision Table**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Type of visit</td>
<td>D</td>
<td>D</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>2. Participating Physician?</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reimburse 50%</td>
</tr>
<tr>
<td>2. Reimburse 70%</td>
</tr>
<tr>
<td>3. Reimburse 90%</td>
</tr>
<tr>
<td>4. Impossible or no reimbursement</td>
</tr>
</tbody>
</table>

Reimbursement depends on whether the patient visited the doctor's office (D), a hospital (H) or a lab (L) and whether the Doctor is a Participating Physician.

Each column represents a rule.

http://web.sxu.edu/rogers/sys/decision_tables.html
Perspectives on Process Modeling

A new perspective on process modeling is reflected in the combination of three ideas

♦ **Process:** an organized, coordinated flow of activities, conducted by participants, acting on and deciding with data and knowledge, to achieve a business goal.

♦ **Decision:** decisions are made by applying business knowledge in the form of business rules or other decision logic to process data. A decision model likewise reflects how a decision is made.

♦ **Event:** A process can also be considered a connected sequence of events that respond to states, causes, and conditions. In an event-based view, the process is a linkage of the transitions from one processing state to another.

(Debevoise & Taylor 2014)
Decision-Aware Process Models: Managing Process Logic and Decision Logic Separately

- The process model contains the process logic → procedural
- Decision logic is externalized from decision tasks and represented in a different kind of model → declarative
- Separating business decisions from business process tasks
  - simplifies the business process model
  - allows to manage business logic in a declarative form

Business Logic / Decision Logic

- Process Logic
- Decision Logic
- Business Logic

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Person Employment History</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Good</td>
<td>low</td>
</tr>
<tr>
<td>High</td>
<td>Bad</td>
<td>bad</td>
</tr>
<tr>
<td>Low</td>
<td>Bad</td>
<td>low</td>
</tr>
<tr>
<td>High</td>
<td>Good</td>
<td>high</td>
</tr>
</tbody>
</table>

Prof. Dr. Knut Hinkelmann

Decision-Aware Business Processes
Distinguishing a Procedural Task from a Declarative Decision

- A procedural solution specifies how, in a step-by-step manner, something is to be done.
  - A business process model is a procedural solution because it prescribes a set of tasks that are carried out in a particular sequence.

- A declarative solution only specifies what needs to be done, with no details as to how, in a step-by-step manner, it is to be carried out, because sequence is irrelevant to arriving at the correct result.
  - A Decision Table is a declarative solution because it is a set of unordered business logic, not a set of ordered tasks.

(von Halle & Goldberg 2010, p. 67)
Procedural versus Declarative

A procedural solution specifies how, in a step by step manner, something is to be done.

Business process is a procedural solution of tasks to be performed in precise sequential order. The “How” of a unit of work.

A declarative solution is what needs to be done, with no details as to the methods to be used (no sequential information).

A declarative solution occurs when sequence is irrelevant to the result. The “What” of a unit of work.

(von Halle & Goldberg 2010, p. 67)
Example 1: Declarative vs. Procedural Solutions

Option 1

Start → Person Employment History → Good → Person Debt → Low → Set Person Credit Rating to A → End

Start → Person Debt → Bad → Set Person Credit Rating to A → End

Option 2

Start → Person Debt → Low → Person Employment History → High → Set Person Credit Rating to A → End

Start → Person Employment History → High → Set Person Credit Rating to A → End

Option 3

Start → Determine Person Credit Rating → End

Process Model

Decision Table

<table>
<thead>
<tr>
<th>Rule Pattern</th>
<th>Person Debt</th>
<th>Person Employment History</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>is Low</td>
<td>is Good</td>
<td>= &quot;A&quot;</td>
</tr>
<tr>
<td>1</td>
<td>is Low</td>
<td>is Bad</td>
<td>= ?</td>
</tr>
<tr>
<td>1</td>
<td>is High</td>
<td>is Good</td>
<td>= ?</td>
</tr>
<tr>
<td>1</td>
<td>is High</td>
<td>is Bad</td>
<td>= ?</td>
</tr>
</tbody>
</table>

(von Halle & Goldberg 2010, p. 69)
Advantages of Separating Business Processes and Business Logic in Option 3

- The Decision Table implies no particular sequence among the conditions to be tested.
- The Decision Table easily highlights all possible combinations of conditions.
- To change or add conditions in a business process model is much more cumbersome than doing so in a Decision table.
  - If other conditions are needed, additional columns can be added to a decision table.

(von Halle & Goldberg 2010, p. 68f)
Example 2: Business Logic contained in a Process Model

(von Halle & Goldberg 2010, p. 71)
Managing Business Logic separately

- This solution has two tasks with their Decision Models.
- The Decision Models can be viewed, managed, and executed as one whole set of business logic.
- The process model is simplified. The decision logic is a black box evaluating conditions and reaching a conclusion.
- Business Logic can be reused
  - the whole decision model
  - Individual decision tables/rules

(von Halle & Goldberg 2010, p. 71f)
Example 3: Collapsing gateways for a complex discount decision into a decision
Integrating the Decision Model with BPMN

- Execution of a decision described by a Decision Model is a particular type of task in BPMN.
- In BPMN 2.0 the corresponding task type is called a business rule task.
- In the figure below, Validate Order is the decision task. Its logic is described by a Decision Model. The gateway simply tests the output of the decision and routes the flow either to A or B based on the result.

(Von Halle & Goldberg 2010, p. 425)
## Distinctions between Business Process and Business Decision

<table>
<thead>
<tr>
<th>Business Process</th>
<th>Business Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Procedural in nature</td>
<td>• Declarative in nature</td>
</tr>
<tr>
<td>• Consists of tasks connected by sequence</td>
<td>• Consists of Rule Families connected by inferential relationships (all independent of sequence)</td>
</tr>
<tr>
<td>• Is all about how (step-by-step sequence to carry out work)</td>
<td>• Is all about what is to be concluded (the logic leading from conditions to conclusion)</td>
</tr>
<tr>
<td>• Improvements in business process aim for increased work efficiency</td>
<td>• Improvements in a business decision aim for smarter business logic</td>
</tr>
<tr>
<td>• Represented best in a procedural business process model</td>
<td>• Represented best in a declarative Decision Model</td>
</tr>
</tbody>
</table>

(von Halle & Goldberg 2010, p.70)
Advantages of separating Business Logic from Business Process Model

- Allows a much simpler business process model
  - If a business process is too complicated, a reason might be that business rules are embedded in the flow

- Makes changes to business process and business logic easier
  - Permits changes in the Decision Model without changing the business process model and vice versa

- Makes governance of business processes and business logic easier to manage

- Decision Model can be reused in several processes
  - the whole decision model
  - individual decision tables and rules
Achieving Business Excellence by Managing Decision Logic Separately

- von Halle and Goldberg argue that operational excellence alone is insufficient for sustainable competitive advantage.

- Key business processes must not only be efficient and consumer-friendly but also smart and agile
  - Business processes become agile when declarative business decisions are separated from procedural business process tasks
  - Business processes become smart when the business decisions are governed appropriately by business leaders

- When the business leadership clearly understands the business logic behind the business decisions, the impact of those decisions can be ascertained, and the business can quickly and easily make adjustments.

(von Halle & Goldberg 2010, p. 78)
Literatur


- Tom Debevoise and James Taylor (2014) The Microguide to Process and Decision Modeling in BPMN/DMN.