Free Chapter

Real-World Decision Modeling with DMN

Effective Communication of Decision-Making

James Taylor & Jan Purchase

Foreword by

Dr. Richard Soley, CEO, OMG

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Real-World Decision Modeling with DMN

James Taylor & Jan Purchase

Organizations make thousands of automated, operational decisions every week—from targeted pricing of products to determining which customers get automatic approval, from customizing website navigation and content to satisfying regulatory mandates. How well they make these decisions drives their profitability, makes or breaks their reputation and powers customer satisfaction.

How these decisions are made is one of a company's most important assets. All too often these decisions are not explicitly managed, assessed or even visible to the company's business experts. Instead they are buried in the company's software code and policy manuals, where they are hidden from view and may even be contradictory. Decision modeling gives you the power to change this, to make your organization's decisions transparent, agile and scalable.

Written by two of the field's foremost experts, this book addresses why, when and how to model decisions using the Decision Model and Notation (DMN), a new open standard for representing business decisions. This comprehensive book features:

- Over 220 practical illustrations
- 47 best practices
- 13 common misconceptions to avoid
- 12 patterns and approaches
- 3 worked examples

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Reviews

"This comprehensive and incredibly useful book offers a wealth of practical advice to anyone interested in decision management and its potential to improve enterprise applications. Using a blend of user case studies, patterns, best practices and pragmatic techniques, "Real-World Decision Modeling with DMN" shows you how to discover, model, analyze and design the critical decisions that drive your business!"
—David Herring, Manager of BPM & ODM Delivery at Kaiser Permanente.

"Well written and very impressive in its scope."
—Alan Fish, Principal Consultant, Decision Solutions, FICO and author of "Knowledge Automation: How to Implement Decision Management in Business Processes".

"If you are looking for a complete treatise on decisions, look no further. Even though you end up in decision modeling and Decision Modeling Notation (DMN), you are treated to all the aspects of decisions explained with great care and clarity. This is a greatly needed book that will be studied by decision managers and practitioners for the next decade or more. It will end up on my physical and logical bookshelves."
—Jim Sinur, Vice President and Research Fellow, Aragon Research.

"Written by two of the foremost experts in decision management, this book provides an extensive exploration of business decisions and how they are used in modern digital organizations. Taylor and Purchase distill for us the why, how, when and where to apply decision modeling in order to specify business decisions that are effective. Going beyond just an introduction to the Decision Model and Notation (DMN), the authors position this standard with respect to other well established standard notations such as BPMN. This is truly a first comprehensive handbook of decision management."
—**Denis Gagne**, Chair of BPMN MIWG, CEO & CTO at Trisotech.

"A comprehensive and very readable treatment of the subject, covering both the theory and practical application of DMN, and illustrated with plenty of examples and advanced techniques. An invaluable companion."
—Jolyon Cox, Development Director, RapidGen Software Ltd.

Reviews

"This book contains a wealth of knowledge and brings together the expertise of two decision management & modeling authorities. It is written by and for professionals, and I particularly like the numerous real-world experiences, best practices, misconceptions, patterns and business examples. At the same time, because the Decision Model and Notation (DMN) standard is used throughout the book, it is also a full and readable description of all aspects of the standard, from the business value, the business context, the decision requirements level, all the way to FEEL and decision tables (a part which I read with specific care). All well elaborated and clearly explained. A must read."
—**Jan Vanthienen**, Professor of Information Management, Business Information Systems Group, KU Leuven (Belgium), Pioneer of Decision Table Theory and Long Term Contributor to Business Rules, Decisions, Validation and Verification Research.

"I highly recommend this book to anyone who is interested in Decision Management and especially decision modeling. The authors use their knowledge and industry experience to explain, both generally and in detail, why you cannot neglect decision management and modeling for business or IT development. The great value of the book is the comprehensive insight into decision modeling and the DMN standard, grounded in real-world cases. It works as a text book and for newcomers to Decision Management."
—**Odd Steen**, Associate Professor, Department of Informatics, Lund University.

"As a long-time Decision Management consultant and practitioner, it is important for me to have an objective Decision Management reference available. With "Real-World Decision Modeling", I've now found a comprehensive practical guide. James Taylor is clearly the premier authority on Decision Management, and he has teamed up with Jan Purchase to produce the authoritative text on Decision Modeling. For locating a particular best practice, identifying a way to integrate the Decision Management Notation with another notation, or referring a less experienced colleague or client to a good decision modeling information source, and much more, this book is the definitive work."
—Dan Binney, Harmony Solution Services LLC.

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Foreword

Decisions, decisions. Do I buy this book, or move down the line to some other tome on decision-making, or just chuck it all and go get a latte? Every decision is a trade-off of resources—time, space, cost—and return—time, space, money. Many decisions are trivial (e.g., the aforementioned latte!), but the other end of the spectrum harbors life and death decisions. Even those, however, are tradeoffs, though generally with rather nonlinear results. The "seat of the pants" are far too often the center of the decision-making process, but as more data becomes available and processing power enables dealing with the available flow of data, managers' excuses for ad hoc decision-making are less and less viable.

And a flood of data is in fact infecting the world. Turning that flood of data into information, and that information into informed decisions -- in real-time -- is becoming harder and harder, and more and more important. The advent of the Internet of Things means not only a better-metered world, but an inundation of content the likes of which the world has never seen before. Estimates of connected devices on the worldwide Internet range into the hundreds of billions by the year 2025 (consider that the number of people on planet Earth in the same time range will still only be in the billions); each of those little devices pumping out data will certainly amount to more than even Noah could handle.

The only viable approach to solving this problem—the dove bearing an olive leaf—will be automation. The good news is that modern computing infrastructure is up to the task. An unheard-of convergence of forces implies that viability: computing speeds literally four orders of magnitude greater than in the 1960's, a level of connectivity ubiquity no-one foresaw in even 1990 due to the popularity of the World-Wide Web (and the attendant growth of the Internet beneath it), and plummeting costs for all that compute power, connectivity, and even storage. The move to cloud computing, along with widely available open source software, even allows an approach to computing that tears away initial cost and allows data manipulation to be within reach to anyone, everywhere.

The missing link connecting that dove to that ark is, of course, a consistent and pragmatic approach to defining and carrying out that decision-making automation. That link is an international standard for defining operational decision processes, the Object Management Group's Decision Management Notation (DMN). DMN is not so much a process for defining decisions, but rather a modeling language for capturing the design of decision processes. Operational decisions can always be defined in terms of inputs (the current operational situation) and outputs (the wished-for outcome), and the DMN language allows non-programmers to capture that model in a well-defined—and automatable—notation.

The power of shared and standardized notation is frequently not fully appreciated, but consider the role of shared world languages (the lingua franca of medieval Europe, a French/Latin amalgam; or even the Bad English of the modern world). Shared notations knit together organizations, companies, peoples, communities and countries; they de-

crease costs (consistent and shared tools; lower training costs; portable and reusable designs). They bring about higher productivity and lower costs, and standards of practice in the automation field even decrease switching costs (often to zero), allowing a choice of implementations based on price, support and feature lists.

That's what you hold in your hand -- a disciplined approach to decision-making based around the DMN. That is, not a book just about the technology of DMN, but a way to think about decision-making as a management discipline, preparing for automation of decisions in the face of the data onslaught. Decisions, decisions. This book is an important step forward to moving decision making away from the seat of the pants.

Richard Mark Soley, Ph.D.
Chairman and Chief Executive Officer
Object Management Group, Inc.
27 September 2016

Preface

It has been 14 or more years since I first used the phrase "Decision Management" to describe the use of technology for the systematic identification, automation and improvement of operational business decisions. At the heart of any successful Decision Management project is a clear and thorough understanding of the decisions involved. The advent of the Decision Model and Notation (DMN) standard has given us an industry standard way to model decisions using proven techniques and approaches. Decision modeling with DMN is a powerful, real-world approach to unambiguously describe decision-making, specify analytic requirements and develop decision logic—business rules.

This book is not just a description of the standard and the notation, but a distillation of many hard-earned lessons from real projects. Jan and I bring different perspectives having worked on different kind of projects. As we brought this experience together it became clear that we shared a common approach and agreed on a wide ranging set of best practices. This book is the result.

James Taylor

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All elegant and empowering innovations—for example, the wheel, the jet-engine, the printing press and the internet—have one thing in common: after they are adopted, it becomes hard to imagine what the world would be like without them. We make no lesser claim for Decision Management and Decision Modeling. Once organizations routinely and consciously capture, manage, improve and are able to justify their key decisions, they will wonder how automated systems ever evolved without this facility. Furthermore, as laws such as the European General Data Protection Regulation (GDPR) and industry compliance legislation insist with increasing force that all automated systems must be capable of comprehensively explaining their behavior after the fact, there will be an ever increasing legal requirement for a more rigorous approach to automated decision-making. The increasing use of machine learning in automation will also increase the need for regimented governance of decisions and the ability to explain counterintuitive decision outcomes—both use cases for decision modeling.

Like James, I have seen Decision Modeling transform the way organizations run their businesses and give their subject matter experts a truly effective means of communicating their ideas. Our goal for this book has been to present the case for decision modeling and bring the benefits of this simple idea to new organizations.

Jan Purchase

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4 The Value of Decision Management and Decision Modeling

This is a summary of chapter 4 - more detail is provided in the book

There is one thing worse than managing your decisions and that is not managing your decisions
—After Oscar Wilde

Decisions are important to organizations, determining how customers are treated, how risk is managed, how supply chains are controlled and ultimately determining the profitability and effectiveness of the organization. Understanding, modeling, managing and automating decisions is an increasingly important element of many organizations' business strategy. Modeling these decisions is pivotal to using them as a focus to improve business outcomes.

4.1 Definitions and Introductions

4.1.1 Decision

A decision is a determination that businesses make on a regular basis, a selection or calculation of an outcome that depends on a number of prevailing circumstances (inputs) and which, ultimately, has an observable impact on the behavior of the organization.

4.1.2 Decision Modeling

Decision modeling expresses how a decision should be made as a rigorous, verifiable model. It formalizes decision-making so it can be clearly and widely understood, managed and used effectively. Decision modeling supports the documentation of an organization's decisions such that they can be made consistently, improved over time and automated where appropriate.

4.1.3 Decision Management

The Decision Management Manifesto (Taylor, The Decision Management Manifesto, 2013) states:

Decision Management is an approach that improves day-to-day business operations. It increases an organization's business agility and adaptability by making its systems easier to monitor and change. It puts Big Data to work improving the effectiveness and profitability of every action. It is a proven framework for effectively applying innovative technologies such as business rules, predictive analytics and optimization.

4.1.4 Decision Management Systems

Decision Management Systems are different from typical information systems in three ways—they are more agile, more analytic and more adaptive. (Taylor, Decision Management Systems: A Practical Guide to Using Business Rules and Predictive Analytics, 2012)

4.2.2 There are relationships between these concepts

1. Decision Discovery and Modeling is the first step in Decision Management. Beginning to develop a decision model for decisions that are discovered is a powerful tool for identifying the best candidates for automation as well as for providing the description needed for ongoing management.
2. When defining and implementing the Decision Services at the heart of a Decision Management System, a decision model scopes and drives the design in a way that works for both waterfall and more agile methodologies.
3. Decision Monitoring and Improvement, as well as maintenance of decision-making, use decision models to track impact of change and manage experimentation.

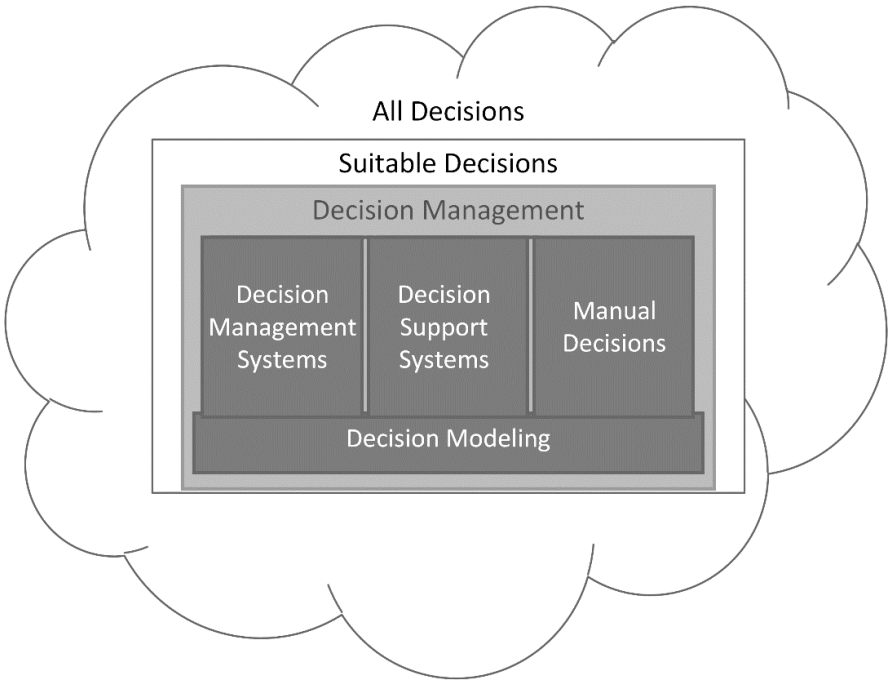


Figure 4-1 Relationships between the concepts

Decision modeling can thus both drive and orchestrate the use of technology to develop and sustain Decision Management Systems as shown in Figure 4-2.

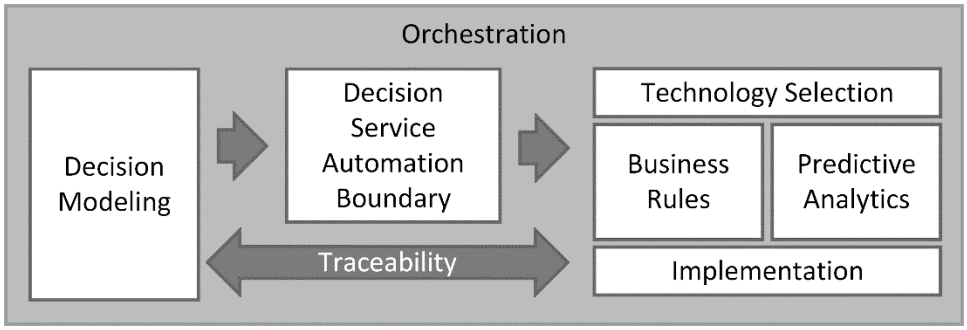


Figure 4-2 The role of Decision Modeling

4.2 The Value of Decision Modeling

Decision modeling adds value by bringing the organizations' decision-making approach "out of the shadows". Creating an explicit, managed and business-accessible definition of decision-making allows for validation, management, automation and more.

Producing a decision model provides:

- Transparent, traceable, business oriented representation
- Precise and executable representation of requirements
- Enterprise consistency and compliance
- Support for any balance of manual and automated decision-making
- Managed complexity
- Integration of analytic technologies
- Measurable performance and continuous improvement

Tangible Benefits of Adopting Decision Modeling include:

- Lower time to market
- Lower development cost
- More agility
- Improved business engagement
- Greater scalability

This is a summary of chapter 4 - more detail is provided in the book

5 How and When to Apply Decision Modeling

Timing in life is everything
—John Sculley

Decision modeling is a powerful technique that is broadly applicable. Many different business problems can be addressed, wholly or in part, by decision modeling. Like any technique, however, there are some problems to which decision modeling is well suited and others where it is not.

This chapter introduces the basics of decision modeling and considers the situations where it will work well and those where it is less likely to do so. It discusses how to target decision modeling, including the specific characteristics of decisions that make them benefit most from the approach. Finally, it puts decision modeling in context, by outlining a Decision Management approach and showing where decision modeling fits in that approach.

5.1 How Decisions Are Modeled

5.1.1 Decision modeling basics

Later chapters discuss decision modeling in detail, covering the notation, basic and advanced concepts, best practices and the integration of a standards-based approach to decision modeling into an overall business architecture. This section introduces the basics of decision modeling to facilitate a discussion of when and where to adopt it.

Decision modeling is fundamentally about expressing decision-making as a rigorous, structured, verifiable model rather than as unstructured, informal and potentially ambiguous text. Instead of simply writing out long-hand what decision-making an organization wants, needs or wishes to conduct, decision modeling formalizes it so it can be clearly and widely understood, managed and used effectively.

Any decision modeling approach must support the definition of decisions, allow for the specification of the information and know-how required to make the decision, express the business value of a decision and put that decision in context.

5.1.2 Defining decisions

A decision is primarily defined by:

- Its **outcome**: what it is trying to determine, its conclusion(s);
- Its **inputs**: the information it uses to make this determination and on which it is dependent;
- Its **structure:** the elements involved in making it *and*

- Its **logic**: the means of selecting or calculating a specific outcome value in each scenario to which the decision is applied by using its inputs.

A repeatable decision's outcome is knowable in advance. It can be one of a number of discrete values (e.g., should we accept a client's loan request—yes or no? What credit rating should we assign a customer—AAA, AA, A, B…?) or a continuous value within a range (e.g., the price of this insurance policy, the interest rate to charge). It can be a simple value or a complex document containing multiple elements, for instance a proposal for restructuring a debt. A decision's outcome has a direct impact on the business, often directing a business process between alternative paths or creating a critical piece of information. Each one also has a measurable business value.

Like decision outcomes, each input also has a range of expected values. The logic of a decision shows how an outcome is derived from its inputs. One way to do this is to describe how its conclusions are determined according to sets of conditions tested on its inputs. As this logic represents business policy it is important that decision definitions focus on the business meaning and intent of this logic rather than the technical details of how it is implemented. Logic should be expressed clearly and concisely to support review and, where necessary, challenges to its accuracy.

This logic is divided up and managed by the decision's structure (see Section 5.1.4). The structure breaks a decision down into more granular pieces, each of which can have its own outcome, inputs, structure and logic.

5.1.3 Question and allowed answers

The pivotal property of a decision is its business rationale. Failure to define this early can lead to misidentified or unclear decisions. The purpose of any decision being modeled should be carefully considered. The most effective way to capture a decision's purpose and to establish its outcome is to identify:

- What business question is answered by the decision?
- What are the possible or allowed answers? Is there a default?

Every decision should have a crisp and succinct description for each of these, expressed in standard business terms. The business purpose of a decision is to answer this question using one (or more) of the allowed answers.

5.1.4 The structure of decisions

Most business decisions are non-trivial and many are extremely complex. Decision modeling addresses this by breaking down decisions into smaller, more granular decisions. Through this decomposition even the most complex decisions can be understood. This creates a hierarchical structure for a decision that can be effectively linked to the information inputs with which each piece of the decision is made and to the knowledge that will allow it to be made legally, accurately and effectively. For each decision being modeled the structure defines:

- Which other decisions are dependent on this decision or are required by it?
- What inputs do these decisions have and how does each decision in the model

consume the available inputs?

- Is there any supporting knowledge that might constrain or guide how the decision reaches its conclusion such as external mandates or regulations, internal policies, expertise or best practices?

This information is collected and refined iteratively to model the decision in increasing detail.

5.1.5 Business value of decisions

It is important to know the business value of a decision and precisely how it is measured or determined for all decisions (automated or manual). This clarifies their definition and assists in monitoring their business performance. Business value defines what makes a good (or bad) decision and shows what trade-offs might be required when the decision is being made. The definitions of different types of business value are discussed in Section 5.4.5.

5.1.6 The context of a decision

The context of a decision frames and surrounds it. This context is separate from the decision and adds clarity to its definition. A definition specifies what decision is being made whereas a context describes how it is used. Specifically, the context defines:

- **Business process**: which business processes use or are controlled by the decision? Which events trigger (or are triggered by) it? How are decisions coordinated?
- **Business organization**: which parts of the business, or even individuals, own (i.e., are accountable for) the decision? Which parts of the business maintain and execute it (i.e., perform it operationally)? Which parts of the organization are interested in the decision and need to be informed of changes?
- **Business motivation**: the value the business derives from the decision and how this is measured as a Key Performance Indicator. What is the business importance and priority of each decision?
- **Architecture**: which existing systems or components use (or are used by) the decision?
- **Business data**: what business data is required by or available for decision-making? How are distinct data sources related and what timeliness and data quality do they provide?

5.2 Where Decision Modeling Works Best

One of the challenges in identifying that decision modeling will be an effective technique in a given scenario is that, by definition, the decisions in question will not necessarily be well understood until decision modeling is applied to them. This means that the characteristics that make a decision a good target (discussed below in Section 5.4) may not be known when the choice to adopt decision modeling must be made.

To resolve this, it is possible to assess existing systems, business processes or business areas with a view to adopting decision modeling without first identifying the decisions within them. Three key elements indicate that decision modeling will be beneficial: value, scale and transparency. Figure 5-1 shows how these three characteristics intersect to create both a sweet spot where value, transparency and scale overlap as well as some clear areas of additional opportunity.

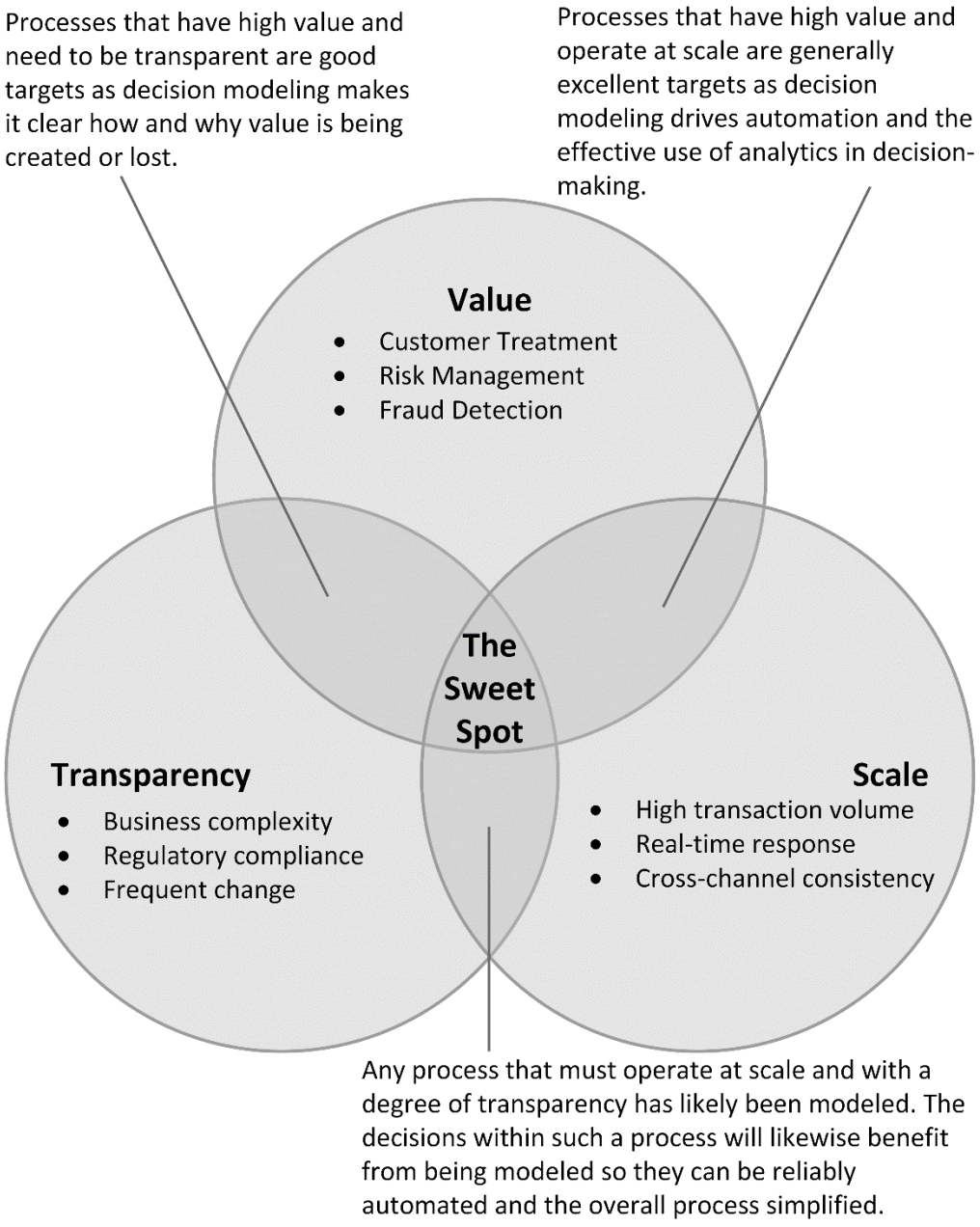


Figure 5-1 Three dimensions of suitability

Regardless of the business area's characteristics, however, there is value to an organization of understanding and modeling decisions. Organizations often find it easier to manage risk if all the decisions involved in risk are clearly modeled and managed, even those decisions and business areas that don't "pass" the tests in this chapter. When personnel are retiring, when organizations are undergoing a significant reorganization or for

a myriad of other reasons, decision modeling can create and capture organizational value well outside these boundaries.

5.2.1 High value operations

The way in which a business process, system or business area adds value makes a difference to the potential for decision modeling. Those areas focused on customer treatment, on risk management and on fraud prevention and detection are particularly likely to show a return on decision modeling. These are all decision-centric problems where the decisions made determine business outcomes directly. For instance, it does not really matter how efficiently an insurance organization can process a claim if it decides to process a fraudulent claim as though it were legitimate—bad decision-making has a far larger negative impact than efficient processing has a positive one.

5.2.1.1 Customer treatment

Most organizations want or need to treat customers in accordance with their corporate policies. At the same time, they want to treat good customers better than poor ones, reflecting the value of a customer in the value of the treatment offered to that customer. They may also want to target new and existing customers effectively to drive future growth. This combination of a need for consistency and for targeted customer treatment puts a premium on well-defined and well managed decision-making and creates an opportunity for decision modeling to add value.

5.2.1.2 Risk management

All organizations need to manage risk. They need to impose controls on their business activities to ensure safe operations and to correctly account for risks they accept. They may need to accept or reject transactions based on their impact to the organization's overall risk profile and, potentially, disclose this impact to a third party (e.g., a regulatory authority). In parts of the business where managing risk is a day to day activity, decisions must be made in the context of the organization's risk portfolio and risk policies. A clear understanding of decision-making is essential in these circumstances because the decisions made must uphold the risk policies and be demonstrably compliant with industry mandates and regulations. In addition, decisions can articulate tradeoffs between risk and customer growth.

5.2.1.3 Fraud detection and prevention

Organizations at risk of fraud, those where the identity of those they interact with may be falsified or where false transactions may need to be processed, are engaged in a running battle with those who seek to defraud them. For example, trying to manage fraud through a "pay and chase" approach that seeks to detect payments that should not have been made has a very poor success rate. This puts a premium on preventing fraudulent transactions from entering the system in the first place. Ensuring that decisions to detect, report and prevent fraud are made quickly and effectively is critical. Decision modeling is a powerful tool in ensuring that they are.

5.2.2 High scale operations

Decision modeling is a way of defining, in advance, how decisions should and will be made. As such, the scale at which decisions need to be made acts as a powerful multiplier for its value. Decision-making is going to require scale and repay an investment in decision modeling when there is: high transaction volume, a need for real-time response or a desire for consistency across different channels.

5.2.2.1 High transaction volume

Any transactions that must be processed in large numbers require an organization to think about how it is going to handle these transactions. Business process and other models can help define how a transaction will flow through an organization and its systems. Most transactions, however, will also require an organization to make decisions. When transaction volumes are high the value of modeling these decisions to ensure they can be made repeatedly, correctly and consistently will be likewise high.

High transaction volumes also motivate organizations to optimize the cost of making decisions—by reducing or eliminating the need for manual intervention or minimizing use of expensive resources. Decision modeling's support for automation directly facilitates this.

5.2.2.2 Real-time response

If a transaction must be handled in real-time then it will not be practical to have manual handling of that transaction—some form of automation is going to be required. Without time to escalate or refer a transaction, decisions about transactions will need to be made automatically. Because decision modeling allows a precise, automatable definition of decision-making, it is extremely valuable as part of designing a real-time response to a transaction or event.

5.2.2.3 Cross-channel consistency

As organizations become more complex they must handle interactions across multiple channels. Web, mobile, in person and automated channels must be coordinated and must behave consistently. While the systems and processes involved in each channel are often different, decision-making must be consistent or at least integrated across the channels. Decision modeling allows this coordination to be managed effectively.

When a business area includes many business processes across which consistency is desirable or demanded, this area is likely to be a good candidate regardless of the motivation for consistency. While delivering consistency across channels is the most common, it is the need for consistency that is the driver here. Because decision modeling enables the reuse of shared decision services across many parts of the organization, it is essential for this consistency.

5.2.3 Operations requiring transparency

The final aspect of a business domain that identifies it as one where decision modeling may offer great value is a need for SMEs, business owners and external parties (e.g. regulators or auditors) to clearly see and understand what is happening in the business—for transparency. Where a business domain has a great deal of business complexi-

ty, where regulatory compliance is critical or where change is constant the transparency of decision modeling is required.

5.2.3.1 Business complexity

Most organizations have some aspects of their business that are fundamentally more complex than others. Where the business is complex, there is value in enabling business experts to understand and control the behavior of information systems. There is also value in being able to capture best practices and tribal knowledge so that the expertise of experienced staff is not lost when they move on or retire. Decision modeling is an effective tool in both situations.

5.2.3.2 Regulatory compliance

Some organizations have the luxury of operating without detailed regulatory oversight, but many must constantly focus on following, and being seen to follow, detailed regulations. Because ensuring compliance with regulations is complex, demonstrating compliance is often even harder and punishments for non-compliance can be severe, effective tools are required for managing the impact of regulations on the business. Decision modeling is one such tool which also enables the use of other tools such as BRMSs that can likewise help.

5.2.3.3 Frequent change

Regardless of the complexity of a business area or its regulatory framework, it is always a challenge to manage a business domain that is subject to constant change. If the way the business operates must constantly be adjusted, it is essential that there is transparency and clarity as to how it is operating now. It's only safe to change something if you understand it. Decision modeling is a powerful tool for making it clear how the business is (or should be) operating such that it can be rapidly, and safely, changed as business needs change.

5.3 When Decision Modeling is Less Useful

Decision modeling can be less useful simply when none of the above conditions are true. In addition, when decision logic is being discussed and decision modeling considered, there are a few red flags that identify the domain as one in which decision modeling is likely to be less useful:

- If the domain of discussion is a technical one rather than a business one. Decision modeling is fundamentally a way to model *business* decisions.
- More specifically, if the decisions are implementation specific rather than business focused; for example, logic aimed at cleaning up data quality issues across systems.
- If the decisions concerned are trivial and have no inherent business value such as those required for purely technical data format translation.
- If the decisions are highly localized, tactical, short-lived and their value is not transferable such as the logic involved in one-off system integration.

Even if the area is one that appears to meet the criteria for decision modeling, it may also be the case that the logic involved is not consciously understood or that it cannot be readily analyzed. In these circumstances decision modeling may not be useful. Care is warranted, however, as some areas are considered poorly understood only because no-one has really attempted to understand them or to use a suitable approach. Developing an initial decision model, or attempting to, may reveal that some of the area can be usefully modeled. Do not write off any area too quickly.

5.4 Characteristics of a Suitable Decision

If a business domain is suitable then the next step will be to identify candidate decisions within that business domain. How to discover decisions within an area of the business is described later (see the Section on methodology in 12.2). Many organizations conduct initial decision discovery workshops and quickly generate many candidate decisions. Decision discovery is also an ongoing activity, however, best managed in tandem with an evolving set of business processes. As the business evolves and changes, as new business processes are considered or new systems implemented, new decisions will be discovered.

As decisions are identified it is possible to consider each to see how suitable it is for decision modeling—how much benefit will accrue from modeling the decision. Each decision can be considered in turn for suitability. This too should also be an ongoing activity, subject to periodic reevaluation. Some decisions may be initially ruled out of scope—perhaps they were not the focus of the project during which they were discovered—and later need to be reassessed. For instance:

- If the regulatory environment tightens or court rulings make it imperative that decision-making be compliant then a decision may become a better candidate for modeling.
- New competitors or changed behavior on the part of existing competitors, especially a competitor that is now changing and adapting more rapidly, may likewise increase the value of modeling specific decisions such as those related to pricing or promotion.
- The business of the organization may evolve to make a decision more important (e.g., the volume or cost of manual processing may increase), driving up the value of modeling it.

It is also important to periodically re-assess decisions already modeled to see if they still need to be maintained and updated. While few regulations are withdrawn, it does occasionally happen and this will cause some decisions to be retired. Similarly, changes to business models and the competitive environment may sideline decisions or even make them irrelevant. It is important that redundant models are retired otherwise governance and modeling teams can be overwhelmed with work on old decisions, leaving no capacity for new ones. It is important to maintain the relevance and leanness of decision repositories.

A set of characteristics can be described for a decision that allow it to be characterized as suitable for decision modeling. No one characteristic or group of characteristics is definitive. These characteristics are better thought of as ways to prioritize and order decisions in terms of the likely value that decision modeling will bring. The characteristics, in descending order of priority, are:

5.4.1 Is made frequently

Perhaps the most basic characteristic of a suitable decision is how often that decision must be made. The more often a decision must be made the more value there is likely to be from understanding and being able to systematically improve that decision. The value of a decision can be considered to be the impact of that decision multiplied by its frequency. Thus a decision made more frequently is going to be more valuable than it might at first appear. Even a relatively simple, low value decision that is made frequently may have a significant cumulative value making it a better target for decision modeling. Decisions made many times an hour or more are ideal.

For instance, one large retail bank considering a Next Best Action initiative identified 140M touch points a month with customers. This means that the decision as to the most suitable action or offer to make to a customer must be made approximately 200,000 times an hour.

While most decisions that are modeled are made frequently, there are some good use cases for modeling low volume decisions, sometimes even those that will only be made once. Where the value of knowing how a decision will be made in advance is high, or the impact of making it is substantial, it can be worth modeling a decision even if it is not made very often.

5.4.2 Needs to be applied consistently

In parallel with the frequency of the decision, it is worth considering how consistently it must be made. Generally, a decision that is made frequently should also be made consistently and decision modeling is particularly effective when this combination is seen. Especially when a decision must be made consistently across many parts of an organization or across many channels or multiple processes, decision modeling will be a powerful tool for consistency.

Note that this does not mean that the decision will have the same outcome each time, only that the approach used to make the decision should be consistent. A decision to determine the correct content to display to a website visitor based on their profile, interests and behavior, for instance, may result in different content every time but is likely to be based on a consistent decision-making approach and so be a good fit for decision modeling.

Sometimes a decision is not currently being made consistently but there is a desire to make it consistent and repeatable. For instance, different claims adjustors might be reserving against claims in a different way at present. An organization may decide that this is unacceptable and use decision modeling to drive to a consistent, repeatable approach.

5.4.3 Has real business impact

The business impact of a decision may be assessed in terms of direct financial consequences (e.g., profit increase or cost reduction) as well as non-financial benefits such as risk reduction, preservation of reputation or legal compliance. To be quantifiable, such measures of business value should be linked to metrics that are monitored on an ongoing basis such as customer retention rate or fraudulent claims paid. The impact of a decision can be seen in the metrics or measures that it alters.

The value of a decision might be obvious and immediately calculable such as the revenue from an automated cross-sell or the amount of money saved by not unnecessarily referring a policy to an underwriter. Alternatively, the value might be such that it can only be measured after-the-fact with analysis, such as by measuring how many loyal customers were retained by offering a strategic discount. Value may also come from the cost and probability of error in a decision, for instance if a non-compliant decision can result in a fine that could be avoided.

5.4.4 Is measurable

Strongly related to the business impact of the decision is the ease with which that business impact can be accurately measured. Bitter experience suggests that a decision that has a real business impact but one that cannot easily be measured is a poor candidate for modeling. If the impact of improving a decision cannot be proven, then improving it can seem like an expense without a return.

Decisions may be poorly measurable because the required data cannot be captured, because it cannot be captured at a sufficiently granular level to notice the improvement or because it cannot be captured often enough. Solving a measurement problem like this can be addressed as part of a decision-centric project, and will need to be if the decision in question is going to be targeted effectively. It may also be that other impacts exist that are poorly understood, obscuring any improvement caused by better decision-making.

5.4.5 Has inherent business value

Distinct from the previous two considerations, this characteristic concerns the value of the business logic *itself*. Does the business logic have an inherent and lasting value or convey an explicit benefit or advantage? This value may be proprietary, representing an interpretation or a specification into which much analysis time has been invested or a resource that would be expensive to replace. For instance, the logic might currently reside in the heads of SMEs who may leave the company. Decisions can also have value if their definition is, or could be, contested. For instance, if multiple versions of policy exist and the organization needs to select one and justify it in each case.

Modeling such a decision creates value in various ways:

- It creates durable documentation that is concrete and easily understood. This is available to employees and won't be lost when the experts who created it leave the company.

- It eliminates confusion when a decision is subject to many competing forces by expressing the current policy or regulatory 'interpretation' clearly.
- It provides the ability to review and optimize decisions based on an accessible definition.
- It can be used as an effective training resource.
- It allows implicit business knowledge and requirements to be explicitly formulated and captured by subject matter experts.

5.4.6 Changes frequently

Some decisions are stable and the way they are made need not be changed very often. In contrast, other decisions must be constantly adjusted and refined to reflect new regulations, court rulings, policies, competitive behavior, business partner practices or similar. The more frequently the decision-making approach must change, the more value there is from a formal, manageable model of the decision-making. A model of the decision-making is easier to assess to see how it might need to change, easier to change and it is easier to verify that it has been changed appropriately.

Just as some decisions have regular change imposed upon them, others require frequent business-led change from within an organization. Triggers for change in such decisions are likely to be business triggers: an update to the business domain or an innovation to optimize profit or reduce costs. The need for this kind of change is generally first observed, and better understood, by business personnel rather than members of the technical team. The best approach is to allow management of these decisions by the business themselves so they can determine when and how the decision-making approach must be changed. Modeling this kind of decision allows greater control by business professionals.

5.4.7 Must be made very quickly

Some decisions must be made very quickly. If a decision is required as part of a real-time interaction, then it cannot be deferred to a person and must be completely automated. Modeling decisions that must be automated in this way has high value.

Similarly, some decisions that need not be made in real-time have more value if they are made quickly. There is a concept in decision-making of **Decision Latency**. This concept, first articulated by Richard Hackathorn of Boulder Technology Inc., in articles published in 2002[1], states that the value of a decision generally declines the longer it takes to make it unless a delay can improve the accuracy of the decision.

Figure 5-2 shows some of the ways in which value can decay with time and the matching ways in which value increases when time to decide is reduced:

- Sometimes it displays a classic decay curve: decaying quickly initially and then slowing.

[1] *Minimizing Action Distance* in DM Review, September 2002

- Sometimes this decline is gradual, with each small delay in decision-making reducing the value of the decision linearly.
- Sometimes this decline is more of a step function, with delays longer than a certain threshold (a regulatory deadline for instance) causing a significant reduction in value.
- Sometimes the value stays flat for an extended period during which a change in the time taken to make the decision has no impact on the value of that decision.

The decision latency of the decision can impact the value of modeling and automating the decision. If significant value can be created by making the decision more rapidly, then a more rigorous understanding of the decision—a decision model—is likely to be valuable.

5.4.8 Is expensive to make

If a decision has a high processing cost in terms of manual work (e.g., personnel time), relative to the cost of automation, then it is likely to be worthwhile to automate it. When decisions are made manually, there is often a great deal of variation, even inconsistency, in decision-making. It is also common that much of the domain expertise required to make the decision well is not documented or managed effectively. This means that the retirement or departure of critical personnel can significantly degrade the accuracy and timeliness of decision-making. Modeling and managing these decisions captures this domain expertise so it can be reviewed, shared, and automated where this is cost effective.

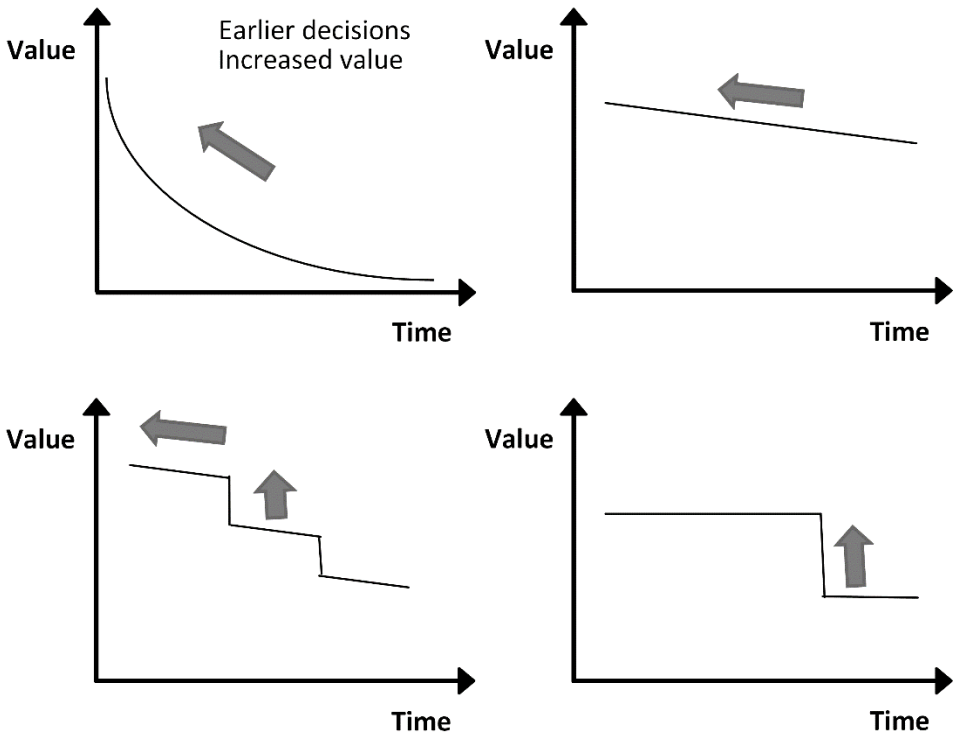


Figure 5-2 Decision Latency and the Rate of Value Increase in Different Scenarios

5.4.9 Can be audited or reviewed

Many decisions are driven by external regulations. Organizations making these decisions often have to demonstrate that their decisions are compliant with these regulations. In addition, decisions based on policies or a mix of regulations and policy are often subject to audit and must be explicable to an external or internal reviewer, sometimes under time pressure. In these circumstances the decision needs to be traceable to supporting documentation and it must be possible to justify its behavior. Decision modeling helps with both of these.

5.4.10 Has a high cost or risk of error

Sometimes making a poor decision has a serious consequence in terms of business outage, loss of reputation or fines. In some scenarios the consequence is more modest but it is easy to make a poor decision. In either case, the potential losses from poor decision-making (the product of the maximum loss and its probability) are significant. Decisions that have these kinds of risks need to be well understood so that the risk can be minimized and mitigated. Decision modeling provides the clarity and transparency necessary for risk mitigation efforts while also helping to identify exactly where in the decision-making errors are most likely and allowing this decision-making to be improved.

5.5 Decision Modeling in Context

Decision modeling is a key technique in the successful adoption of Decision Management and the construction of Decision Management Systems. Decision Management has a basic structure consisting of three main phases: Decision Discovery and Modeling, Decision Service Definition and Implementation and Decision Measurement and Improvement[2]. These phases progress iteratively while decision modeling has a role in all three phases as shown in Figure 5-3 Phases of Decision Management.

5.5.1 Decision Discovery and Modeling

The first step in Decision Management is Decision Discovery and Modeling. Decision Discovery and Modeling identifies and describes the repeatable decisions that matter to a business—the ones that drive operational results. It separates these operational decisions from business processes and systems, externalizing them and allowing them to be managed and evolved independently.

Decision Discovery and Modeling is first and foremost about capturing a transparent, unambiguous definition of the decisions that are to be managed. This involves the use of a decision modeling approach such as that described in Chapter 12. Identifying a broad set of candidate decisions allows Decision Management efforts to find the most effective focus points. These decisions are modeled for clarity and specificity using DMN. A decision model ensures there is enough precision to draw automation

[2] In previous publications these have been referred to as Decision Discovery, Decision Service Definition and Implementation and Decision Measurement and Improvement. The names have changed but the meaning has not.

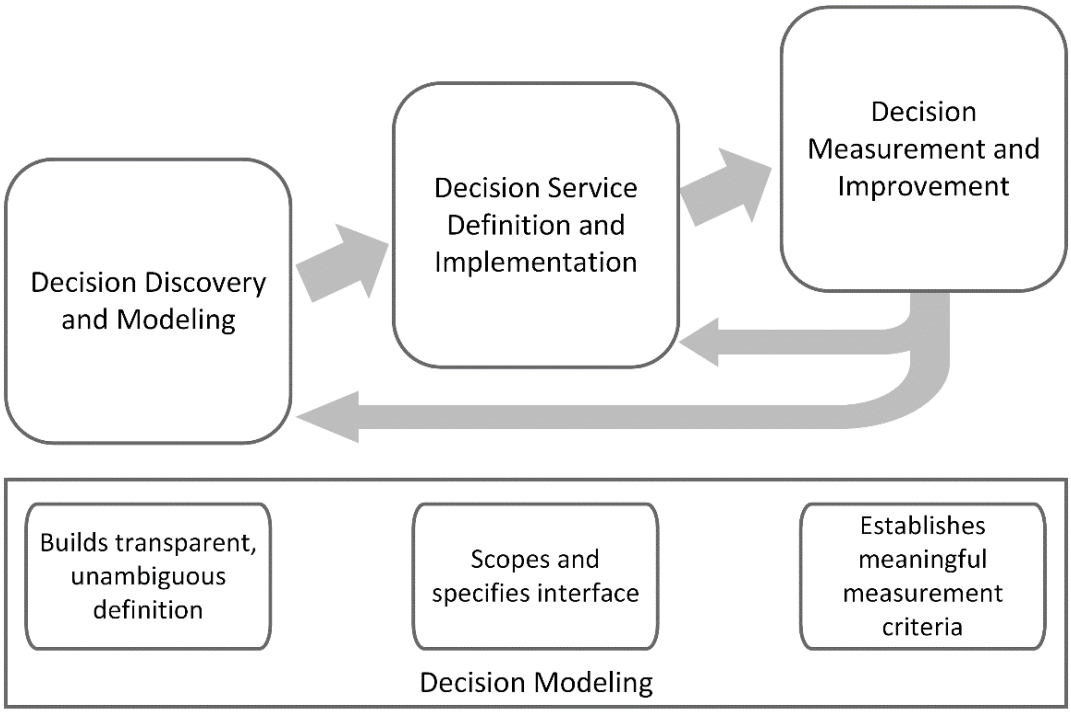


Figure 5-3 Phases of Decision Management

boundaries and to drive towards a successful implementation. The use of DMN, a standard and business-friendly notation, allows these decisions to be understood and owned by the business. Decision modeling using DMN also provides common language between business analysts, architects, business owners, IT professionals and analytic teams so these models can orchestrate the Decision Management technology required by each business problem.

This combination of process separation and modeling allows decision-making to be linked explicitly to performance measures and KPIs (Key Performance Indicators), so that it is clear what changes to decision-making will be required to improve any given measure. This linkage helps drive effective models—ones that will have a positive business outcome in terms of these measures and KPIs—and establishes the framework for monitoring decision effectiveness.

The use of DMN also exposes decision logic to earlier and more thorough expert review by bringing it earlier in the development cycle, into Decision Discovery and Modeling. This allows for rapid identification of vague definitions, contradictions and misunderstandings.

Decision Discovery and Modeling extends an organization's requirements and architectural approach to explicitly focus on operational business decisions. This is where the core activities of decision modeling should be performed.

5.5.2 Decision Service Definition and Implementation

The second step in Decision Management is the creation of Decision Services to automate some or all of the decisions identified and modeled in Decision Discovery and Modeling.

Decision Service Definition and Implementation uses decision modeling to scope and specify the interface for these Decision Services. Decision Services replace hard-coded decision logic in processes and systems to make those processes and systems simpler, smarter and more agile. Decision Services are stand-alone components, generally built using Business Rules Management Systems. They can be enhanced with the results of data mining and predictive analytics, at the time of their original creation or anytime thereafter.

Decision Services implement all or part of a decision model. They are business services in a Service Oriented Architecture (SOA) that deliver an answer to a specific business question—the one defined for the decision. These services do not update information or have other side effects. They just answer questions such as "how should we handle this claim?" or "what is the right discount for this order?" They are how systems and processes find out what the best or most appropriate decision outcome—answer—is for a particular customer or transaction. Because they don't make any permanent changes and they have no memory, they can be used to answer questions whenever they arise without worrying about potential side effects, making the decision reusable and widely applicable.

Most organizations have developed an SOA infrastructure for deploying and managing services. This infrastructure is used to access a Decision Service just like any other service. In addition, it allows the Decision Service to access enterprise resources and other services (using the same SOA infrastructure) and can make various business-level interfaces available for other services to use.

Decision models play a critical role in Decision Service Definition and Implementation. As noted in section 8.1.6, a Decision Service is defined in terms of the decisions that are included in the service, the data and decision results required as inputs to the service and the decision(s) that can be invoked in the service. Decision models also provide a framework for agile and iterative development of Decision Services, allowing each phase or iteration to be scoped, modeled and implemented in a controlled way without forcing a waterfall development approach. Because decision models also make the interactions and dependencies within and between Decision Services explicit, they help organizations scale to dozens or hundreds of Decision Services while avoiding complexity issues such as the management of dependencies.

Most importantly, decision models show how the various technologies used in a Decision Service are being orchestrated to deliver the overall answer. Currently, Decision Services are built primarily using decision logic—business rules—specified as part of the decision model and often managed using a BRMS. Many Decision Services implement decisions based entirely on policy, regulation and best practices—all of which can be represented using business rules. Other Decision Services also require analytic insight

from data mining and predictive analytics to be integrated into the service to deliver the required decision-making. Some may even require constraint-based or other kinds of optimization. All the required technologies should be encapsulated within the Decision Service and orchestrated according to a defined decision model.

5.5.3 Decision Measurement and Improvement

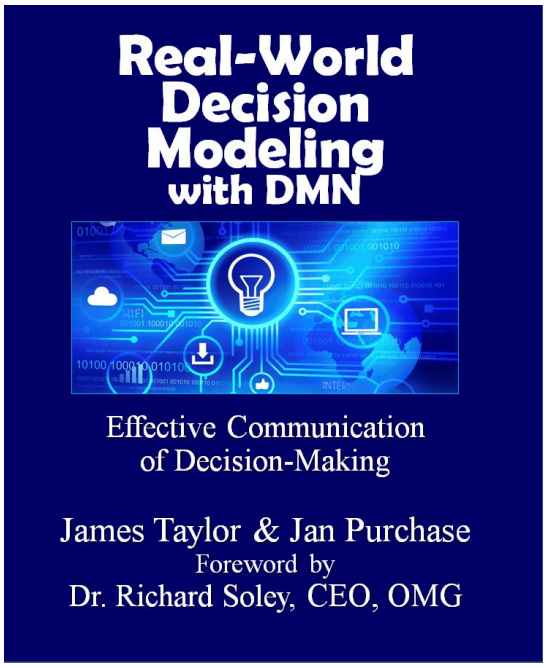
The final step is to close the loop with Decision Measurement and Improvement. Decision Measurement and Improvement ensures that decision-making is monitored and constantly improved to cope with a changing environment and deliver increasing value over time.

Decision Measurement and Improvement—the application of performance management techniques and technologies to the monitoring of decisions—is critical. With a Decision Management approach, the business understands how specific decisions create value. These decisions are linked to the performance metrics being tracked for individuals as well as for the business as a whole. To continuously improve business performance, decision-centric organizations monitor decision performance, throughput and basic statistics. For example, how many times a decision is made to approve, reject or refer a customer case is a measure of decision effectiveness. Too many referrals will increase the burden on staff doing manual reviews. Too many rejections, thanks to false negatives for instance, will impact customer service or sales. Similarly, decisions that take too long or that cost too much (because they use data that must be purchased, for instance) may have a negative overall impact. Tracking and reporting this information will help the business owners understand and thus manage their decisions more effectively by targeting improvements.

Decision models provide meaningful measurement criteria and crucial connective tissue for this phase. Connecting decisions to both the KPIs and metrics they impact and to the decision logic that implements them, decision models glue a decision monitoring environment together. Decision models support impact analysis and other investigative techniques as they can be used to see which higher-level decisions are impacted by a specific proposed change and how those decisions impact the business and its systems and processes. By connecting a local change to its broader business context, decision models support more sophisticated analysis and more systematic improvement.

Real-World Decision Modeling with DMN

Effective Communication of Decision-Making



Organizations make thousands of automated, operational decisions every week—from targeted pricing of products to determining which customers get automatic approval, from customizing website navigation and content to satisfying regulatory mandates. How well they make these decisions drives their profitability, makes or breaks their reputation and powers customer satisfaction.

How these decisions are made is one of a company's most important assets. All too often these decisions are not explicitly managed, assessed or even visible to the company's business experts. Instead they are buried in the company's software code and policy manuals, where they are hidden from view and may even be contradictory. Decision modeling gives you the power to change this, to make your organization's decisions transparent, agile and scalable.

Written by two of the field's foremost experts, this book addresses why, when and how to model decisions using the Decision Model and Notation (DMN), a new open standard for representing business decisions.

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JAMES TAYLOR has been focused on Decision Management for the last 14 years – since he first came up with the phrase – and he is almost certainly the best known proponent of the approach. While working at FICO he wrote a book on the topic with Neil Raden. Since then he has written Decision Management Systems: A Practical Guide to Using Business Rules and Predictive Analytics (IBM Press, 2012), dozens of articles and white papers and several book chapters expanding and developing the core concepts. One of the original submitters of the Decision Model and Notation standard, he has been using decision modeling on client projects since 2011. He has designed and written effective development methodologies and developed several modeling tools, including one based on DMN - DecisionsFirst Modeler. As the founder and CEO of Decision Management Solutions, he works with clients to help them implement Decision Management and Decision Modeling as well with vendors who are adopting Decision Management as an approach that maximizes the value of their products.

JAN PURCHASE has been working in investment banking for 19 years, the last 13 of which he has focused exclusively on the use of business decisions, decision modeling (TDM and DMN), business rules, business rule management systems (BRMS) and business process modeling. He is a founder of Lux Magi Financial Rules (LMFR), a company specializing in delivering the benefits of all of these concepts to financial organizations, as well as providing training and mentoring in their use. All of LMFR's clients have benefited from the adoption of decision modeling; one international initiative included a set of fourteen separate decision modeling projects trained and mentored by LMFR. Jan has maintained a blog 'Decision Management for Finance' since 2010 highlighting the practical lessons learned from applying decision modeling and BRMS at scale and providing useful feedback to LMFR's clients and vendor partners. He has published many white papers, hosted multiple webinars and chaired several public coaching sessions on the application of decision modeling and BRMS to problems in finance. Lux Magi has been applying TDM and, more recently DMN, to finance and regulatory compliance projects since 2011.