

Creating a Knowledge Book for WSDOT: Lessons and Future Directions

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Knowledge Management Services

Creating a Knowledge Book for WSDOT: Lessons and Future Directions

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Deploying Practical Solutions Using Lean Techniques and Knowledge Management (PS AID Project)

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1. INTRODUCTION

Individual employees at WSDOT develop specialized knowledge through their education, years of work at the agency and through collaboration with peers at other organizations. This knowledge goes beyond what one can learn from a textbook, training course or procedures manual. It is built up through an accumulation of experiences, observation, analysis and personal interactions. This experience enables an expert to know what questions to ask, diagnose a problem and make judgements about what needs to be done.

When these employees change positions or leave WSDOT to retire and/or pursue other career opportunities, the agency is at risk of losing valuable knowledge. This loss of knowledge can impair the agency's ability to achieve its stated goals and make best use of available resources. Regression in capabilities occurs rather than forward progress.

In 2015, as part of WSDOT's Accelerated Innovation Deployment (AID) project, "*Deploying Practical Solutions with Lean Techniques and Knowledge Management*." (PS AID Project), WSDOT tested a technique for knowledge capture, sharing and reuse. This technique, called the Method for Analyzing and Structuring Knowledge (MASK) involves interviewing one or more experts, structuring what they know using a series of standard models, and presenting these models – with links to relevant reference materials in a format that can be easily navigated and used by successors.

The MASK Methodology was developed and implemented in France by Drs. Jean-Louis Ermine, Djilali Benmahamed, and Pierre Tchounikine. Dr. Denise Bedford of Georgetown University had a working knowledge of MASK through collaborations with Dr. Ermine, and served as the knowledge engineer for the WSDOT knowledge book effort¹.

2. BACKGROUND ON MASK²

The MASK method provides a comprehensive, multi-dimensional-view of knowledge. The approach enables a deep understanding of the target topic area, providing a picture that is greater than the simple sum of its individual components. The MASK technique is based on the theory that *knowledge is formed by information that acquires meaning from a given context*. The context allows one to assess the significance and implications of a piece of information. For example, a driver's license may indicate that someone is 20 years of age. The significance of this information varies depending on whether the individual is ordering a drink in a bar, or demonstrating eligibility for a youth rate at a museum.

MASK includes six models: three that provide a context for understanding and interpreting knowledge

¹ At the time of WSDOT's AID project initiation, there was only one known example of MASK use within the United States (at Kraft Foods), and a single English fluent consultant with significant experience implementing the technique.

² This section is based on a summary of the MASK method in J.L. Ermine, Knowledge Management: The Creative Loop (2018)

and three that tap into the expert(s) thought processes, providing meaning to information. Each set of models represents knowledge about structure, process and evolution.

The six MASK models are illustrated in Table 1 and Table 2.

Table 1. Models that Provide Context for Interpreting Information

Model	Purpose	Model Components
Phenomena: effects or events to be controlled, understood, or managed in some way.	<ul style="list-style-type: none"> Specify what is generally known Explain basic principles 	<ul style="list-style-type: none"> Triggering event for the phenomenon Source of the phenomenon Flows created by the source Target – effects created and observed Consequences Influencing factors
Activities: organization of activities leading to a product or output	<ul style="list-style-type: none"> Describe basic processes Create a “how to” guide 	<ul style="list-style-type: none"> Breakdown of activities Input and output flows People involved Resources required Knowledge, skills and attitudes required
History: description of how the knowledge domain has evolved to reach its current state	<ul style="list-style-type: none"> Provide historical context essential for understanding a knowledge domain 	<ul style="list-style-type: none"> Developmental stages or generations of knowledge evolution with associated timelines Significant events or milestones Connections between generations illustrating causality or influence

Table 2. Models that Provide Meaning to Information

Model	Purpose	Model Components
Concept: description of a concept from the knowledge domain	<ul style="list-style-type: none"> Define essential vocabulary used in the knowledge domain Specify structure and relationships between different elements in the domain 	<ul style="list-style-type: none"> Concept definitions Concept classification – breakdown into sub-concepts
Task: breakdown of a problem solving method	<ul style="list-style-type: none"> Document a noteworthy approach or procedure 	<ul style="list-style-type: none"> Task definitions Indication of sequential, alternative, repetitive and parallel tasks
Evolution: description of the evolution of a specific concept or object in the knowledge domain	<ul style="list-style-type: none"> Provide an understanding of improvements made from an earlier design 	<ul style="list-style-type: none"> Description of different generations of the concept or object with associated timelines Drivers of evolution across generations Rationale for each generation

3. EXAMPLE KNOWLEDGE BOOKS

3.1 KRAFT FOODS

Kraft Foods was the first US organization to apply the MASK methodology. They were motivated to create knowledge books by a 2012 divestiture/spinoff of Kraft Foods Group, Inc. from Kraft Foods Inc., as well as impending retirements of key individuals. Kraft has used MASK to develop over 20 knowledge books in key technology areas including production of processed cheese and concentrated milk products. The company's central research, development, quality, and innovation (RDQ&I) unit led this effort. Kraft identified domain areas for knowledge capture based on:

- Mission critical - needed to support current and future business strategies
- Current core competency that helps drive competitive advantage
- Not readily accessible – difficult to find documentation, no cohorts to leverage
- Rare or unique, resides with one expert, at risk of losing knowledge, and expertise not available externally
- Stabilized - knowledge area not likely to evolve and become obsolete or be replaced

Kraft knowledge books were produced in PowerPoint format. PowerPoint was selected for its accessibility to employees and ease of updating. The knowledge books were resource-intensive to create – as an example, one book took 6 months to develop and is 300 pages long.

Knowledge books are used to complement technical training and as a tool for new employee orientation. They are also used for troubleshooting issues.

Kraft identified several success factors for knowledge books:

1. The expert(s) must be available to participate and make the knowledge book a priority. Management support is key.
2. The needs of future recipients of the knowledge book must be considered. Early engagement of recipients is important.
3. Existing relevant documentation should be included in the knowledge book – by referencing or including the content. It is important not to underestimate time requirements to do this step.
4. Knowledge books should be living objects. A champion should be identified to own it and socialize it. The knowledge book should be integrated into training on the topic.
5. The field covered by the knowledge book must be largely stabilized.
6. The expert(s) should have the ability to communicate knowledge in a structured format.

Knowledge books are only one of several different knowledge transfer and learning techniques in place at Kraft. Other techniques include:

- job shadowing/apprenticeships
- short-term assignments
- detailed mapping of job responsibilities and knowledge needed to complete tasks/role;

- technical reports

For further information on knowledge books at Kraft see:

- [Advances in Transportation Agency Knowledge Management](#), NCHRP Project 20-68A, Scan 12-04, 2014
- [APQC Best Practices Report: Transferring and Applying Critical Knowledge](#), 2013

3.2 MINNESOTA DEPARTMENT OF TRANSPORTATION

In 2017, the Minnesota DOT (MnDOT) initiated a pilot demonstration project to apply the MASK Method. They engaged Jef Tendron, the knowledge engineer that created the Kraft knowledge books for this pilot. The pilot produced a knowledge book on concrete pavement rehabilitation. Jef worked with Gordy Bruhn, MnDOT's concrete senior engineering specialist.

The process of developing the knowledge book involved:

- An initial 60-90 minute scoping interview to map out the critical knowledge related to concrete pavement rehabilitation
- A series of interviews conducted by the knowledge engineer with the expert - an estimated 20 hours face-to-face and 20 hours of Skype interviews were held
- Work on the part of the knowledge engineer to create a draft knowledge book
- An iterative process of validation and revision

The knowledge book took roughly one year to complete. It is divided into four major sections: (1) essential information about concrete, (2) how to prepare a project, (3) how to carry out concrete repairs, and (4) peripheral information such as traffic management, warranty and plan development.

The knowledge book focuses on concept models and task models. It also includes phenomenon models, a history model and a simple lineage model. Examples of models included are listed below:

- History Model – list of key milestones in concrete pavement rehabilitation practice evolution
- Phenomenon Model – freeze-thaw cycles, delamination
- Concept Models – composition of concrete, structure of a concrete pavement, concrete expansion/contraction, reinforcing bars, types of cracks, causes of faulting, causes of partial depth repair failures, locations of spalling, analyzing cores, types of repairs, purposes of pavement grinding, repair warranty, traffic management options
- Evolution Model – reduction of water content in concrete
- Task Model – rehab project development (models for different phases), carrying out pavement repairs (models for multiple types of repairs)

After completing the initial knowledge book as a proof of concept, MnDOT created two more – one on Bituminous Mix Design and one on Structural Steel Fabrication.

MnDOT's initial knowledge books were developed in PowerPoint (following the Kraft Foods model). However, MnDOT is converting the knowledge books to an e-learning platform to meet ADA compliance

requirements and to better enable access to the content from mobile devices.

For further information on MnDOT's knowledge book pilot, see:

- [MnDOT Research Project Page](#)
- [Linda Hinrichs - Before They Hit the Road-MnDOT Knowledge Books, May 2019](#)
- [Mike Leegard – Presentation to Concrete Paving Association, March 2019](#)

4. WSDOT'S KNOWLEDGE BOOK STRUCTURE AND CONTENT

WSDOT's knowledge book is about highway safety analysis – how to use available information from crash reports and other sources to diagnose safety issues – which leads to selection of appropriate countermeasures that reduce the risk of crashes and fatalities. Version 1 of WSDOT's knowledge book is organized as follows:

- Chapter 1 defines high level concepts (e.g. sustainable safety, crash, countermeasure, diagnosis) and describes how crash diagnostics and countermeasure selection has evolved. It uses MASK concept and history models.
- Chapter 2 provides a high level picture of crash diagnostics and countermeasure selection: the context within which it is performed, inputs, outputs, outcomes and activities. It presents a MASK phenomenon model and illustrates four key activities discussed in chapters 3-6.
- Chapters 3-6 present activity and task models. They also define key concepts related to each activity. The task models break down each of the activities and cover information, tools and expertise required for each task.

Chapters 3 and 4 are fully built out; chapters 5 and 6 were not in the scope of the knowledge book, but include a basic framework that can be filled in.

Figure 1 shows the table of contents of the knowledge book.

TABLE OF CONTENTS	
01	Crash Diagnostics and Countermeasure Selection: An Evolving Practice
02	Crash Diagnostics and Countermeasure Selection Today
03	Crash Diagnostics
04	Countermeasure Identification
05	Countermeasure Analysis
06	Economic Analysis

Figure 1. WSDOT's Knowledge Book Table of Contents

Figures 2-5 show examples of the different MASK models included in the book.

crash diagnostics and countermeasure selection: an evolving practice

Evolution

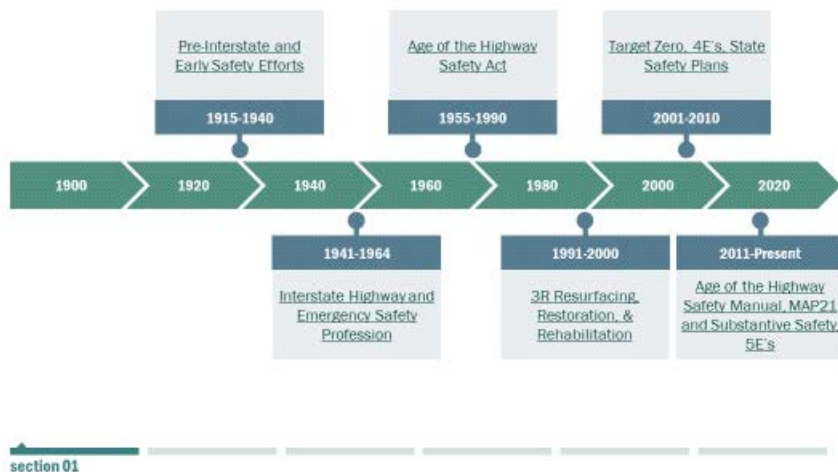


Figure 2. WSDOT's History Model

Overview



Figure 3. WSDOT's Phenomenon Model

Activity Model

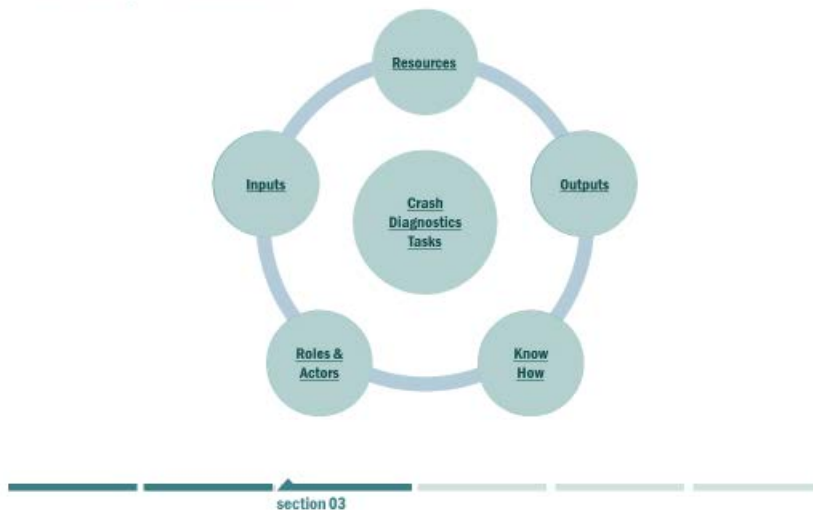
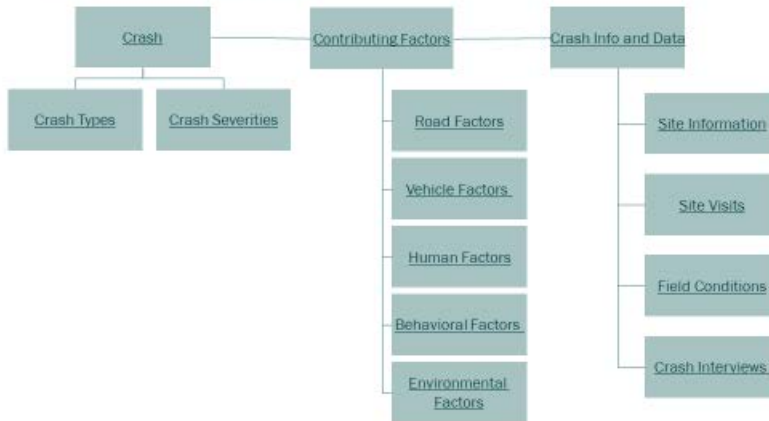


Figure 4. Activity Model

Key Concepts



section 03

23

Figure 5. Concept Model

Task 1: Review Safety data

Activity>Task>Step>Knowledge Resources



section 03

37

Figure 6. Task Model

The version 1 knowledge book was delivered to WSDOT as two integrated PowerPoint files. The main file provides the base content and navigation features; the second file contains linked content. The knowledge book was constructed this way to facilitate future updates. The assumption was that the main file would remain fairly static whereas the second file of linked content would be more frequently updated with detailed information. This architecture would also facilitate future migration of the detailed content to a content management or e-learning system – in which text for each topic or concept would be maintained in a database and assigned an appropriate author for updating. The version 1 knowledge book had approximately 170 pages; the supplemental file had 330 pages.

WSDOT evaluated the version 1 knowledge book and decided that while Version 1 provides a valuable compilation and organization of safety analysis content, a more condensed, focused version with an emphasis on graphics rather than text would better meet the agency's needs. Work is currently underway to produce version 2 of the knowledge book.

5. WSDOT'S KNOWLEDGE BOOK DEVELOPMENT PROCESS

WSDOT's knowledge book was created through application of the MASK methodology. Templates for the different MASK models are provided in Appendix A. A checklist of questions used to guide each stage of the knowledge book development process is included in Appendix B. The activities involved to develop WSDOT's knowledge book are summarized in the subsections below.

5.1 SCOPING AND OBJECTIVES FOR THE KNOWLEDGE BOOK

Crash diagnostics was identified as a good candidate for a knowledge book for several reasons. It is an important practice at WSDOT, and central to the agency's vision, mission and values – which emphasize safety. It is an activity that relies not only on written guidance but on the tacit knowledge built from experience. It is also a practice that had been evolving, which led to variations in practice across the agency. There was a desire to improve consistency and establish a common understanding of key concepts. Four primary safety experts were identified to participate in development of the knowledge book: John Milton, State Safety Engineer; Matt Neeley, Capital Program Development and Management; Ida Van Schalkwyk, Traffic Operations; and John Donahue, Development Division. Other subject matter experts (SMEs) that were consulted included: Chris Schroedel, Development Division; John Tevas, Development Division; Mark Leth, Northwest Region; Jennene Ring, North Central Region Traffic Safety Engineer; Kumiko Izawa, Capital Program Development and Management; and Justin Sheets, Traffic Operations.

Based on initial discussions with the primary safety experts, the following initial goals were established for the knowledge book:

- Create a validated tool which can be used to train novices to successfully contribute to Safety Management and which also provides a continuous learning path from novice to expert.
- Explain how crash diagnostics fits into the larger safety management process – to promote understanding of context and value and the development of expert judgment.

- Provide a self-guiding tool which can help novices to navigate and integrate sources, applications, expertise, and other materials to complete a crash diagnosis task – to iteratively learn over multiple uses.
- Clarify and elaborate the problem formulation and design aspects of crash diagnostics – the essential knowledge that still lives in the heads of experts and is referenced in the literature as “judgment”.

5.2 INITIAL MODELING

An initial meeting with experts was used to identify the target readership for the knowledge book and identify available WSDOT and national resources on safety analysis.

The resources identified in the initial meeting (including WSDOT training materials and the AASHTO Highway Safety Manual) were reviewed and used to create preliminary versions of the phenomenon, activity, task and concept models. The concept models were developed using semantic analysis of several core chapters of the AASHTO Highway Safety Manual.

5.3 INTERVIEWS AND MODEL REFINEMENTS

Once draft models were created, subject matter experts (SME) were interviewed and asked to:

- Validate or adjust the models;
- Offer advice regarding additional sources needed to understand and learn (set of structured questions);
- Describe specific examples or cases and to explain the way they made judgments or how they came to different conclusions; and
- Share “stories” of how they learned, mistakes they made, how they changed their approach over time.

Based on the discussions, several modifications were made to the initial models. SME’s identified several additional resources with material that could be referenced. They also provided ideas for presenting concepts at the start of each chapter as well as linking concepts to activities and tasks.

5.4 KNOWLEDGE BOOK OUTLINE

A draft outline for the knowledge book was created, annotated with notes on the sources to be referenced in each section.

The outline was reviewed in a series of meetings with SMEs. The SMEs provided comments on the outline and the models and made specific suggestions for materials to integrate. At this time, there was also a discussion about how the navigation would work, and how the knowledge book would be updated. The group recognized that there would be tradeoffs to make between complexity (level of detail, number of hyperlinks) and ease of maintenance. They suggested that the book might contain links to web pages or other documents that are regularly updated – as opposed to duplicating this content within the book itself.

The outline for the knowledge book was revised based on the SME input.

5.5 CONTENT BUILDOUT

A spreadsheet model was created to track each page of content to be created, consistent with the outline. The resources identified by the SMEs and the SME interviews were used to build out the content. The MASK models provided the organizing framework. Each model included hyperlinks which led to other slides with detailed information.

Content was reviewed by WSDOT staff, who made suggestions for improvement. Updates were made based on comments received.

6. FUTURE KNOWLEDGE BOOK DEVELOPMENT GUIDE

6.1 LESSONS LEARNED FROM WSDOT'S KNOWLEDGE BOOK DEVELOPMENT EFFORT

While the knowledge book created through this effort continues to evolve to meet WSDOT's needs, valuable experience was gained that can be used to guide future efforts. Key lessons are summarized below.

- **Recognize Time Requirements.** In retrospect, the WSDOT knowledge book scope was too ambitious given the level of resources that were allocated to the task. The knowledge book creation process would have benefited from more time – on the part of both the knowledge engineer, and the SMEs that participated. The process is highly iterative, and requires many cycles of interviewing, modeling and refinement. Future knowledge book efforts should build in sufficient time commitment to allow for these cycles.
- **Single Expert.** The WSDOT knowledge book drew upon the expertise of multiple individuals, but did not have a primary designated expert. This complicated the content development process given the need to integrate multiple perspectives. The development effort would have benefited from having a single expert viewpoint. Future knowledge book efforts should distinguish subject matter expertise from subject matter practitioners or those with positional authority and identify a single expert who can make time to participate in knowledge interviews and serve as the primary owner.
- **Use of Graphics.** WSDOT's knowledge book would have benefited from a more graphics-centric approach, including diagrams and photographs that go beyond the depiction of the MASK models. Both the Kraft and MnDOT knowledge books provide examples of this.
- **Book Organization and Content.** WSDOT's knowledge book was organized around the MASK models – the initial chapter covered the history model; the second chapter covered the phenomenon model and the high level activity model, and the remaining chapters covered activity and task models for four phases of safety analysis (diagnostics, countermeasure identification, countermeasure evaluation, and economic evaluation). All chapters included

concept models. While this organization was logical and was vetted and agreed to by WSDOT's experts, the product could have benefited from a structure that emphasized the topics the user would look for (e.g., safety performance considerations rather than phenomena). The MASK models would support the structure but not be the focus of navigation. The book also contains several referenced external resources. These are important to include but the organization and content should emphasize the key things that the users of the book should know that are not easily found in other sources.

- **Development Process.** A top-down process was used, with considerable work to create and refine an outline for the knowledge book and plan out the different sections. Actual content development beyond the high level models was the last step in the development process. Future knowledge books would benefit from a hybrid top-down and bottom-up approach in which portions of the technical content are developed early on to gain agreement on the presentation as well as depth of the substantive content. Early creation of substantive graphics would fit well with this approach.
- **Use of External Content.** Considerable effort was spent reviewing and incorporating relevant content from external sources. In retrospect, effort would have been more productively spent distilling essential insights from experts and referencing supporting external content.
- **Integration with Vocabulary Resources.** Future knowledge books should be designed for integration with WSDOT's glossary and thesauri to leverage available definitions of terms such as "crash", "sustainable safety", "countermeasure", etc.
- **Referencing External Material.** Several external resources are identified in the version 1 knowledge book but the linked material is not maintained with permanent URLs. This means there is a potential for losing linked content. Future efforts should consider obtaining copies that can be managed for long term access.

6.2 FUTURE KNOWLEDGE BOOK DEVELOPMENT AT WSDOT

As noted earlier, WSDOT is using the version 1 knowledge book as a resource base for creating a version 2 that is more graphical and more focused on selected content. Once version 2 is complete and put into production, WSDOT should seek feedback from the target end users and use the feedback to add to the above list of lessons learned. The lessons should inform future knowledge book development efforts.

In order to move to a mature practice in which knowledge books are one key element of a knowledge management strategy at WSDOT, the following steps should be considered:

1. **Develop and publish criteria for identifying suitable knowledge book applications at WSDOT.** These criteria can be based on those used by Kraft. For example:
 - Knowledge domain is considered essential to WSDOT's mission
 - Knowledge domain is relatively stable
 - Knowledge domain is not currently widely shared across multiple individuals at WSDOT
 - External expertise in this domain is lacking or difficult for WSDOT to access

- WSDOT is at risk of losing available expert(s) in the topic
 - A lead expert is available with the motivation and time needed to make the knowledge book successful
2. **Identify and prioritize a list of candidate knowledge book topics as part of a larger knowledge management strategy**
 - Compile workforce statistics indicating likely retirement trajectories
 - Work with agency managers to identify key experts at risk of departure
 - Apply the established criteria to identify and prioritize topics
 3. **Seek funding for a knowledge book development effort and procure services**
 - Consider research funds or grants
 - Seek services from individuals experienced in application of the MASK method as well as those with experience creating e-learning materials that are ADA compliant
 - Scope effort to include initial set of 1-3 knowledge books (depending on resources available)
 - Include task to define requirements for target knowledge book platform, and produce knowledge book using a platform that meets the requirements
 - Reference the MASK model diagrams and standard knowledge book creation process in Appendix A and B in the request for proposals
 4. **Create a knowledge book integration plan**
 - Identify how the knowledge book concept model development process can leverage and be integrated with WSDOT's available vocabulary resources – e.g. link to glossaries and thesauri
 - Identify how the knowledge book activity model development process can inform and be informed by WSDOT's Business Function Classification Scheme (BFCs)
 - Identify how external resources will be referenced and linked to the knowledge book. For example, web resources that may be ephemeral can be moved to a more permanent location prior to linking.
 5. **Create a knowledge book maintenance plan**
 - As part of the scoping phase of each knowledge book, develop a maintenance plan to identify tasks and responsibilities for periodic updates to the knowledge book content. The maintenance plan should:
 - Identify the organizational unit within WSDOT with responsibility for making sure that periodic updates are made
 - Identify where the authoritative version of the knowledge book will be stored
 - Identify the anticipated frequency of updates: e.g., as needed/continuous, quarterly, annually
 - Identify a target length and complexity level that will be manageable to maintain with available resources
 - Identify the plan for making updates once the original lead expert changes jobs, leaves WSDOT or is otherwise unable to continue
 - Identify the process for making updates – which may vary based on the knowledge book platform and available staff resources. For example, a single expert may be

charged with keeping the book up to date as they think of new content to include. Alternatively, an individual within a publications unit may be designated for making updates submitted by the expert.

6. Create a knowledge book implementation plan

- As part of the scoping phase of each knowledge book, develop an implementation plan to ensure that the knowledge book is being used and is adding value for WSDOT. The implementation plan should:
 - Identify the individual who will champion use of the knowledge book
 - Identify the target users and steps for engaging representatives of these users early in the knowledge book development process
 - Identify how and when the target users are expected to make use of the knowledge book
 - Identify opportunities to introduce the knowledge book to target users – e.g. as part of onboarding or training activities
 - Monitor use and feedback to identify to determine the long term value of the resource and improvement needs

APPENDIX A: MASK MODEL DIAGRAMS

The following models were provided by Dr. Denise Bedford and used to create the knowledge book.

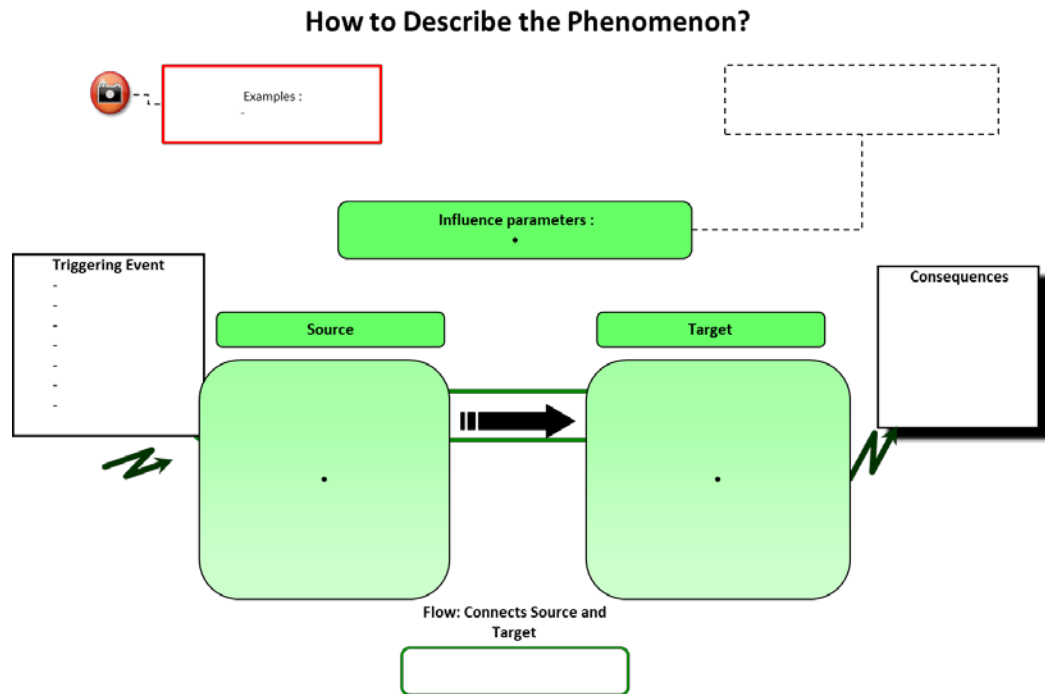


Figure A-1. Phenomenon Model

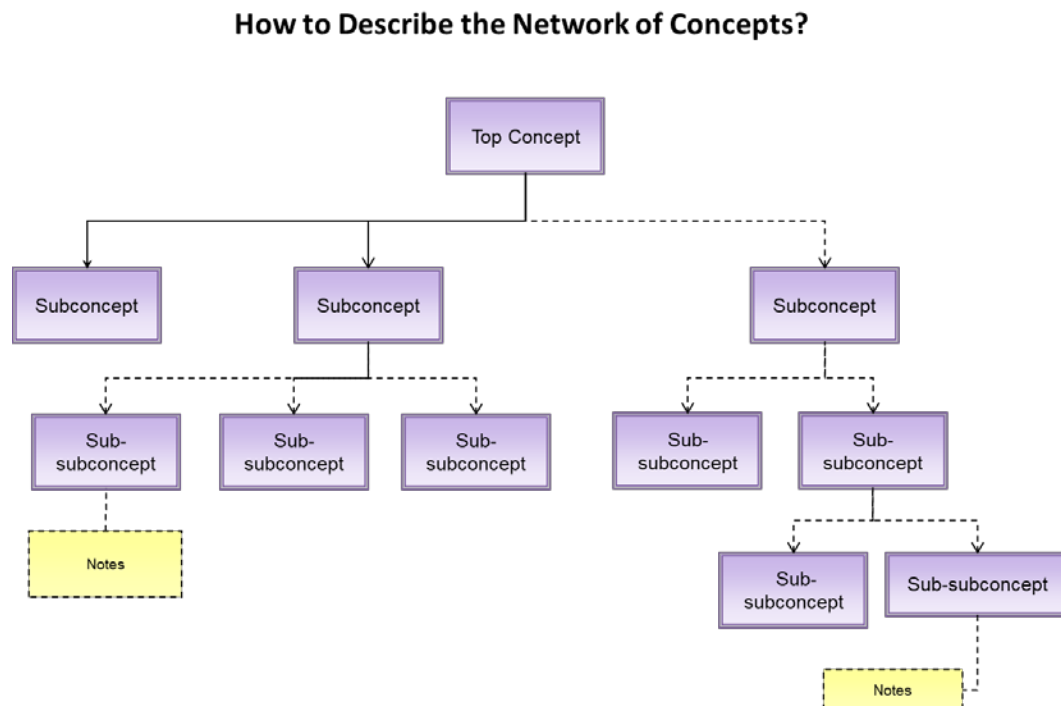


Figure A-2. Concept Model

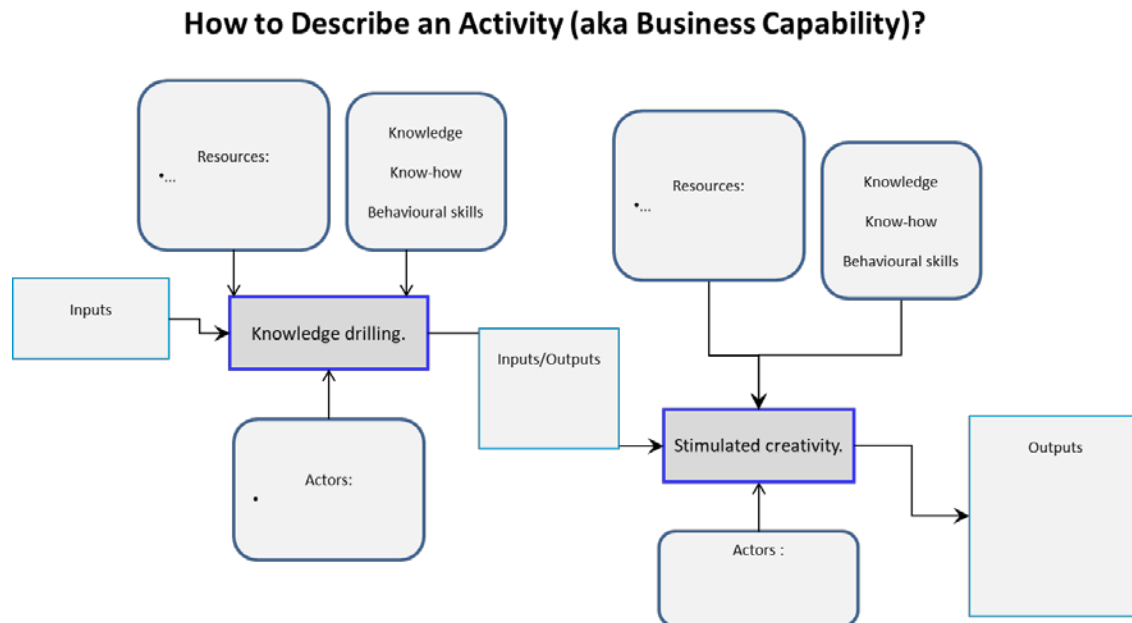


Figure A-3. Activity Model

The task model **How to describe a specific task or know-how ?**

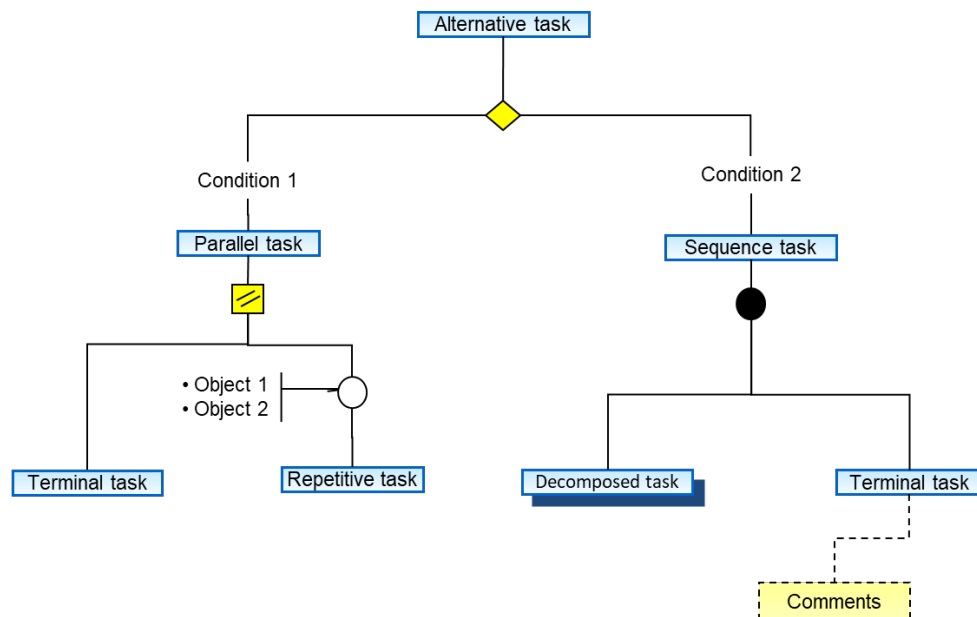


Figure A-4. Task Model

How to describe the history of the domain ?

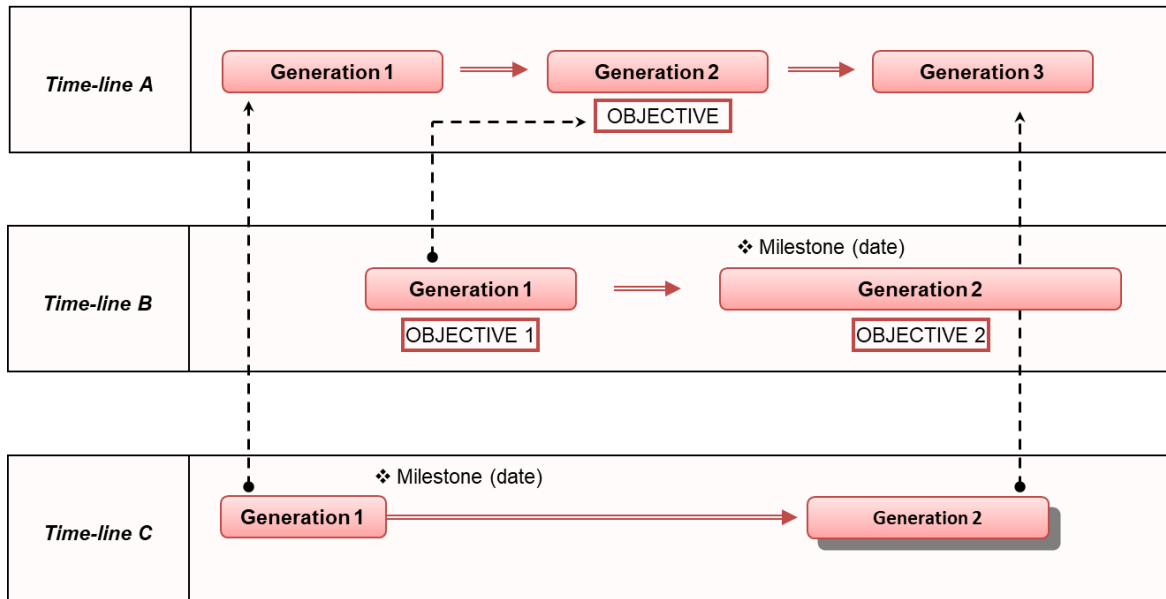


Figure A-5. History Model

How to describe the evolution of the objects or concepts ?

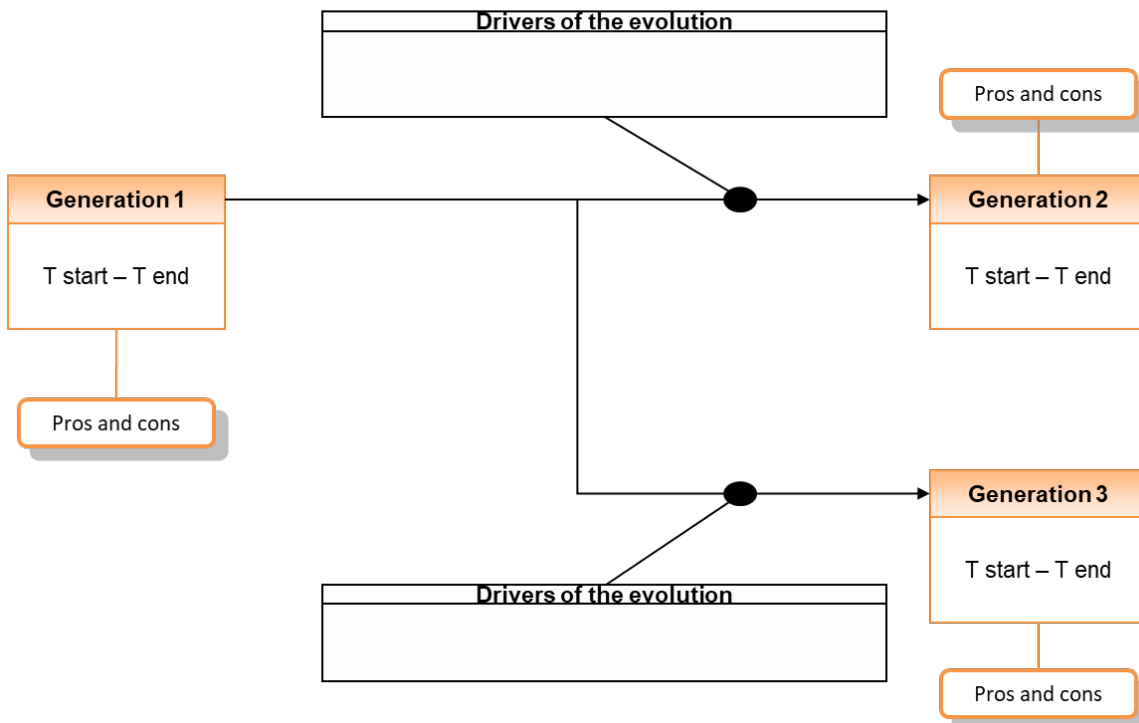


Figure A-6. Evolution Model

APPENDIX B. PROCESS FOR CREATING A KNOWLEDGE BOOK

The following list provides a standard methodology for creating a knowledge book. There are six stages defined. For each stage, a list of questions to be answered is provided. Dr. Denise Bedford used this framework to develop the knowledge book.

- **Stage 1: Elaborate the Framework**
 - What is the knowledge domain we're covering? What is the main focus?
 - What will be the title of the knowledge book?
 - Are there one or more processes linked to the knowledge domain?
 - What are the inputs to the processes? The outputs?
 - What are the devices, tools, applications used in the process(es)?
 - Who are the people or groups of people involved in this domain?
 - What is the degree of involvement of each of these individuals or groups?
 - What information sources are used, produced or stored in the domain?
 - In what form/channels is information generally shared?
 - In what context is the KB being developed?
 - What do you understand to be the future use of the knowledge book?
- **Stage 2: Identify the Potential Readership**
 - Who are the readers of the knowledge book?
 - What are the general characteristics of these readers?
 - What is their personal culture? Their education level? Their technical competencies? Are they English speakers?
 - What are their roles (job titles, level in the hierarchy)?
 - What is their working environment like?
 - What are the context and circumstances of the "reading"? What are their typical information behaviors and use patterns? How much time do they have available for reading?
 - What is the level of expertise of the readership re: this knowledge domain? Do you expect novices, specialists or experts to read/use the knowledge book?
 - Is this linked to training activities or manuals?
- **Stage 3: Identify the Sources of Knowledge**
 - Identify all of the sources of knowledge important to the process
 - Who are the people with an interest in and recognized experience in this knowledge domain?
 - What is the specific area of expertise of each of these people, what could be their potential contribution to the drafting of the KB?
 - Are there professional associations, communities of practice and working groups involved in this domain? How can we involve them?
 - Are there meetings, seminars, exhibitions, workshops, fairs and seminars during the last three years on this domain?

- What are the technological tools most currently used as part of your practice?
- Are there methodologies (procedures, quality standards, good practice...) used as part of the practice?
- What information resources exist (specialized libraries, key periodicals and books, websites and discussion groups)?
- What is the source of documentation for this knowledge domain?
- **Stage 4: Analyze and Structure the Knowledge Domain**
 - Can we identify the types of knowledge to be collected based on the following typology (activities, know-how, phenomena involved in the job, history of the domain, domain concepts, evolution of concepts, objects, solutions)?
 - Is one (or several) type of knowledge clearly a priority?
 - What are the knowledge types that seem not important in the framework of your KB? Why?
 - Depending on the types of knowledge identified, what resources will we need to collect this information?
 - Do we have sufficient knowledge of the domain to conduct the interviews? To tease out the tacit knowledge?
 - Do we have analytical grids, questionnaires for each type of knowledge to be collected, in order to adapt the interviews?
- **Stage 5: Synthesize the Sets of Knowledge Elements**
 - Can we build out the knowledge elements/components? Are there elements out of context which we should ignore?
 - What are the top knowledge elements in your opinion?
 - Can we classify all identified knowledge?
 - For each knowledge element answer the following questions:
 - What is the main idea? Does it lead to a meaningful title?
 - Based on the main idea, is each element relevant and consistent?
 - Is the element of value to the knowledge domain?
 - Is the element revealing untreated issues, or gaps in knowledge?
 - Among the knowledge elements, are you sure there are no redundancies?
 - Among the knowledge elements, is there a dominant axis which connects all of the other elements?
 - Is there one element that best structures the knowledge in the domain?
 - What structure is most evocative or relevant to your readership?
- **Stage 6: Compose the Knowledge Chunks**
 - Is there a clear identification of knowledge elements? Is there a clear name for each element? Is the meaning and added value clear? Can we easily identify its relationship to other elements?
 - Can we clearly explain the element? Are there easily understandable examples or case studies that readers will be able to relate to?

- Can we translate abstract concepts using metaphors or comparisons that make sense? Are there proverbs, mottos, aphorisms that pertain? Anything that supports memes? Do these speak directly to the readers?
- How do we explain elements? Words, multimedia, visuals...
- What links can we identify (to people and experts) that the reader might relate to?
- What information links will help to provide additional explanations?
- Are there images that will help understanding?
- **Stage 7: Review the Knowledge Chunks**
 - Is there any remaining unnecessary information that may generate noise or require unnecessary attention from the reader?
 - Is the organization of the knowledge elements coherent? Does each element represent one idea? Are the logical links made between elements? Are the links clear?
 - Are there any potential misunderstandings in the text?
 - Is the presentation well balanced? Is there a good ratio of text and graphics?
 - Is the syntax effective and strong (e.g., length of sentences, simplicity of wording, adapted to target readers, language errors, typos)
 - Is each page well-presented and attractive?
 - Do the illustrations bring added value to the text? Are they worth the reader's time?

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