Introduction to IDEF0/3 for Business Process Modelling.

Contents

Introduction .......................................................................................................................................... 2
Introduction to IDEF0 and IDEF3: ..................................................................................................... 2
Parent and Child Maps........................................................................................................................ 2
Tunnelling........................................................................................................................................... 3
Construction of IDEF Maps .................................................................................................................. 3
Branches and Joins................................................................................................................................ 3
Starting an IDEF0 Map .......................................................................................................................... 4
Root definition.................................................................................................................................... 4
The IDEF0 Numbering Convention....................................................................................................... 5
Creating a model................................................................................................................................... 5
  Decomposition..................................................................................................................................... 6
The origin of IDEF.................................................................................................................................. 8
Layering in IDEF Models....................................................................................................................... 10
Other uses of IDEF.................................................................................................................................. 11
The IGOE Diagram............................................................................................................................... 11
The IGOEM diagram............................................................................................................................. 13
Conclusion............................................................................................................................................ 13

Tables & Figures

Figure 1: IDEF Symbols .......................................................................................................................... 2
Figure 2: Example of generic functional steps....................................................................................... 3
Figure 3: Example of IDEF0 Functional View....................................................................................... 3
Figure 4: Example of IDEF3 Process Map............................................................................................. 3
Figure 5: Example of joining arrows....................................................................................................... 4
Figure 6: The IDEF numbering convention........................................................................................... 5
Figure 7: Example of Hierarchical Parent-Child Structure .................................................................... 5
Figure 8: Example of A0 Context Map for small bakers........................................................................ 6
Figure 9: Example of A1 Functional Decomposition for Make Bread..................................................... 7
Figure 10: Decomposition of Make Bread, Step 3 ............................................................................... 7
Figure 11: Example of A0 map................................................................................................................ 8
Figure 12: Functional decomposition of Operational Process Map........................................................ 9
Figure 13: Decomposition of box A2, Sell products and services ......................................................... 9
Figure 14: Decomposition of box A21 Create and Maintain Sales Plan.................................................. 10
Figure 15: Process decomposition of Box A211 Perform customer market intelligence analysis............ 10
Figure 16: Cluttered map example......................................................................................................... 11
Figure 17: IGOE Template .................................................................................................................... 12
Figure 18: Example IGOE model........................................................................................................... 12
Figure 19: IGOEM Model....................................................................................................................... 13
Introduction

Ideal process maps are consistent, simple to understand and readable without reference to any supporting documents.

They should be as easy to use as a road map or an atlas, providing the user with the level of detail they need and no more.

This white paper presents IDEF as a business process notation which provides a simpler alternative to the better known BPMN notation.

BPMN is compared with IDEF at the end of this document.

Introduction to IDEF0 and IDEF3:

IDEF0 is used to model business functions
IDEF3 is used to model business processes

The simplicity of IDEF0 makes it very quick and simple to use:

Boxes define functions, processes or a whole enterprise, arrows show connections and labels to these arrows define their purpose.

Mapping starts with a box which describes the function to be mapped.

Arrows signifying Inputs, Controls, Outputs and Mechanisms are then added to the box. These are called ICOMS. The term Mechanism can be confusing but refers to the resources required to make the process work. In the IGOE development of IDEF, Mechanism is replaced by Enabler.

IDEF0 and IDEF3 can be used to examine any business function or process. I have used it to establish the key processes and business rules in organisational functions ranging from Manufacturing to HR and Operational Design.

As IDEF uses simple English and graphics, it allows business users and subject matter experts to work together to quickly understand, review, improve and design business processes.

With an IDEF guideline of 3-6 boxes in each map, unnecessary detail is excluded (in practice, up to eight boxes is acceptable). Where more detail is required, this is shown by creating child maps.

In the author’s opinion, the restriction to 3 – 6 boxes is not a problem. Functional steps are typically as simple as shown below:
Introduction to IDEF0/3 for Business Process Modelling.

Figure 2: Example of generic functional steps

Activities within box 4, Action can be shown within a child map. Child maps are indicated by the shadow outline on the parent box.

**Tunnelling**

When an arrow into a box is tunneled on the connecting end (the arrow head), it means that it does not need to be shown on the child as it applies to all activities at that level. Tunnelling an arrow at the unconnected end indicates that the data or input is not relevant to or supplied by the parent map. Tunnelling also helps reduce the clutter of unwanted detail on a map. Examples of tunnelling are shown later in this document.

**Construction of IDEF Maps**

IDEF0 and IDEF3 maps can be used respectively to provide functional and process views of the activities within an enterprise.

IDEF0 provides a functional view of the activities within an organisation.

Figure 3: Example of IDEF0 Functional View

Decisions are not shown in IDEF0 maps. Decisions are activities within a function and are performed according to assigned business rules. These maps show WHAT is required, not how it is done.

IDEF3 maps show the process steps and decisions at the lowest level of decomposition.

Figure 4: Example of IDEF3 Process Map

**Branches and Joins**

The logic of a map is explained by the arrows between boxes. Any output arrow may become an input, control, or mechanism to any other box following.

Arrows may branch to show that they connect to more than one box as shown in Figure 13 and combine to show that they both produce a specific output as shown in Figure 6 following.
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Figure 5: Example of joining arrows

Joining arrows are shown in the example above where quality records are produced both from A311 Prepare for prototype and market testing and A314 Manage production

Starting an IDEF0 Map

Root definition
This clearly states the purpose of the enterprise/entity that you are examining.

For example, the purpose of a car could be defined as *Safely and reliably transport family of four and luggage at reasonable cost.*

We know what we want it to do, what resources it needs and what rules apply to its use but do not need to know it works.

As a driver, you may only be interested in the fuel and tyres. As a mechanic diagnosing why the engine won’t start, the level of detail that you are interested in may go down to the lowest level of decomposition (i.e. the smallest part of the assembly), e.g. the spark plugs.
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The IDEF0 Numbering Convention

The same principles apply to mapping the processes within an organisation

For example, a ‘Car’ can be broken down into parts which are clearly identified and numbered so that their location within the car is defined and tells us ‘What is what, and what goes where’.

Creating a model

Define the purpose of the enterprise e.g. *Bake Bread for Public Sale* and then identify the inputs, controls, outputs and mechanisms required.
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This simple model provides a context for the processes and activities within the enterprise. It does not require any knowledge of process mapping notations and uses natural language.

The (|) symbol means that the arrow is tunnelled and therefore not seen in the child maps. This reduces clutter – so we can tunnel staff as a resource/mechanism that applies to all activities. However, we leave Gas supply to ovens untunnelled as this is specific to the child map.

‘Opening the box’ of Bake break for public sale shows the supporting functions:

**Decomposition**
Decomposition is part of the jargon of process improvement. It simply means breaking a process or function down to its component parts. This can down to the smallest parts, the ‘nuts and bolts’ or to assemblies or generic processes.

Note that the arrows in and out of the map are shown in the parent and child maps unless they are tunnelled. For example, the mechanism ‘staff’ is tunnelled on the parent map and therefore not shown on the child map.
Introduction to IDEF0/3 for Business Process Modelling.

Figure 9: Example of A1 Functional Decomposition for Make Bread

Step 3 of this series of functions is broken down into a process map as shown:

<table>
<thead>
<tr>
<th>Breadmaking Functions</th>
<th>Baking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive orders</td>
<td>START</td>
</tr>
<tr>
<td>Forecast orders</td>
<td>Mix ingredients</td>
</tr>
<tr>
<td>Forecast requirements</td>
<td>Knead mixture into dough</td>
</tr>
<tr>
<td>Variation to requirements</td>
<td>Allow dough to rise</td>
</tr>
<tr>
<td>Ad hoc Orders</td>
<td>Pre heat oven</td>
</tr>
<tr>
<td>Manage inventory</td>
<td>Bake break</td>
</tr>
<tr>
<td>Make bread</td>
<td>Bread available for sale</td>
</tr>
<tr>
<td>Sold bread</td>
<td>END</td>
</tr>
</tbody>
</table>

Figure 10: Decomposition of Make Bread, Step 3.

How I applied IDEF0 and IDEF3 modelling to an international organisation is shown following.
Introduction to IDEF0/3 for Business Process Modelling.

The example above shows the interactions between functions. For example, business rules and goals are defined in Box A1, Direct & Manage Business and these branch to connect to boxes A2, A3 and A4. Customer intelligence feeds back from Box A4, After Sales to Box A1 as an input.

Map A21 below is the child map of box A2. This shows the functional steps within A2 Sell Products and Services. Note that the ICOMS at this level match those of the parent level unless tunnelled e.g a call out at this level but not the parent one.

The detail within the box is shown in increasing levels of detail as it is decomposed, or broken down into its composite parts. The A0 and all subsequent maps should contain 3 – 6 boxes, each of which feeds into the subsequent process step or process as an input, control or mechanism.

The origin of IDEF

IDEF, standing for Integrated DEFinition Methods originated in United States Air Force in the 1970s. It defines a developing family of modeling languages which range from functional modeling to data, simulation, object-oriented analysis/design and knowledge acquisition. IDEF methods have now been defined up to IDEF14:

- IDEF0: Function modeling
- IDEF1: Information Modeling
- IDEF1X: Data Modeling
- IDEF2: Simulation Model Design
- IDEF3: Process Description Capture
- IDEF4: Object-Oriented Design
- IDEF5: Ontology Description Capture
- IDEF6: Design Rationale Capture
- IDEF7: Information System Auditing
- IDEF8: User Interface Modeling
- IDEF9: Business Constraint Discovery
- IDEF10: Implementation Architecture Modeling
- IDEF11: Information Artifact Modeling
- IDEF12: Organization Modeling
- IDEF13: Three Schema Mapping Design
- IDEF14: Network Design

For business process modelling we are only interested in IDEF0 and IDEF3
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Figure 12: Functional decomposition of Operational Process Map

The shadow boxes show that processes have been decomposed, i.e. that there is another level of detail mapped below each box. Note that the tunnelled arrow tails indicate that they are not shown on the parent map (Figure 12).

The numbering scheme clearly shows the position of processes and functions within the IDEF model.

Figure 13: Decomposition of box A2, Sell products and services
Introduction to IDEF0/3 for Business Process Modelling.

The operation of box A21 is now detailed at a lower level of decomposition, in the map following. Note that the arrow ‘Sales and service strategy’ is tunnelled as it enters the box ‘Create & Maintain Sales Plan’. This means that it is not shown on the child map, Figure 15.

![Diagram](image)

**Figure 14: Decomposition of box A21 Create and Maintain Sales Plan**

At the lowest level of decomposition, the process steps for A211 are shown by an IDEF3 process map.

![Diagram](image)

**Figure 15: Process decomposition of Box A211 Perform customer market intelligence analysis**

Layering in IDEF Models

Messy connecting lines on a map can be confusing as shown by the example below.
Maps are easier and quicker to read when more straight lines are used and line crossings are minimised. To reduce the clutter on map, the layering option typically available on drawing and modelling packages such as Microsoft Visio should be used to present the view required by specific users.

Other uses of IDEF

The IGOE Diagram

The simplicity of an IDEF0 model provides the basis of the IGOE model. IGOE is an acronym for Input, Guide, Output, and Enabler. These are the basic requirements for any business process. It’s origins in IDEF are obvious, the main difference being that Mechanism is replaced by the more understandable term, Enabler.
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Figure 17: IGOE Template

A simple example of making a sandwich is below.

Figure 18: Example IGOE model
The IGOEM diagram
I add Measures to IGOE to create an IGOEM diagram. Process performance measures are often overlooked in process modelling.

![IGOEM Model Diagram]

Figure 19: IGOEM Model

Conclusion
IDEF is a simple modelling notation which provides a basis for discussion and the collaborative exploration of process problems or potential improvements. As they use simple English and notation, there is no knowledge barrier to using the technique, unlike BPMN which tends to be used inconsistently and with too many symbols.

IDEF vs BPMN
Introduction to IDEF0/3 for Business Process Modelling.

<table>
<thead>
<tr>
<th>BPMN</th>
<th>IDEF0 &amp; IDEF3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 100 symbols in BPMN library</td>
<td>Boxes and arrows for IDEF0</td>
</tr>
<tr>
<td></td>
<td>Boxes, decision boxes and arrows</td>
</tr>
<tr>
<td>Training and and/or reference books required to create and read BPMN maps</td>
<td>IDEF can be learned in minutes</td>
</tr>
<tr>
<td>No numbering convention</td>
<td>Numbering convention ensures that reference numbers are applied to all maps and boxes on those maps.</td>
</tr>
<tr>
<td>No limit on the number of process elements per page</td>
<td>Limit of 3-6 elements per map. (although this may be extended 8)</td>
</tr>
<tr>
<td>Maps may include excessive, irrelevant and mixed levels of detail that confuse the reader.</td>
<td>Correct use of Parent-Child modelling and tunnelling ensures that the only the appropriate level of detail is shown in process decompositions.</td>
</tr>
<tr>
<td>Process mapping can be performed in silos without a context which identifies where the resulting maps are within the structure of the enterprise.</td>
<td>Process decomposition from A0 provides a hierarchical structure and numbering system which clearly shows the ‘address’ for a process within an enterprise.</td>
</tr>
<tr>
<td>Business rules, controls and resources are not shown in the maps and are often ignored in process mapping workshops.</td>
<td>Provided by the Control and Mechanism arrows</td>
</tr>
<tr>
<td>Both within individual companies and across industry, no standardisation. Multiple process maps, created by different people without following a standardised approach and naming and numbering convention. This makes them impossible to fit together to form an end to end, layer to layer set of maps that describe the enterprise</td>
<td>Simple process notation reduces variation and supports modelling standardisation.</td>
</tr>
<tr>
<td>Non standard English e.g. ‘catching’ and ‘throwing’ for message handling.</td>
<td>Conventional English</td>
</tr>
</tbody>
</table>

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