Those that can...

Prof Jon Holt & Simon Perry
Overview

1. Introduction
2. People
3. Modelling competencies
4. Defining a bespoke framework
5. Competency assessment
6. Conclusions
1. Introduction

• In this presentation we will ask
  – What is competency, competence?
  – Why do we need it?
  – How do we understand various frameworks?
  – How do we define our own frameworks?
  – How do we assess competence?

• Based on authors’ experiences, trials and tribulations
Realising successful systems & projects

• By no means trivial
• Three fundamental concepts
  – People
  – Process
  – Tools
• Important to address all three
Three Fundamental Concepts

```
«block»
Process
1..*

drives

Person
1..*
enables

Tool
1..*
```

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Realising success

• People:
  – Relevant competencies required

• Process:
  – Flexible
  – Scalable (size and rigour)

• Tools:
  – Techniques, such as modelling
  – Frameworks, such as UK-SPEC, SFIA, INCOSE, etc.
  – Tools, modelling tools, assessment tools
2. People

• We mean people with the right skills for their role
  – Competence
  – According to Stakeholder Role
  – Define a competency scope

• Competency frameworks
  – Generic, based on standards
  – Bespoke, based on organisation
Capability vs competence

• Capability demonstrates the ability of an organisation or organisational unit
  – Audited against standards
  – Assessed against standards

• Competence demonstrates the ability of the individual
  – Assessed against a competency framework
Rationale for competency assessment

- Self assessment
- Team assessment
- Career development
- Staff appraisals
- CPD - Chartership/accreditation
- Tendering
- Safety cases
Competency assessment

• Self assessment
  – Quicker and easier
  – Can we trust the result?
  – Requires rigorous approach

• Third-party assessment
  – Resource-intensive
  – Trustworthy results
  – Competence of assessors
  – Requires rigorous approach
3. Modelling competencies

• Defining and assessing is non-trivial
  – Complex
  – Often difficult to understand
  – Often difficult to communicate

• One way to address these issues is by using modelling techniques
  – We can model various frameworks
  – From these, we can develop bespoke frameworks
SFIA - Skills For the Information Age
INCOSE Competencies Framework
4. Defining a bespoke framework

```
Person
\[ holds \]
\[ 1..* \]
Stakeholder Role
\[ 1..* \]
```
# Defining levels – Level 1 - Awareness

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 – Awareness</td>
<td>‘speak knowledgeably about a particular aspect of the Competency. The main aim is for the assessee to demonstrate that they understand each Indicator fully, and back this up with examples - either theoretical or real-life.’</td>
<td>Unique for each ’Competency’</td>
</tr>
</tbody>
</table>
# Defining levels – Level 2 - Support

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 2 – Support</td>
<td>‘reflect the ability to implement the concepts that were discussed at Level 1 for this Competency’</td>
<td>Has achieved Level 1, 'Awareness', for this Competency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has implemented the concepts discussed at Level 1</td>
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<tr>
<td></td>
<td></td>
<td>Has been trained in some way</td>
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<tr>
<td></td>
<td></td>
<td>Has supported other people in the implementation of work Activities that use the Indicators in Level 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has created Artefacts related to the Competency as characterised by the Indicators for Level 1</td>
</tr>
<tr>
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<td></td>
<td>Has controlled Artefacts (applied version control, etc.) related to the Competency as characterised by the Indicators for Level 1</td>
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<tr>
<td></td>
<td></td>
<td>Has had Artefacts reviewed and has been able to address any issues that have arisen as a result of the review</td>
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<tr>
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<td></td>
<td>Can identify best practice in the Competencies, such as Standards, books, methodologies, etc.</td>
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</tbody>
</table>
## Defining levels – Level 3 - Lead

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3 – Lead</td>
<td>‘reflect the ability to be able to lead the Activity that was described at Level 1 and implemented at Level 2’</td>
<td>Has achieved Level 2, support</td>
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<tr>
<td></td>
<td></td>
<td>Has led Activity at a Project level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has managed Level 2 Activity (version control, release, setting work, assessing review responses, etc.).</td>
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<tr>
<td></td>
<td></td>
<td>Has formally reviewed Artefacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has experience facing clients</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has some formal affiliation to a professional body, such as associate or full membership</td>
</tr>
</tbody>
</table>
# Defining levels – Level 4 - Expert

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 4 – Expert</td>
<td>‘reflect the ability to be a true, recognised expert in the field that is described by this Competency’</td>
<td>Has achieved Level 3, Lead</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Holds formal Chartered status from a recognised professional body</td>
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<tr>
<td></td>
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<td>Has published in the field</td>
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<td>Has external recognition</td>
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<td></td>
<td>Has led Activity at the strategic or Programme level</td>
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<tr>
<td></td>
<td></td>
<td>Has mentored Level 2 and Level 3 staff</td>
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<td></td>
<td></td>
<td>Has contributed to best practice</td>
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<tr>
<td></td>
<td></td>
<td>Is currently active in recognised professional bodies</td>
</tr>
</tbody>
</table>
# Example Evidence Types

<table>
<thead>
<tr>
<th>Level</th>
<th>Evidence Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 – Awareness</td>
<td><em>Tacit knowledge.</em></td>
</tr>
<tr>
<td></td>
<td><em>Informal training course</em></td>
</tr>
<tr>
<td>Level 2 – Support</td>
<td>Formal training course</td>
</tr>
<tr>
<td></td>
<td>Activity – Artefact</td>
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<td></td>
<td>Activity – sworn statement</td>
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<tr>
<td></td>
<td>Activity – formal review</td>
</tr>
<tr>
<td>Level 3 – Lead</td>
<td>Educational qualification</td>
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<tr>
<td></td>
<td>Lead activity</td>
</tr>
<tr>
<td></td>
<td>Reviewer</td>
</tr>
<tr>
<td>Level 4 - Expert</td>
<td>Professional qualification</td>
</tr>
<tr>
<td></td>
<td>Publications</td>
</tr>
<tr>
<td></td>
<td>Public speaking</td>
</tr>
<tr>
<td></td>
<td>Activity definition</td>
</tr>
</tbody>
</table>
Example competency definition – ‘Modelling’ – Level 1 Indicators

<table>
<thead>
<tr>
<th>Competency</th>
<th>Description</th>
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</tr>
</thead>
</table>
| Modelling  | This Competency relates to generic modelling. | - Understands the need for modelling  
- Can provide an appropriate definition of modelling  
- Understands the concept of abstraction  
- Understands the concept of connection to reality  
- Understands the concept of different approaches to modelling  
- Understands the concept of consistency  
- Can define what a view is  
- Understand the difference between modelling and drawing pictures.  
- Understands structural modelling  
- Understands behavioural modelling |
5. Competency assessment

• Create a ‘Competency Scope’ for a Stakeholder Role

• Use a framework
  – Standard
  – Bespoke

• Perform assessment

• Produce a ‘Competency Profile’
Example competency scope – Requirements Engineer - bespoke (MBSE)
Example competency scope – Requirements Engineer - standard (INCOSE)
Example Competency Profile

Level 4 - expert
Level 3 - practitioner
Level 2 - supervised practitioner
Level 1 - awareness

Systems Thinking
- Systems concepts
- Super-system capability issues

Holistic Life Cycle View
- Determining and managing stakeholder requirements
- Integration and verification
- Validation
- Functional analysis
- Modelling and simulation

Systems Engineering Management
- Life cycle process definition
- Planning, monitoring and controlling
6. Conclusions

• Competency is
  – Essential for successful systems and projects
  – Non-trivial

• Modelling can help us
  – Understand frameworks
  – Define bespoke frameworks
  – Assess
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