A PRAGMATIC GUIDE TO COMPETENCY
Tools, Frameworks and Assessment
Our mission as BCS, The Chartered Institute for IT, is to enable the information society. We promote wider social and economic progress through the advancement of information technology science and practice. We bring together industry, academics, practitioners and government to share knowledge, promote new thinking, inform the design of new curricula, shape public policy and inform the public.

Our vision is to be a world-class organisation for IT. Our 70,000 strong membership includes practitioners, businesses, academics and students in the UK and internationally. We deliver a range of professional development tools for practitioners and employees. A leading IT qualification body, we offer a range of widely recognised qualifications.

Further Information
BCS, The Chartered Institute for IT,
First Floor, Block D,
North Star House, North Star Avenue,
Swindon, SN2 1FA, United Kingdom.
T +44 (0) 1793 417 424
F +44 (0) 1793 417 444
www.bcs.org/contactus
This book is dedicated to Mike, my mentor, friend and paragon of competence

JDH

To Stu, Jo and Sue, probably the best siblings in the world

SAP
## CONTENTS

| List of figures and tables                       | ix |
| Authors                                          | xiii |
| Acknowledgements                                 | xiv |
| Preface                                          | xvi |

### 1 INTRODUCTION

| Competency assessment                              | 1 |
| People's perceptions of their own competence      | 2 |
| Competence versus capability                      | 4 |
| Competency frameworks                             | 5 |
| Evolution of competence over time                 | 6 |
| Assessment versus audit                           | 8 |
| Scope of this book                                | 8 |
| Conclusions                                       | 9 |
| References                                        | 9 |

### 2 COMPETENCY FRAMEWORKS

| Introduction                                       | 11 |
| The UKSPEC                                        | 11 |
| The INCOSE competencies framework                 | 13 |
| SFIA                                              | 15 |
| The association of project management (APM)       | 19 |
| The association of proposal management professionals | 23 |
| Choosing between frameworks                       | 27 |
| Conclusions                                       | 30 |
| References                                        | 35 |

### 3 REQUIREMENTS FOR COMPETENCY ASSESSMENT

| Introduction                                       | 37 |
| Requirements for an assessment process             | 37 |
| Introducing the universal competency assessment model (UCAM) | 39 |
| Self-assessment versus third-party assessment      | 40 |
| Best practice                                     | 41 |
| Bringing it all together – the UCAM meta-model     | 52 |
| Conclusions                                       | 56 |
| References                                        | 56 |
CONTENTS

4 THE UNIVERSAL COMPETENCY ASSESSMENT MODEL (UCAM) PROCESSES

Introduction 57
The UCAM processes – an introduction 58
The framework definition process 63
The framework population process 68
The assessment set-up process 76
The assessment process 82
UCAM support processes 91
Using UCAM 95
Competency of assessors 98
Conclusions 101
References 102

5 CASE STUDIES

Introduction 103
Case study 1 – Generating a new framework 103
Case study 2 – Executing the assessments 121
Case study 3 – Educational framework 134
Conclusions 145
References 145

APPENDICES

APPENDIX A: A SEVEN VIEWS SUMMARY OF THE UCAM PROCESSES

Introduction 149
Overview of the seven views approach 149
The seven views of UCAM 152
References 163

APPENDIX B: SUMMARY OF NOTATION

Introduction 164
Class diagrams 164
Use case diagrams 166
Sequence diagrams 168
Activity diagrams 169
References 170

Index 171
## LIST OF FIGURES AND TABLES

| Figure 2.1 | Key concepts for UKSPEC | 13 |
| Figure 2.2 | High-level view of the INCOSE competencies framework | 16 |
| Figure 2.3 | SFIA framework ontology | 21 |
| Figure 2.4 | The APM framework ontology | 24 |
| Figure 2.5 | The APMP ontology | 28 |
| Figure 3.1 | The ‘framework definition’ element of the meta-model | 42 |
| Figure 3.2 | The ‘framework population’ key elements | 44 |
| Figure 3.3 | Example ‘Generic Applicable Competency Set’ | 47 |
| Figure 3.4 | The Assessment set-up element | 49 |
| Figure 3.5 | Example competency scope | 50 |
| Figure 3.6 | The ‘Assessment’ element | 51 |
| Figure 3.7 | Example competency profile | 53 |
| Figure 3.8 | The UCAM meta-model | 54 |
| Figure 4.1 | The UCAM Requirements | 59 |
| Figure 4.2 | The UCAM Stakeholders | 60 |
| Figure 4.3 | The UCAM Processes | 62 |
| Figure 4.4 | Requirements for the Framework Definition process | 63 |
| Figure 4.5 | The contents of the Framework Definition Process | 64 |
| Figure 4.6 | Carrying out the Framework Definition process | 65 |
| Figure 4.7 | Relationships between the artefacts of the Framework Definition process | 67 |
| Figure 4.8 | Requirements for the Framework Population process | 69 |
| Figure 4.9 | The contents of the Framework Population process | 70 |
| Figure 4.10 | Carrying out the Framework Population process | 71 |
| Figure 4.11 | Relationships between the artefacts of the Framework Population process | 72 |
| Figure 4.12 | Example ‘Populated Applicable Competency Set’ | 73 |
| Figure 4.13 | Requirements for the Assessment Set-up process | 77 |
| Figure 4.14 | The contents of the Assessment Set-up process | 78 |
| Figure 4.15 | Carrying out the Assessment Set-up process | 79 |
| Figure 4.16 | Relationships between the artefacts of the Assessment Set-up process | 80 |
| Figure 4.17 | Example ‘Competency Scope’ | 81 |
| Figure 4.18 | Requirements for the Assessment process | 83 |
| Figure 4.19 | The contents of the Assessment process | 84 |
| Figure 4.20 | Carrying out the Assessment process | 85 |
| Figure 4.21 | Relationships between the artefacts of the Assessment process | 87 |
LIST OF FIGURES AND TABLES

Figure 4.22  Example ‘Competency Profile’ 89
Figure 4.23  The Pre-assessment Processes 92
Figure 4.24  The Post-assessment Processes 93
Figure 4.25  Scenario showing process execution for self-assessment 95
Figure 4.26  Scenario showing process execution for recruitment 96
Figure 4.27  Scenario showing process execution for appraisals 97
Figure 4.28  Example Primary Assessor Competency Profile 99
Figure 4.29  Example Secondary Assessor Competency Profile 100
Figure 5.1  Structure of the competency framework 105
Figure 5.2  The Systems Knowledge competency type 108
Figure 5.3  The ‘Skill’ competency type for the company framework 111
Figure 5.4  The applicable competency set 124
Figure 5.5  The competency scope for the ‘requirements engineer’ role 125
Figure 5.6  The competency scope for the ‘development manager’ role 126
Figure 5.7  The competency scope for the ‘tutor’ role 128
Figure 5.8  The competency scope for the ‘graduate’ role 129
Figure 5.9  Assessment output (profile) for a defined role 132
Figure 5.10  Framework definition for the educational framework 135
Figure A.1  The Seven Views and their relationships 150
Figure A.2  The RV for the UCAM processes 152
Figure A.3  The SV for the UCAM processes 153
Figure A.4  The PSV for the UCAM processes 153
Figure A.5  The PCV for the UCAM processes 154
Figure A.6  Partial PCV for suggested Pre-assessment processes 155
Figure A.7  Partial PCV for suggested Post-assessment processes 155
Figure A.8  The PBV for the UCAM ‘Framework Definition’ process 156
Figure A.9  The PBV for the UCAM ‘Framework Population’ process 157
Figure A.10  The PBV for the UCAM ‘Assessment Set-up’ process 158
Figure A.11  The PBV for the UCAM ‘Assessment’ process 159
Figure A.12  The IV for the UCAM ‘Process Definition’ process 160
Figure A.13  The IV for the UCAM ‘Framework Population’ process 160
Figure A.14  The IV for the UCAM ‘Assessment Set-up’ process 161
Figure A.15  The IV for the UCAM ‘Assessment’ process 161
Figure A.16  Example PIV for UCAM processes showing process execution for self-assessment 162
Figure A.17  Example PIV for UCAM processes showing process execution for recruitment 162
Figure A.18  Example PIV for UCAM processes showing process execution for appraisals 163
Figure B.1  Graphical symbols for elements in a class diagram 164
Figure B.2  Example class diagram 165
Figure B.3  Graphical symbols for elements in a use case diagram 166
Figure B.4  Example use case diagram 167
Figure B.5  Graphical symbols for elements in a sequence diagram 168
Figure B.6  Example sequence diagram 168
Figure B.7  Graphical symbols for elements in an activity diagram 169
Figure B.8  Example activity diagram 170
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Summary of accreditation requirements for the APMP</td>
<td>30</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Partial mapping between SFIA and UKSPEC</td>
<td>32</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Partial mapping between APM and UKSPEC</td>
<td>33</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>Partial mapping between the INCOSE competencies framework and UKSPEC</td>
<td>34</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Mapping between UCAM terms and other frameworks</td>
<td>43</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Example rating scheme</td>
<td>48</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Example of an ‘Indicator Result Set’</td>
<td>51</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>Suggested scope levels</td>
<td>55</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Example of ‘Evidence Types’ and associated ‘Timeliness’</td>
<td>74</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Example ‘Rating Scheme’</td>
<td>75</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Example of a completed ‘Record Sheet’ [partial] showing ‘Rating Scheme’</td>
<td>88</td>
</tr>
<tr>
<td>Table 5.1</td>
<td>Basic definitions and mapping to UCAM</td>
<td>105</td>
</tr>
<tr>
<td>Table 5.2</td>
<td>Definition of level 1 indicators for ‘Systems Knowledge’ competencies</td>
<td>109</td>
</tr>
<tr>
<td>Table 5.3</td>
<td>Definition of level 1 indicators for the ‘Skill’ competency types</td>
<td>111</td>
</tr>
<tr>
<td>Table 5.4</td>
<td>Example of recording the results of an assessment</td>
<td>131</td>
</tr>
<tr>
<td>Table 5.5</td>
<td>Applicable competency set for the educational framework</td>
<td>137</td>
</tr>
<tr>
<td>Table 5.6</td>
<td>Assessment sheet for the ‘Effort’ competency area</td>
<td>139</td>
</tr>
<tr>
<td>Table 5.7</td>
<td>Assessment sheet for the ‘Behaviour’ competency area</td>
<td>140</td>
</tr>
<tr>
<td>Table 5.8</td>
<td>Assessment sheet for the ‘Attitude’ competency area</td>
<td>141</td>
</tr>
<tr>
<td>Table 5.9</td>
<td>Typical profile for the educational framework</td>
<td>144</td>
</tr>
</tbody>
</table>
Dr Jon Holt is an international award-winning author and public speaker in the field of applied systems engineering and research. He has authored many books and papers on systems engineering. His books cover the application of UML and SysML to systems engineering, process modelling, enterprise architectures and competency assessment.

Jon is active in the IET (the Institution of Engineering and Technology) via their Professional Networks and in BCS, the Chartered Institute for IT, as a member of the Learned Society. He is a Fellow of both the IET and BCS and is a Chartered Engineer and Chartered IT Professional.

Jon was the founder-director of Brass Bullet Ltd, a systems engineering consultancy and training company for over 12 years, until it was acquired in 2009. He is currently the Global Head of Systems Engineering for Atego, the leading independent provider of tools and capability for systems engineering.

Simon Perry has worked as a software engineer, systems architect and systems engineer for over 20 years in a wide range of business areas including defence, finance, building construction, nuclear installations, utilities and transport.

Simon is a Principal Consultant at Atego where his role includes consulting, mentoring and the development and delivery of training courses. His main areas of work are concerned with the application of systems modeling to all aspects of systems engineering: process modeling, enterprise architectures and architectural frameworks, requirements engineering, capabilities and competencies.

Simon is a visiting lecturer at Warwick University where he teaches a software engineering course to third year students.

He is the co-author, with Jon Holt, of two other books on modeling and systems engineering. Simon is a member of a number of professional bodies: INCOSE, the IET and BCS. He regularly speaks at events organised by these bodies.
As with all my work, none of it could be possible without the help of many people.

We had lots of help with carrying out the competency assessments, with many people being prepared to let them loose either on themselves or their staff. A big thanks to Alan in Cardiff and his staff who we assessed and subsequently published with – it was a pleasure to work with you! The usual suspects from Aldermaston also deserve a lot of thanks, including Duncan, Jon, Nicky and Keith. Extra thanks go to P3mby who, as usual, went the extra mile and produced some lovely additional work for us – if only they gave out Doctorates for spreadsheets! All the good folk at Abbey Wood should be thanked, including Dave, all of his staff and the many assessees. In terms of helping us perform many, many assessments, special thanks go to Rick, Emma, Tony and Dave from Shrivenham who helped us put the process through the wringer and refine it into what we have today. In terms of innovation, dedication and the sheer volume of work done to tailor the whole approach, we must thank Sylvia who did more for the process and its application than she could ever know. It’s Sylvia’s work that gave us the confidence that we could apply the approach in just about any area imaginable and for this, we take our collective hats off to you.

Thanks to all the good folk at the now-no-longer Brass Bullet Ltd and, more recently, all my new colleagues at Atego. Special thanks to Simon and Mikey B – I am blessed to still be working with both of them after all these years, and look forward to many more.

Of course, thanks as ever go to Mike and Sue. I continue to be inspired by both of them and have learned recently from Sue that ‘it’s never too late’ to keep striving for self-improvement in life.

Finally, all my love and thanks to my beautiful wife, Rebecca, my three (generally) wonderful children, Jude, Eliza and Roo, and my two cats Olive-the-Wondercat and Betty-Moose Davies.

*Jon Holt, January 2011*
As Jon has said, this book would not have been possible without the help of many people and organisations that worked with Jon and me to develop the UCAM and helped us clarify the approach. I therefore echo Jon’s thanks to them all. I would also like to extend my thanks to all those INCOSE members who helped develop the INCOSE Systems Engineering Competencies Framework, and in particular those that I had the pleasure to work with on the Phase 3 Working Group, particularly Simon, Richard, Sandra, David, Dez, Jocelyn, Shane and Ady.

Finally, I could not have written this book and kept my sanity without the love, encouragement and support of my wife Sally. She continues to inspire me every day, and is the only person I know who would put up with being woken by my enthusiastic bongo playing with such equanimity. Also, thanks to our feline alarm clock, Motley the cat, who never fails to wake me up at all the wrong times.

Simon Perry, January 2011
Recent years have seen a significant increase in the use of personnel competency assessments within organisations. This trend derives from the understanding that a well-executed competency assessment programme can offer many and various benefits. A competency assessment programme, for example, can be used in the enhancement of:

- ‘best fit’ human resource allocation;
- professional development of employees;
- pay review processes;
- training requirements identification;
- customer assurance in tendering;
- ability to realize organisational capability.

If however a competency assessment programme is not well executed, if its implementation is ad hoc, then, like all powerful tools in ill-prepared hands, it can cause immense damage and all the areas of potential benefit could actually be adversely affected in the process.

Competency is a measure of an individual’s ability in terms of their knowledge, skills and behaviour to perform a given role. Competency assessment in an organisation, if carried out correctly, will be key to the organisation’s overall capability improvement and will lead to improved customer confidence. To be correct a competency assessment process must be:

- repeatable, so that comparison of results can be made;
- measurable, in measures that are documented, known and understood;
- based on best practice, traceable to standards and frameworks;
- transferable between frameworks, as an assessment process limited to a single framework will have limited application;
- tailorable, so that it can be modified for different organisations or for different sections within a single organisation.
This book defines an approach and a set of processes for competency assessment that satisfy these criteria – a set of powerful tools that can be used by an organisation to consolidate its competency assessment work into a coherent approach, allowing assessments against competencies from multiple frameworks to be undertaken.
In order to succeed in any business, conventional wisdom tells us that we need three things: people, process and products. We need people with the right skills to do their jobs properly, we need processes in place in order to realise and demonstrate our capabilities and we need the right products, or tools, to allow us to do our jobs properly. This book is about people. In particular, this book is about demonstrating how professional we are as people and about inspiring confidence in those around us.

Confidence is a commodity that is none too easy to quantify, yet one that drives a lot of what we do in everyday life. Whenever we buy a product or service, we need to have confidence that it will do its job properly. Whenever we deal with a person on an individual level, it is important that we have confidence in them — likewise, it is also important that others have confidence in us. In order to inspire confidence, it is essential that we can demonstrate our own professionalism, which comes down to our individual competence. This competence may take many forms, for example, technical knowledge, qualifications, presentation skills, peer recognition, social skills and so on. But what are these competences and how do we demonstrate them to other people? This book aims to cover exactly that — how to decide what competencies are relevant and how to demonstrate our own, or assess others’, competencies.

There is, undoubtedly, an overhead in implementing the kind of robust, repeatable and rigorous approach to competency assessment described in this book. So why bother? Why is demonstrating professionalism and inspiring confidence so important if it adds to an organisation’s overheads? The simple answer is another question: what is the cost of failure if you don’t demonstrate professionalism and inspire confidence?

It is very easy for projects to go wrong. When projects do go wrong and result in disasters or failures, then they will inevitably become big news. When projects go well, on the other hand, they are ignored. The reality of this unfortunate state of affairs is that clients’ confidence is damaged and the whole issue of professionalism is brought into question.

This can have a serious impact on an organisation, with a direct loss of income resulting from failure, a drop in share prices and, perhaps more importantly, damage to an organisation’s reputation that can take years to restore, all being possible outcomes for the organisation. Witness, for example, the massive cost,
drop in share value and damage to reputation of BP resulting from the Gulf of Mexico oil spill in 2010. It is estimated that the spill will cost the company $40 billion. Following the spill, it was reported that BP’s shares had fallen by 35 per cent resulting in a $60 billion loss in market value and that there had been a 10 to 40 per cent drop in petrol sales in the USA.

Being able to demonstrate professionalism and inspire confidence can help to avoid such costly failure. It can also be an important differentiator that can help to distinguish one organisation from another and can, perhaps, make the difference between winning and losing a contract.

Before we go further, it is important that there are some clear definitions for the key terms that will be used throughout this book. The terms used are very similar and, therefore, it is crucial that they are defined at this point and that the subtle differences in meaning are pointed out. The terms used in this book are taken from the Cambridge English dictionary and are:

- competence – the ability to do something well;
- competency – an important skill that is needed to do a job.

The key difference here is that ‘competence’ reflects the total ability of the individual, whereas a ‘competency’ is a single skill; (hopefully) one of many that the individual will hold. The sum of an individual’s competencies will make up their competence and it is these individual competencies that are assessed to provide an overall indication of competence.

COMPETENCY ASSESSMENT

In order to demonstrate competence, there must be some way to qualify and measure it, and this is where competency assessment comes in. Competency assessment may take many forms, from filling in a simple form to in-depth psychological analysis, and any, or all, of these techniques may be valid where appropriate. This book proposes a process-based approach to competency assessment known as the Universal Competency Assessment Model that is intended to be as flexible and scalable as possible.

There are several reasons why someone may want to carry out a competency assessment:

- To inspire customer confidence and provide a competitive edge. This was alluded to in the previous section, but what this comes down to is our own credibility, and the confidence that this will inspire in others. When someone makes a choice between a number of people to do something, it is the one who inspires the most confidence who will usually be chosen. One initial argument against this statement is that cost will often have an impact, as some people will always go for the cheapest option but, to counter this, people will also pay more for someone in whom they have confidence. Therefore, on a purely financial level, demonstrating competence is one way to charge
more for a person and can be used to help strengthen a business case for someone to pay more money.

- As part of an individual’s career development, at a professional or personal level. At a professional level this may include being formally recognised by our peers or by a professional body. For example, achieving ‘chartered’ status is seen as a goal in many industries and will often be accompanied by a right to practise in a particular field. Indeed, in many areas, a certain level of formal competence is necessary in order to work. On a personal level, many people are interested in planning their career paths and setting themselves individual goals. This may be, for example, obtaining chartered status or gaining a new position in an organisation. Again, competency assessment can be used as a valuable tool when developing a career plan or carrying out Continued Professional Development (CPD).

- As part of a recruitment process. Many organisations are finding that recruiting people on the basis of a CV (resumé) or a single interview is simply not good enough. It is all too easy to be impressed by someone’s CV or the way that they perform at an interview, only to be let down when they actually start the work. Many organisations now use competency assessment not just as an added measure but as a major part of the actual recruitment process itself. We are living in an increasingly litigious world and it is very difficult to remove someone from a company without long and costly lawsuits (which can put a small company out of business) so it becomes even more important that we recruit the right people in the first instance.

- As part of an organisation’s appraisal process. Most companies carry out some sort of appraisal on a regular basis. For example, it may be that each person in a company is assessed on an annual basis to see if they are performing properly. Competency assessment can be a very powerful tool in such cases, as it allows competencies that people possess to be compared directly to the competencies required for their post. It is a very useful mechanism to have a competency set (known as a ‘competency scope’) defined for different positions in the business, as it is then possible to compare people’s actual competencies (known as a ‘competency profile’) with the competency scope to assess suitability. By comparing several of these competency profiles, it is also possible to see how a person’s competence has evolved over time and how quickly. This can give an excellent indication of the ability and willingness of a person to learn and take on new tasks. Such competency assessments are being used widely for appraisal and even, in some cases, being tied directly into pay reviews.

- To identify training requirements from the point of view of a person or business unit. It is essential that people have the right competencies for their job and when gaps have been identified through assessment, this can be used as an excellent guide in those areas for which training is required. This can be done at a personal level for personal development or may be done as part of a team or business unit effort.

- To identify training requirements from a trainer’s point of view. Competency frameworks and competency assessments are big news for training providers—or should be. By understanding those areas in which people require competence
and how they will be assessed, it is possible to create new courses and tailor existing courses towards delivering these competencies. A good training course should map onto established and recognised competency frameworks so that the people buying the training know exactly what they are getting and can map it directly onto their business plans. This not only provides a better service, but also provides another good reason why someone should choose you as a trainer over your competitors.

These are not the only reasons why competency assessment is so important, but it should provide an indication of some of the main reasons why we need to understand and be able to demonstrate competence.

When considering the whole idea of competency assessment, it is essential that you consider why you want to do it in the first place, and what you want to achieve. In the world of engineering, this is known as establishing the requirements for a system or project and it is very important that this is not taken lightly, as too many people will blindly apply competency assessment to their work and not understand why. Unsurprisingly, these are often the same people that cannot see the point of competency assessment and see it as an unnecessary overhead.

**PEOPLE’S PERCEPTIONS OF THEIR OWN COMPETENCE**

Every person has their own opinion of how competent they are in a particular area, regardless of how competent they actually are. In their fascinating paper on people’s own views of themselves, Kruger and Dunning (1999) ran a series of four trials where they asked a sample of people to judge how competent they saw themselves being. The results of this work were quite surprising as it demonstrated that incompetent people tend to see themselves as more competent than they actually are, whereas more competent people tend to see themselves as less competent than they actually are. The authors summed this up quite nicely by stating

> people who are unskilled in these domains suffer a dual burden: not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it.

This is very important as it means that the incompetent will rate themselves higher, whereas competent people will rate themselves lower. One of the dangers here is that two people may each rate themselves and come to the same conclusion – that they hold a certain level of competence. The truth may be, however, that they are both at opposite ends of the competence spectrum, but that people may think that they are the same.

This can have a direct impact on an organisation, since it means that less competent people can be undertaking work for which they are not competent,
possibly leading to work that is not fit for purpose and which costs the organisation both time and money to put right and, perhaps more importantly, adversely affects their reputation. Conversely, the more competent person may be given work that is below their level of competency. This also constrains the performance of an organisation, since it is not making the best use of that person.

This is a crucial reason why there is such a need for a pragmatic approach to competency assessment that can minimise the chance of these errors occurring. The assessments should be as objective as possible and, of course, the competency of the assessors themselves should be brought into question.

One of the conclusions made by the authors of this excellent paper is that incompetent people have no idea how incompetent they are, a conclusion that has been backed up by many previous studies referenced in the paper. The use of competency assessment, with a good, simple visual output may go some way to convincing incompetent people that they do not hold the lofty levels of competence that they believe that they do.

COMPETENCE VERSUS CAPABILITY

There is often some confusion between the terms ‘capability’ and ‘competence’ as they are inherently very closely related to each other. However, there are subtle differences between the two, so, for the purposes of this book, the definitions will be as follows:

- **Capability** describes the ability of an organisation or organisational unit.
- **Competence** describes the ability of an individual to do something.

When we talk about capability in the sense defined here, we are talking about the ability to deliver a product or service. This ability is demonstrated through the use of effective processes. Indeed, when it comes to assessing capability, the established approach is to assess the process which provides an indication of the capability and its maturity. Examples of such capability determination include: the Capability Maturity Model Integrated (CMMI) (and its family) and Software Process Improvement and Capability dEtermination (SPICE).

Capability has been an increasingly important subject over the last 10 years or so as many large project tenders are now awarded on the basis of capability. For example, as part of a tender, bidders will be asked not only to provide an overview of their solution but also will be asked to demonstrate that they have the capability to deliver that solution. One of the problems associated with such an approach is that capability can be demonstrated in an organisation, but in order to realise that capability, it is necessary to have staff with appropriate competence. Many large organisations will bid for projects without having enough staff to carry out the work and will then recruit new staff once they have won the contract. In many cases, this will involve employing people, known as contractors, on a contractual basis. Many contractors, as is the nature of the job, will change employers and projects, depending on where their skills are required. As a
consequence of this, it is not unusual to find the same people working on different contracts depending on who has won what. This has the potential to have a very negative impact on a project as, in some cases, new contracts come up as the company responsible for delivering the previous contract has not done its job properly and will not be awarded another contract. If the people who have performed so badly on one contract then change employers and switch to the new project, has any benefit whatsoever been achieved?

As a result of this type of activity happening time and time again, companies are coming around to realising that not only is the capability important, but also the competencies of the staff needed to realise that capability.

It is possible to draw up a simple equation to represent this relationship – before immediately switching off at the very thought of an equation, please bear in mind that this is about as mathematically challenging as this book will get.

Confidence = capability + competence

In order to inspire confidence, we need to demonstrate both the capability (ability of the business) and the competence (ability of the individuals). This demonstration is crucial in order to inspire confidence. It is no good simply having ways to define and measure capability and competence if they are never applied; confidence comes from the active demonstration of both capability and competence.

When we need to demonstrate capability, we need best-practice models against which to compare our processes, usually in the form of standards. When we need to demonstrate competence, we also need best-practice models, which are usually in the form of competency frameworks.

COMPETENCY FRAMEWORKS

A competency framework describes a set of competencies (the ‘things’ that are measured to demonstrate competence) that are applicable to a particular field. Every industry has some sort of competency framework, as do many organisations. These frameworks should be viewed as standards and, just like any other standard, they may exist at many levels, including:

- Generic frameworks, which may apply internationally and apply to a particular discipline.
- Industry-specific frameworks. Some industries have their own frameworks that are usually owned by relevant professional bodies or industrial organisations. Examples of these include, among others, Skills Framework for the Information Age (SFIA) for the IT industry and Association of Proposal Management Professionals (APMP) for the bidding industry.
- Organisation-specific frameworks. Many companies, particularly large ones, have their own competency framework that is geared towards their
particular organisation. These frameworks are often held and managed by the human resources centre but in many cases, as is increasingly becoming the case, a dedicated role or department may be allocated specifically to address all matters relating to competency and competency assessment.

- Regulatory or legally required frameworks. Some industries have their own competency frameworks that actually become mandated as part of a certification scheme. For example, the railway industry in the UK has such a scheme for railway signalling. The Institution of Railway Signal Engineers (IRSE) operates a competence certification scheme, known as the ‘IRSE Licensing Scheme’. To quote from their official website, the main aim of the scheme is to provide assurance about the competence of individuals to carry out technical safety-critical or safety-related work on signalling and railway telecommunications equipment and systems. It provides a cross industry accepted benchmark of competence for personnel carrying out a range of activities from maintenance through design, installation, testing, project engineering and senior technical management.

The railway signalling industry is by no means unique and there are equivalent schemes in other industries, such as the nuclear and aerospace industries.

- Technique or technology-based frameworks. Some specific techniques have their own competence programmes that demonstrate an individual’s knowledge and skills for that technique. For example, the Unified Modelling Language (UML) is a visual modelling language that is used extensively in the worlds of software and systems engineering. The language itself is specified in a standard that is managed and configured by a standards body known as the Object Management Group (OMG) in the USA. The management group operates a scheme known as the ‘OMG Certified UML Professional’, or OCUP, that is a ‘rigorous, comprehensive, and fair test of a person’s knowledge of OMG’s specifications for unified modeling language’ (OCUP).

A number of frameworks will be discussed later in this book, but for now consider the question of which framework is the right one for you. This is a question that is not quite so easily answered. For example, you may work in the Information Technology (IT) industry and use the SFIA framework as a basis for assessments. However, this framework is aimed mainly at the technical aspects of IT and not so much at the management side, so it may be that it is desirable also to look at the Association of Project Management (APM) framework also. Now consider the scenario where you may also be involved with bidding for IT projects, in which case another framework, such as APMP may also be of interest. What if there is also an in-house framework that needs to be used?

The point here is that each framework will have its own strengths and weaknesses, which is only natural and is certainly not intended to be a criticism of any particular framework. As a consequence of this, it is often required to mix-and-match between different frameworks in order to get the most appropriate parts of each and combine them into a single framework. However, this is far easier said
than done and the issue of trying to use more than one framework is a very challenging and complex one.

The same problem occurs when one wants to create a new framework for a different industry. The last thing that the world needs is yet more frameworks, so, again, the idea of cherry-picking different parts from different frameworks is a very attractive one. This is one of the areas that this book will address.

**EVOLUTION OF COMPETENCE OVER TIME**

One of the most common misconceptions concerning competence is that the goal is to hold the highest competence possible and that an individual’s competence should constantly increase as their career progresses. This is complete fallacy. The goal is to hold the appropriate competence for whatever role is being played. As an individual’s career progresses, their role will, quite naturally, evolve. For example, someone may start their career as a technician and then move into a more senior technical role, then progress (or regress) to management, before ending up at board level in an organisation. The point here is that the competence for that person is not increasing all the time, but the role that they play is changing and, hence, the set of competencies that define their competence will change over time. It is important that the person holds the right competence for each role at each point in their career. This phenomenon will be referred to as ‘competence evolution’ and will become very important when competency profiles are discussed later in this book.

**ASSESSMENT VERSUS AUDIT**

When we talk about demonstrating competence, we inevitably use the phrase ‘competency assessment’. This is no accident and it is very important that the term ‘assessment’ rather than ‘audit’ is used.

When the term ‘audit’ is used, it implies that there will be a binary outcome or, to put it another way, a ‘pass or fail’ outcome. A typical audit will identify a number of areas that are of interest, compare it to a standard and identify a set of non-conformances (usually major and minor). The result of such an audit will be a straight pass or fail, as a set of non-conformances will be provided.

When the term ‘assessment’ is used, it implies that there will be a graduated outcome that will provide an indication of a level of achievement in a particular area. The result of an assessment will typically be a profile that will show how mature a person (in the case of competency) or organisation (in the case of capability) is in a specific area. One of the major goals of an assessment approach is to provide a mechanism for self-improvement, and a profile, rather than a pass-or-fail output, is far more useful for this. This is a very simplified definition of an audit, but it is not within the scope of this book to argue the pros and cons of audits versus assessments, but it is useful to understand, at a high level, the differences between the two.
SCOPE OF THIS BOOK

This book is aimed at people who have an interest in understanding and defining competency frameworks. It is also aimed at people who may be interested in carrying out competency assessment, whether it is for self-assessment or third-party assessment. The book will show how a number of these frameworks work and how they can be understood and analysed. A process will also be introduced and described that can be used to assess competency using any framework. A number of real-world case studies will be described that show a number of different ways in which the processes and approach in this book can be applied in reality.

CONCLUSIONS

There is a need for inspiring confidence in the people with whom we deal, whether they are clients or fellow workers. In order to inspire confidence, we need to demonstrate our professionalism at an organisational and personal level. At an organisational level, we need to demonstrate capability and at a personal level, we need to demonstrate competence.

In order to demonstrate competence, there is a need for competency assessment that can be applied in a flexible and scalable manner. We demonstrate competency according to established and recognised norms, usually in the form of single, or a set of, competency frameworks. When using multiple frameworks, it is desirable to mix and match between them in order to ensure that the resultant framework is a good fit for our original requirements.

REFERENCES

Cambridge English Dictionary (CED)


Institution for Railway Signal Engineers (IRSE) www.irse.org/Licensing.html (Accessed February 2011).


INTRODUCTION

This chapter looks at some of the many competency frameworks that exist in the real world. A small sample of these frameworks will be chosen and investigated in more detail. The main aim behind this exercise is to show the different structures of the frameworks and to discuss how each one achieves its stated objectives. There are two broad categories of frameworks that will be considered here, which are:

- Public-domain frameworks. These public domain frameworks are typically geared towards a specific industry or profession and are often managed and controlled by professional bodies or industry groups. Indeed, as will be discussed later in this book, one of the main uses for competency frameworks and competency assessment is for continued professional development, so it is natural that the professional bodies take a leading role in such matters.

- Private or in-house frameworks. These are typically geared specifically towards a particular organisation or company and are usually proprietary. As they are owned by their relevant organisations, these tend not to be available for the general public and tend to be used exclusively for in-house activities, such as staff appraisals, tendering, and so on.

For the purposes of this chapter, the focus will be solely on the public-domain frameworks and will not cover private frameworks at all. Having said that, the same concepts that are identified and discussed for public frameworks are equally applicable to private frameworks.

The sample of frameworks has been chosen to provide a wide spread of interest across a number of disciplines and, in particular, will include:

- UKSPEC, the UK Standard for Professional Engineering Competence. The UKSPEC is the cornerstone of all technical competences in the UK. The UKSPEC is used as the basis for professional accreditation, such as Chartered Engineer (CEng) and Chartered IT Professional (CITP), and all UK professional bodies use it as part of their professional assessment. The UKSPEC is owned and managed by the Engineering Council (see UKSPEC for more details);
SFIA. The acronymically challenged framework known as SFIA (pronounced 'Sophia') is a framework that is geared towards the skills required for the effective implementation and use of Information Systems (ISs) making use of Information and Communications Technology (ICT). The SFIA framework maps directly back to the UKSPEC and is owned and managed by the SFIA Foundation (see SFIA for more details);

INCOSE, the International Council on Systems Engineering competencies framework, is an international body that is committed to furthering the discipline of systems engineering. They have produced a competency framework that maps back to the UKSPEC and covers various cross-cutting concepts associated with systems engineering. Please note that the term 'systems engineering' is the engineering definition of the term, rather than the IT definition of the term. The INCOSE framework is owned and managed by INCOSE (see INCOSE for more details);

APM, the Association for Project Management Body of Knowledge. The APM framework forms the heart of the APM assessment and accreditation and is aimed specifically at the discipline of project management for all industries. The APM Body of Knowledge is owned and managed by the APM (see APM for more details);

APMP, the Association of Proposal Management Professionals framework. The APMP (not to be confused with APM) framework is aimed specifically at proposal and bid management within an organisation and identifies a number of skills required for such activities. The APMP framework is owned and managed by the APMP (see APMP for more details).

These particular frameworks were chosen as they represent a broad spread of interest and will hopefully provide, at a minimum, one that is directly related to most readers' professions. The idea here is to show that the techniques introduced and discussed in this book can be used for any framework and are not just limited to technical skills, but can be applied across the wider business.

In order to understand each framework and to get it into a format that can be compared and contrasted, each of the frameworks has been modelled in order to identify areas of complexity, aid understanding and help to communicate the different key concepts. The approach taken was the ‘seven views’ approach (Holt 2009) and uses the UML as its modelling notation. It should be stressed, however, before the readers of this book collectively snap it shut in disgust, that this is not a modelling book and it is not intended to provide a treatise on the pros and cons of modelling and its various notations. Please be assured that the modelling utilised in this book is used purely as a tool and will be kept to an absolute minimum.

The main use of the modelling in this chapter is to provide a brief, high-level ontology for each of the frameworks, so that the concepts may be compared and contrasted. These ontologies will also be used as a basis for abstracting a common ontology in the next chapter. Each ontology simply identifies the main concepts and terminology that is used in each framework and relates them together in the form of diagrams.
THE UKSPEC

Introduction
It was stated earlier that the UKSPEC is the cornerstone of all technical competences in the UK. The UKSPEC is used as the basis for professional accreditation, such as CEng and CITP, and all UK professional bodies use it as part of their professional assessment. It is essential, therefore, that the UKSPEC is understood before any other framework is looked at. To put matters bluntly, if a framework does not map onto the concepts in the UKSPEC, then it will not be recognised at a professional level.

The UKSPEC ontology
The UKSPEC, just like all the other frameworks, can be distilled down to a simple diagram that encapsulates all the main concepts, the terminology used and the relationships between them. In other words, it has a simple ontology.

Figure 2.1 Key concepts for UKSPEC

The diagram in Figure 2.1 shows the key concepts and terminology for the UKSPEC. It can be seen that 'Competency' is made up of the following concepts:

- ‘Knowledge’, which refers to having domain knowledge in a particular discipline or application area. For example, a university degree in engineering will provide a basic knowledge of engineering (the discipline) while experience in industry would also provide knowledge of the field (domain knowledge).

- ‘Skill’, which refers to the techniques, tools, methodologies and approaches that are employed in order to implement the knowledge. The skill depends upon having the knowledge in the first instance and really makes the knowledge useful, rather than knowledge for the sake of knowledge.

- ‘Understanding’, which refers to the ability to be able to apply the right knowledge and skills at the right time and to understand the implications for such use. This is the really difficult aspect of competence to get right. It involves understanding why the knowledge and skills have been employed and what benefits have been realised in doing so.
Competency may be thought of as existing in five ‘Generic competency’ categories, which are:

1. ‘A: Education, training and experience’. This includes formal education, industrial training, work experience, and so on.
2. ‘B: Application’. This includes being able to apply, or having experience of applying the different skills and knowledge for particular application areas.
3. ‘C: Provide leadership’. It is important that an individual is able to lead teams or other individuals where necessary, which is reflected here.
4. ‘D: Demonstrate interpersonal skills’. This includes what is often referred to as ‘soft skills’ such as verbal and non-verbal communication, abstract things, and so on.
5. ‘E: Demonstrate personal commitment’. This includes embracing CPD, involvement with professional bodies and industrial groups, publishing, promoting engineering, and so on.

These competencies are held at a particular level or ‘Threshold’ and, currently, there are three levels of recognition within the Engineering Council UK (ECUK):

1. Engineering Technician (EngTech). The EngTech qualification defines the competence and commitment required before an individual can call themselves an engineering technician. The UKSPEC defines an engineering technician as someone who is concerned with applying proven techniques and procedures to the solution of practical engineering problems. They carry supervisory or technical responsibility, and are competent to exercise creative aptitudes and skills within defined fields of technology. Professional Engineering Technicians contribute to the design, development, manufacture, commissioning, decommissioning, operation or maintenance of products, equipment, processes or services. Professional Engineering Technicians are required to apply safe systems of working.

2. Incorporated Engineer (IEng). The IEng qualification defines the competence and commitment required before an individual can call themselves an incorporated engineer. The UKSPEC defines an incorporated engineer as someone who can maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation. Incorporated Engineers are variously engaged in technical and commercial management and possess effective interpersonal skills.

3. Chartered Engineer (CEng). The CEng qualification defines the competence and commitment required before an individual can call themselves a chartered engineer. The UKSPEC defines a chartered engineer as someone who is...
characterized by their ability to develop appropriate solutions to engineering problems, using new or existing technologies, through innovation, creativity and change. They might develop and apply new technologies, promote advanced designs and design methods, introduce new and more efficient production techniques, marketing and construction concepts, or pioneer new engineering services and management methods. Chartered Engineers are variously engaged in technical and commercial leadership and possess effective interpersonal skills.

The high-level concepts contained within the UKSPEC form a common pattern throughout many other frameworks and this provides the starting point for mapping and compliance between frameworks.

Discussion on the UKSPEC
The UKSPEC is, by design, a very high-level document, being as it is the benchmark for demonstrating competence. As it is such a high-level document, the descriptions for each of the generic competencies is also at a very high level. It is due to the high-level nature of the descriptions that it is impossible to be assessed directly against the UKSPEC as such, as each of the descriptions is open to different interpretations. Therefore, it is necessary to have a specialised interpretation of the UKSPEC for specific industries or disciplines that is, effectively, where the rest of the frameworks described in this chapter come in. Each of the following frameworks may be thought of as a specialised filter that may be applied to the generic UKSPEC to provide a bespoke interpretation of its requirements.

THE INCOSE COMPETENCIES FRAMEWORK

Background
INCOSE is an international industrial body that was set up to further the aims of systems engineering. It is not the role of this book to enter into the great ‘what is a systems engineer’ debate, but it is probably a good idea to provide a very brief overview of exactly what is meant by the terms ‘systems engineering’ and ‘systems engineer’. The discipline of systems engineering is concerned with the interdisciplinary practices and principles that enable the realisation of successful systems. By the term ‘system’ here, we mean: physical systems, electronic systems, software systems, people systems, political systems, environmental systems, and so on and, indeed, any combination of these systems. The role of a systems engineer, therefore, is to enable the development of such systems. The role of a systems engineer is not to maintain PCs. Unfortunately, the term ‘systems engineer’ is shared by people who enable systems engineering and maintainers of PCs. Although both types are people essential in today’s society, in the context of this book, we always mean the former, rather than the latter. INCOSE is concerned with the former, rather than the latter and if you are curious as to what makes a good systems engineer, then the INCOSE systems engineering competencies framework is a good place to start.
The INCOSE framework ontology
The focus of the framework is concerned with the concept of ‘Systems Engineering Ability’ which is described in Figure 2.2.

Figure 2.2 High-level view of the INCOSE competencies framework

The INCOSE competencies framework has a concept of ‘Systems engineering ability’ that may be broken down into four main areas:

- Supporting Technique. A supporting technique is a specific technique that is used to support the main competencies, for example: failure analysis, decision analysis, the use of specific notations and languages, and so on. These techniques are very important but are not much value by themselves as it is when they are used to support and enable competencies that they start to add true benefits. These supporting techniques tend to be of a more technical nature and, therefore, easier to teach and measure. Due to the sheer number of these different techniques, the INCOSE framework does not go into any detail in this area, but simply provides a checklist to which one may want to refer when considering such techniques.
Basic Skills and Behaviour. These represent the soft skills that are required in order to be a systems engineer, including skills such as: abstract thinking and communication (verbal/non-verbal, listening, writing, and so on). These softer skills tend to be less easy to teach or, indeed, to measure and can often rely on the objectivity of an assessor. Again, the INCOSE framework does not enter into much detail in this area and only provides a simple list of suggested areas that may be considered.

Domain Knowledge. This knowledge is related directly to the domain in which the person is working. As systems engineering is a multi-disciplinary subject, it can cover, potentially, any domain. As the scope of ‘any domain’ is so wide, it is not covered in any detail in this framework.

Competency. So far, the INCOSE framework has managed to sidestep all three of the areas covered, but the focus of the framework is very much on what is referred to as ‘Competency’, which refers to the core skills required for a systems engineer. These will be discussed in more detail in the remainder of this section.

The basic mapping between what is presented here and what exists in the UKSPEC seems relatively straightforward, but there is a potential ambiguity. The basic mapping is as follows:

- Both INCOSE concepts of ‘Supporting Technique’ and ‘Basic Skill and Behaviour’ map onto the UKSPEC concept of ‘Skill’.
- The INCOSE concept of ‘Domain Knowledge’ maps onto the UKSPEC concept of ‘Knowledge’.
- The INCOSE concept of ‘Competency’ maps onto the UKSPEC concept of ‘Understanding’.
- The INCOSE concept of ‘Systems Engineering Ability’ maps onto the UKSPEC concept of ‘Competency’.

The ambiguity should be quite clear from this mapping – the term ‘Competency’ has a different meaning in each of the frameworks. This is quite an important concept when considering competency assessment, so, when using the INCOSE framework, it is always worth having this ambiguity in mind.

The basic hierarchy of these competencies can be seen on the left-hand side of the diagram, which states that one or more ‘Competency’ is part of one of three types of ‘Theme’. Each ‘Competency’ is made up of one or more ‘Indicator(s)’. It is worth looking at each of these concepts in a little more detail.

The concept of a ‘Theme’ is really just a broad categorisation of competencies. The three themes that exist are:

- ‘Systems Thinking’, which is concerned with high-level, generic concepts associated with systems engineering. This theme covers the following competencies: ‘Systems Concepts’, ‘Enterprise and Technical Environment’ and ‘Super System Capability Issues’;
‘Systems Engineering Management’, which covers the aspects of management that are applicable to systems engineering. This theme covers the following competencies: ‘Concurrent Engineering’, ‘Enterprise Integration’, ‘Integration of Specialisms’, ‘Life-cycle Process Definition’ and ‘Planning, Monitoring and Control’;

‘Holistic Life-cycle View’, which covers the competencies that one may expect to see associated with the various best-practice systems engineering processes. This theme covers the following competencies: ‘Determine and Manage Stakeholder Requirements’, ‘System Design’ (that contains a further nine variations on systems design), ‘Integration and Verification’, ‘Validation’ and ‘Transition to operation’.

Each of these competencies that have been identified in the previous list may be held at a particular level of competency. The INCOSE framework identifies four levels of competency:

1. ‘Awareness’. The awareness level indicates that the person is able to understand basic concepts, to understand how the system fits into their enterprise and to be able to ask relevant questions associated with each competency. It may be that the person has no actual experience of the competency but does display some theoretical knowledge and understanding of it.

2. ‘Supervised practitioner’. An individual who has competencies held at the supervised practitioner level will have some real experience of the competency. They will be able to display true understanding through the application of systems techniques and concepts as part of their work.

3. ‘Practitioner’. An individual who has competencies held at the practitioner level will provide guidance and lead activity in this area. They will be able to supervise people at lower levels of competency and may very well lead teams or groups of people.

4. ‘Expert’. The expert level represents those rare individuals who truly lead the field in a particular area. They are able to display their experience by defining best-practice, policy or process within an organisation or industry.

Each of the competencies that have been identified may be held at any of these four levels. At each of the levels and for each competency, there are a number of indicators defined, and it is these indicators that are actually assessed. Each indicator is a simple statement of what must be demonstrated to contribute towards meeting a competency. The indicator should be measurable in some accepted form.

Discussion
The INCOSE framework is the most immature of all the frameworks presented here. This is by no means intended to be a derogatory use of the term ‘immature’, but is simply intended to reflect the fact that the framework itself is relatively new and has not been through many iterations. Indeed, when compared to a framework like SFIA, the INCOSE framework is positively embryonic, but this is no bad thing. The INCOSE framework is simple and easy enough to understand and focuses on a specific aspect of competency, the systems engineering competencies, rather than trying to be a master of all disciplines, which is to be applauded.
With regard to the mechanics of the framework, there is a good example of a point that will be discussed later in the book, that of meeting lower levels. For example, at first glance, one would expect that if an individual attains the ‘Practitioner’ level for a competency, then surely they must also hold the ‘Supervised Practitioner’ level? This is logical and makes perfect sense, but is this the case here? Certainly there is nothing in the framework to state this explicitly and it will form a discussion point later in this book.

Also, because of the relatively few iterations that have been completed of the INCOSE framework, there are some areas, quite naturally, that are covered in more detail than others. For example, the ‘System Design: Concept Generation’ competency, at the ‘Supervised Practitioner’ level has single indicator defined. This means that a person will either pass or fail here and there is no room for argument. Take, on the other hand, the ‘Determine and Manage Stakeholder Requirements’ competency held at the same level – it has eight indicators defined, meaning that it may be possible to demonstrate seven out of eight indicators potentially to achieve a pass at this level. This can become quite a concern when trying to achieve consistency of results of an assessment. Returning to the point of the immaturity of the framework, however, these are all issues that can be sorted out quite simply in subsequent releases of the framework.

In terms of assessment of the INCOSE framework, there is a set of guidelines for assessment. However these are really a more detailed description of each of the indicators rather than an assessment mechanism as such. Also related to this is the Certified Systems Engineering Practitioner (CSEP) scheme (see CSEP) that has several levels of certification: entry level (Associate Systems Engineering Professional), foundation level (Certified Systems Engineering Professional) and senior level (Expert Systems Engineering Professional). There is also currently one extension to this which covers the USA Department of Defense Acquisition. In order to become certified, it is necessary to apply, pay a fee, sit an exam (at some levels) and attend an interview (at some levels). It should be borne in mind, however, that this is not a competency assessment as such but a certification, so the result will be a pass or fail, rather than a graded profile.

**SFIA**

**Background**

The SFIA is a framework used predominantly in the IT industry and which identifies the skills required to develop effective ISs and makes use of ICT.

The framework itself is owned, managed and configured by the SFIA Foundation, which is made up of the following members:

- the British Computer Society (BCS), the ‘Chartered Institute for IT” (see BCS);
- E-skills UK, the sector skills council for business and information technology (see ESKILLS);
- the Institution for Engineering and Technology (IET), one of the world’s largest professional societies (see IET);
the Institute for Management of Information Systems (IMIS), an international professional body associated with IT management (see IMIS);

- the IT Service Management Forum (ITSMF), a truly independent worldwide forum for IT management professionals (see ITSMF).

The framework has an intended audience of:

- IT professionals and their managers. This includes anybody associated with IT, whether it is providing a product or service operating these IT systems. Notice here that it is assumed that IT managers have a technical background and actually understand what IT is. This is reflected in some of the other stakeholders who are specifically defined as having a non-technical background.

- Human resource managers. This includes anybody involved in recruitment, placement of people in different jobs, competency definition and assessment and so on. Notice that there is no specific requirement here for any particular technical or domain knowledge.

- Non-technical managers. These managers may be people who are involved with management but who do not have a technical or IT background. Of course, there will be a different skillset required for the different types of manager, so it is important that they can be differentiated.

- Internal staff-training personnel and people interested in CPD. It may be perceived here that there is an overlap with HR managers, which may very well be the case. However, there is a strong requirement for a CPD role that is not connected to HR in many organisations. It is increasingly common to find specific departments with their own drivers for competence and competency assessment that are part of a technical department, rather than being seen as remote and inside the HR department.

- People working in professional bodies. It may seem very obvious, but people who work in professional bodies have a strong requirement for understanding what competence is and how it can be measured. Bearing in mind that one of the main requirements for any professional body is providing a mechanism for CPD, then the definition and use of frameworks is a no-brainer.

- Lecturers, trainers and people involved with developing curricula for education. In order to demonstrate effective courses and training resources, it is essential that they meet the needs of the industry. By having a good understanding of the SFIA framework, it is possible to map the key course aspects to the framework, hence ensuring that the training satisfies the requirements of the framework.

- Government personnel. In order to achieve any sort of consistency across the public sector, it is crucial that the government, and its employees, share the same vision of what skills are needed by staff.

- People working in IT service organisations. It is not just the people providing the IT infrastructure and applications, but also the associated services that make up the IT industry as a whole. It is important, therefore, that all aspects of the IT industry can be represented by the framework.
With this in mind, it is now time to look at the key concepts and terminology that are used in the SFIA framework, by considering the SFIA ontology.

**The SFIA ontology**

The framework itself is made up of a two-dimensional matrix that is described in Figure 2.3.

![Figure 2.3 SFIA framework ontology](image)

It can be seen here that the ‘SFIA Framework’ provides a ‘Model’ that is made up of a single ‘Matrix’. This is made up of two main elements that are the ‘Skillset’ and the ‘Level of Responsibility’. The ‘Skillset’ here refers to the broad categorisation of all IT skills that is made up of a number of ‘Category(ies)’. Each ‘Category’ is made up of one or more ‘Subcategory(ies)’, each of which is made up of one or more ‘Skill(s)’. This basic structural hierarchy provides the two levels of categorisation (excluding the highest level, ‘Skillset’ which encompasses everything) and the actual skills themselves, which are the elements that are actually assessed. Each skill has a four-letter abbreviation that provides a unique identifier.

The other dimension of the matrix is the ‘Level of Responsibility’ that is made up of one or more ‘Level(s)’. In SFIA there are seven levels that exist and it is this level that relates to the actual skill that is being assessed. The level at
which a particular skill is held is the ‘Level of Competence’ for an individual in that area. The categories that make up the skillset are:

- the ‘Strategy and Planning’ category, which is made up of: information strategy, advice and guidance, business/IS strategy and planning, and technical strategy and planning;
- the ‘Development’ category, which is made up of: systems development, human factors, and installation and integration;
- the ‘Business change’ category, which is made up of: business change management and relationship management.
- the ‘Service provision’ category, which is made up of: infrastructure, operation and user support;
- the ‘Procurement and management support’ category, which is made up of: supply management, quality and resource management;
- the ‘Ancillary skills’ category, which is made up of: education and training, and sales and marketing.

In terms of the levels, they are defined under the four attributes of: autonomy, influence, complexity and business skills. Each level has, basically, four main headings that are used to define each attribute and the combination of these four descriptions provides the overall description for the level. These levels may be broadly described as follows:

1. ‘Follow’. A person with a skill held at level 1 is expected to be supervised most of the time and seek advice often. They are not expected to make any significant decisions, but will possess a basic knowledge of the skill.
2. ‘Assist’. A person with a skill held at level 2 is expected to work under minor supervision and to only seek advice where necessary. They are expected to begin to use their judgement in making minor decisions.
3. ‘Apply’. A person with a skill held at level 3 is expected to work under general supervision and will be able to make a decision as to when and where advice should be sought.
4. ‘Enable’. A person with a skill held at level 4 will work only under general direction and will have a clear set of responsibilities. They will also plan their own work and follow processes.
5. ‘Ensure, advise’. A person with a skill held at level 5 will work under a very broad direction but will hold full responsibility and accountability in a specific area of work. They will also set their own work goals, plans and objectives and delegate assignments.
6. ‘Initiate, influence’. A person with a skill held at level 6 will have defined responsibility and accountability for a significant area of work. They are also accountable for decisions made by themselves and others below them.
7. ‘Set strategy’. A person with a skill held at level 7 will have significant responsibility and authority and will be involved in defining policy. They will also be accountable for the decisions of any people working as their subordinates.
These levels can be used as a basis for mapping onto an organisation’s specific framework where necessary or may be used as stand-alone definitions.

**Discussion**

One of the immediate observations that strikes many people is the sheer size of the SFIA framework. There are almost 80 skills held at seven levels, which is visualised via a large chart. At first, this can be quite intimidating, but it should be noted that it is the complexity of an entity rather than its size that makes something difficult to understand and, despite its size, SFIA is well structured and defined and deceptively easy to follow.

There are seven levels of responsibility here – most other frameworks only have four or five. This is not a problem and, indeed, it is easier to map to fewer levels than it is to map to more levels (i.e. mapping from seven levels to four is less complex than mapping four levels to seven). The sheer number of levels can put some people off the framework.

The skills themselves and the categorisations shown are really for illustration only. It is made quite clear that it is the actual skills themselves that are important rather than how they are categorised. Indeed, people are encouraged to define their own structure of classification and not just to use SFIA in an off-the-shelf manner.

Like many of these frameworks, the emphasis is largely focused on the technical skills rather than the soft or human skills that may be required for a person. This is a problem that is common to many of the frameworks, but it should be borne in mind that a boundary must be put onto a framework somewhere and this boundary is quite clear in SFIA.

With the number of skills that are identified here, there are some surprising omissions from the technical areas described. One specific area that may be a cause for concern is the area of requirements engineering that is not really addressed in the framework.

The SFIA framework is very mature and has a large and formal process of continuous improvement, dedicated conferences and a massive uptake of its use in the IT industry. In terms of assessment, individuals can become SFIA-accredited consultants; this involves an assessment fee and attending a course to become a listed consultant. This only means that the assessed person is recognised as being able to give advice on SFIA skill areas, so it is not an assessment mechanism as such.

**THE ASSOCIATION OF PROJECT MANAGEMENT (APM)**

**Background**

The APM is the largest independent professional body for management in Europe, whose mission is to ‘develop and promote the professional disciplines of project and programme management for the public benefit’.
The knowledge and experience of its extensive membership is captured in the ‘Body of Knowledge’ that forms the cornerstone of competency assessment and demonstration for project and programme managers. The target audience for the APM is project and programme managers, although it can be and is used extensively by other roles and organisations.

The APM ontology
The concept of APM competency in the APM relies on two main elements – the ‘Framework’ and the ‘Body of Knowledge’ which can be seen in the following diagram.

Figure 2.4 The APM framework ontology

Figure 2.4 shows the APM ontology and it can be seen that the ‘Framework’ uses the ‘Body of Knowledge’. The ‘Framework’ is made up of four ‘Points’, each of which has a number of questions or pieces of advice associated with it that the person must address. These are described as follows:

- ‘1 Review’ refers to an individual’s ability to look at their own abilities and ask four questions: ‘what skills do I have?’, ‘what have I achieved?’, ‘what have I learned?’ and ‘how appropriate are my skills to my current work situation?’ The answers to these questions are recorded in the individual’s
personal record. It is suggested that an initial self-assessment is used to generate these answers.

- ‘2 Plan’ refers to an individual’s ability to plan how to get from where they are to where the want to be. The questions that need to be answered are: ‘what gaps are there in my current knowledge and skills?’, ‘what can I do to fill these gaps?’, ‘where do I want to be in five years time?’ and ‘what do I need to do to achieve this and who can help me?’ The answers to these questions are recorded in the individual’s personal development plan, where their objectives are listed in relation to these questions.

- ‘3 Learn and Develop’ refers to an individual’s ability to execute this plan and to capture any relevant information. The advice that is offered here is: ‘keep a record of everything you have achieved’, ‘we are all different, you may learn in a different way to your colleagues’, ‘there will be opportunities to learn and develop that aren’t in your original plan’. Rather than questions, these are pieces of advice that should be followed at all times. In fairness, they are good, solid, common-sense ideas that should be reflected in all aspects of CPD, not just limited to management frameworks.

- ‘4 Assess Achievement’ refers to an individual’s ability to understand what has been achieved and how it helps. The questions that must be answered are: ‘what have I learnt?’, ‘how does this help me now?’, ‘how might it help me in the future?’ and ‘do I need anything to enhance this learning?’ The answers to these questions are recorded in the individual’s development record, which can then be used as a basis for generating CVs, used in interviews, or wherever else is deemed appropriate.

Each of these points is executed as part of an ongoing cycle and in the order shown above. This may be thought of as being like a continuous professional development iteration that is executed time and time again throughout the life cycle of an individual’s career.

The basis of all the questions that are asked here is that a set of skills must be identified by the individual, and this is where the ‘Body of Knowledge’ comes in. The ‘Body of Knowledge’ itself is made up of seven ‘Section(s)’ each of which is made up of one or more ‘Topic(s)’. These sections and their associated topics may be further described as follows (Note, these sections and topics are omitted from the diagram for the sake of clarity. For a full description of these sections and topics, see SFIA):

- The ‘1 – Project management in context’ section is made up of the following topics: ‘1.1 Project management’, ‘1.2 Programme management’, ‘1.3 Portfolio management’, ‘1.4 Project context’, ‘1.5 Project sponsorship’ and ‘1.6 Project office’.

- The ‘2 – Planning the strategy’ section is made up of the following topics: ‘2.1 Project success and benefits management’, ‘2.2 Stakeholder management’, ‘2.3 Value management’, ‘2.4 Project management plan’, ‘2.5 Project risk management’, ‘2.6 Project quality management’ and ‘2.7 Health, safety and environmental management’.
The ‘3 – Executing the strategy’ section is made up of the following topics: ‘3.1 Scope management’, ‘3.2 Scheduling’, ‘3.3 Resource management’, ‘3.4 Budgeting and cost management’, ‘3.5 Change control’, ‘3.6 Earned value management’, ‘3.7 Information management’, ‘3.8 Issue management’.

The ‘4 – Techniques’ section is made up of the following topics: ‘4.1 Requirements management’, ‘4.2 Development’, ‘4.3 Estimating’, ‘4.4 Technology management’, ‘4.5 Value engineering’, ‘4.6 Modelling and testing’ and ‘4.7 Configuration management’.

The ‘5 – Business and commercial’ section is made up of the following topics: ‘5.1 Business case’, ‘5.2 Marketing and sales’, ‘5.3 Project financing and funding’, ‘5.4 Procurement’ and ‘5.5 Legal awareness’.


The ‘7 – People and the profession’ section is made up of the following topics: ‘7.1 Communication’, ‘7.2 Teamwork’, ‘7.3 Leadership’, ‘7.4 Conflict management’, ‘7.5 Negotiation’, ‘7.6 Human resources management’, ‘7.7 Behavioural characteristics’, ‘7.8 Learning and development’, ‘7.9 Professionalism and ethics’.

Each of these topics will have a number of activities associated with it that help to increase the knowledge of a particular topic. These activities include: work-based on-the-job training, informal CPD, formal events and qualifications (not shown on the diagram for the sake of clarity). Each of these activities is given an ‘APM Rating’ which may be 1, 2, 3, or 5 (no ‘4’) that provides a weighting for making the calculation to derive the ‘CPD points value’. The individual then decides how valuable the information that has been learned is, by defining the ‘Your Value’ on a scale of 2 to 10 where ‘2’ is considered to be of ‘little value’ and ‘10’ is considered to be of ‘high value’. These two values – the ‘APM Rating’ and the ‘Your Value’ – are then multiplied to provide the ‘CPD Points Value’, which may then be used to provide evidence of competency.

Discussion
The APM framework is particularly interesting as it relies, to quite a large extent, on continuous self-assessment. As part of this assessment, the individual can actually put values onto how valuable the new skills are and use these to show potential employers, professional bodies (for professional qualifications, such as Chartered Project Manager) and for internal company assessments.

It is important when applying these techniques in the APM framework that they are based on realistic estimates of how valuable things are for an individual. Part of the danger of such a numbered scheme is that it is open to abuse. It would be hoped that within a professional discipline, this would not occur, but there is always a need for validating assessments and claims made based on self-assessments.
There may be nothing sinister about somebody over-estimating their own values because, as discussed previously in this book, incompetent people tend to over-estimate their own competence.

**Accreditation**
There is a formal accreditation scheme in place that allows people to be trained and assessed to a number of levels. These are:

1. ‘APM introductory certificate in project management’, which is an entry-level qualification that covers the basics of project management and requires the candidate to sit an exam;
2. ‘APM practitioner qualification’, which assesses an individual to demonstrate their practical experience in assisting in the management of projects, and requires the candidate to sit an exam;
3. ‘APM certified project manager’, which is a formal three-stage process leading to full formal recognition as a certified project manager. This level is really what the focus of this book is about – full competency assessment, rather than sitting an exam and gaining a qualification.

In order to gain these qualifications, it is essential that any training provided is recognised by the APM under their ‘accredited provider’ scheme.

**THE ASSOCIATION OF PROPOSAL MANAGEMENT PROFESSIONALS**

**Background**
The APMP is the professional body that defines and supports best practice in the areas of bids, proposals and business acquisition. The APMP has defined a set of competencies that are required in order to become a proposal management professional.

**The APMP ontology**
The APMP ontology describes a multi-level hierarchy that can be seen in Figure 2.5.

It can be seen from Figure 2.5 that the ‘APMP Framework’ is made up of six ‘Syllabus Group(s)’, each of which is made up of one or more ‘Syllabus Area(s)’, each of which is made up of one or more ‘Competence(s)’. The syllabus groups and their associated syllabus areas are described as follows:

1. The ‘Information Research and Management’ syllabus group is made up of the following syllabus areas: ‘Information Gathering’ and ‘Knowledge Management’.
2. The ‘Planning’ syllabus group is made up of the following single syllabus area: ‘Schedule Development’.


5. The ‘Sales Orientation’ syllabus group is made up of the following syllabus areas: ‘Customer Interface Management’, ‘Capture Plan Development’, ‘Winning Strategy Development’, ‘Negotiation Planning’ and ‘Sales Participation’.

---

**Figure 2.5** The APMP ontology

![Diagram of the APMP ontology]
6. The ‘Behaviour and Attitude’ syllabus group is made up of the following syllabus areas: ‘Communication and Persuasiveness’, ‘Quality Orientation’, ‘Building Strategic Relationships and a Successful Team’ and ‘Decision Making and Delegating Responsibility’.

Each of these syllabus areas has a number of competencies defined in a simple table format with a ‘Syllabus Reference’ and ‘Description’. Each of these competencies may be held at one of three ‘Level(s)’, as follows:

1. The APMP ‘Foundation’ level indicates that an individual can act as part of a proposal or bid team. They will be able to follow processes and use tools as well as understanding the basic principles and approaches to work.

2. The APMP ‘Practitioner’ level indicates that an individual can run and manage a bid or proposal within an organisation. This includes being able to tailor any approach to a specific project, for instance to address the needs and problems of a customer response.

3. The APMP ‘Professional’ level indicates that an individual can drive the continuous improvement of the proposal or bid management processes within an organisation.

The APMP framework also includes a simple process that may be followed to achieve professional accreditation.

**Discussion**

The APMP is one of the lesser-known, but arguably more mature organisations. It holds a number of high-quality events, has an extensive and impressive membership (and list of sponsors) and has developed a rigid process for accreditation. This process is very good, but some argue that putting a definitive requirement on the number of years’ experience required can be off-putting to some people, particularly high-flyers who consider themselves to be on a fast-track to accreditation.

The APMP also fills a gap that is not covered in any detail by any of the other frameworks mentioned here. The whole area of proposal management is one that is often overlooked but is, arguably, one of the most important aspects of the business to get right. After all, if an organisation does not win any bids, then it will have a severely restricted income.

**Accreditation**

The APMP specifies a formal process of examination, self-assessment and interview that allows a candidate to pass through the three levels of competence to full, recognised professional status. The actual process and its requirements are summarised very neatly in Table 2.1, taken from the APMP website (see APMP).
### Table 2.1 Summary of accreditation requirements for the APMP

<table>
<thead>
<tr>
<th></th>
<th>Foundation</th>
<th>Practitioner</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referee required</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of years prior experience required</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Tests</td>
<td>Basic knowledge of best practice</td>
<td>Application of best practice</td>
<td>Advocacy of best practice</td>
</tr>
<tr>
<td>Type of assessment required</td>
<td>Multiple choice examination</td>
<td>Online self-assessment</td>
<td>Reference, presentation and interview</td>
</tr>
<tr>
<td>Continuing education unit required per two-year period</td>
<td>20</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

The APMP also offers two levels of membership, which are ‘Member’ and ‘Fellow’, each of which comes with its own set of designations.

## CHOOSING BETWEEN FRAMEWORKS

### Introduction

When it comes to choosing between frameworks, then the scope of each and their intended audience becomes very important. This can lead to problems, however, as it is very rare that a single person will have their entire skillset chosen by a single framework. For example, imagine an individual who works in the proposal management department of an organisation and spends their working life preparing proposals. The obvious choice for this candidate is the APMP framework that is geared solely towards this type of person. However, now consider that this person works in the systems engineering industry, then surely the INCOSE framework would also be of interest to them. There is a need, therefore, to be able to map between these frameworks and to provide a mechanism to mix and match skills from different sources to generate a more complete scope (assessment input) and, hence, profile (assessment output).

One way to address this is to look for a common reference that can be used as a starting point for mapping between the various competency frameworks. In the frameworks that have been considered in this book, there is a convenient framework onto which all of the others map that provides a ready-made starting point for this exercise. The UKSPEC forms the benchmark for professional recognition for all of the frameworks here and is, therefore, the ideal candidate for this mapping.
Mappings
In order to map between the competency frameworks, therefore, it is necessary to map each one individually onto the UKSPEC and this can then be used as an interface to map between the frameworks. For the purposes of this book, a full mapping is not feasible in terms of the number of pages (and trees) that would be required to print this information. Therefore, a partial mapping will be shown between some of UKSPEC and some of three of the frameworks. The scope of this mapping exercise will be limited to:

- One set of generic competencies – ‘A: education, training and experience’. These are the first ones in the framework and are chosen for no other reason than convenience.
- The first 10 skills or competencies from each of the chosen frameworks. These were, again, chosen as the first ones in the framework and the number of 10 was arrived at purely to keep the tables readable.
- The frameworks considered, which will be: SFIA, APM and the INCOSE competencies framework. Again, these were chosen arbitrarily and with a firm eye on the number of pages that would be required to reprint any more mappings.

With this scope in mind, the mappings are as shown in the following Tables 2.2, 2.3 and 2.4.

Table 2.2 shows the partial mapping between SFIA and the UKSPEC. Notice how, with this scope, there is only a single mapping shown. This is not necessarily a poor reflection on SFIA but, rather, shows where the focus of the two frameworks overlaps.

Table 2.3 shows the partial mapping between the APM and the UKSPEC. Notice that there are more mappings here compared to those shown in the SFIA table but, again, this does not necessarily reflect the frameworks as a whole, just the scopes that were chosen here.

Table 2.4 shows the mapping between the INCOSE competencies framework and the UKSPEC. Again, there are a number of mappings here, but nowhere near a complete set.

Discussion
In order to demonstrate how these tables may be used in reality, imagine that a simple scope (input for an assessment) is set to being the UKSPEC generic competencies shown here (the ‘A’ competencies shown on the vertical axis on the tables). In order to demonstrate each generic competency, we will be looking for a specific interpretation of that competency in a source framework, hence the use of the tables.

Tables 2.2, 2.3 and 2.4 each provide a different set of mappings. One immediate thing that stands out is where there is a lack of mappings. This can lead to a number of possible conclusions:
Table 2.2 Partial mapping between SFIA and UKSPEC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1.1: Awareness of Personal Knowledge and Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.2: Enhancement of Technical Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.3: Enhancement of Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.1: Stakeholder Requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.2: Marketing Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.3: Opportunity Exploitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.4: Application Promotion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.5: IPR Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.6: Continuous Improvement X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- There is no mapping, because there is an omission from the source framework. This is possible but not very likely, bearing in mind the maturity of the frameworks and the amount of work and effort that has gone into producing them.
- There is no mapping, because the mapping is outside the scope of the source framework. This is possible and far more likely. As was discussed previously, each framework has a boundary that falls in a different place and it is, therefore, natural that there will be areas, in many cases large areas, where the mapping will not exist. This is particularly true when one bears in mind that the UKSPEC applies to the whole of engineering and science, whereas each framework only represents a subset of this.
There is no mapping because there is some misunderstanding about what exactly is meant in one or more of the source frameworks. This is also possible and, unfortunately, in some cases, all too true. This may be because the framework is poorly written, but, in most cases, this will be because the person reading the framework does not hold an appropriate level of competence to understand matters fully.

The next aspect of the mappings to consider is where mappings exist for more than one framework. For example, consider the mapping between: Table 2.3: ‘A2.2: Marketing Strategy’ – ‘CC01 – Project Sponsorship’, and Table 2.4: ‘A2.2: Marketing Strategy’ – ‘Enterprise Integration’. The fact that there is a common mapping between the two tables means that there is some relationship between

<table>
<thead>
<tr>
<th>Table 2.3 Partial mapping between APM and UKSPEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>A1.1: Awareness of Personal Knowledge and Skills</td>
</tr>
<tr>
<td>A1.2: Enhancement of Technical Skills</td>
</tr>
<tr>
<td>A1.3: Enhancement of Knowledge</td>
</tr>
<tr>
<td>A2.1: Stakeholder Requirements</td>
</tr>
<tr>
<td>A2.2: Marketing Strategy</td>
</tr>
<tr>
<td>A2.3: Opportunity Exploitation</td>
</tr>
<tr>
<td>A2.4: Application Promotion</td>
</tr>
<tr>
<td>A2.5: IPR Awareness</td>
</tr>
<tr>
<td>A2.6: Continuous Improvement</td>
</tr>
</tbody>
</table>
Table 2.4 Partial mapping between the INCOSE competencies framework and UKSPEC

<table>
<thead>
<tr>
<th>Architectural Design</th>
<th>Concept Generation</th>
<th>Concurrent Engineering</th>
<th>Determining and Managing Stakeholder Requirements</th>
<th>Enterprise and Technology Environment</th>
<th>Enterprise Integration</th>
<th>Functional Analysis</th>
<th>Holistic Life-cycle View</th>
<th>Integration of Specialisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1.1: Awareness of Personal Knowledge and Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.2: Enhancement of Technical Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1.3: Enhancement of Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.1: Stakeholder Requirements</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.2: Marketing Strategy</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.3: Opportunity Exploitation</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.4: Application Promotion</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.5: IPR Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2.6: Continuous Improvement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

the mappings, but does not in any way mean that the two represent the same thing. To emphasise this, by cross-correlating between these two tables, it is possible to deduce that:

1. ‘CC01 – Project Sponsorship’ from APM and ‘Enterprise Integration’ from INCOSE are related;
2. ‘CC01 – Project Sponsorship’ from APM and ‘Enterprise Integration’ from INCOSE are not necessarily the same thing.
These mappings will only ever be able to show up potential similarities by identifying relationships through the mappings. In order to understand wherever these two skills represent the same thing, then it is essential that a competent person makes a judgement call as to whether they are the same and, if they are not, why not and how they do relate.

There are two conclusions that can be made based on this mapping:

1. If the skills are not the same, then which one is more appropriate for the scope that we are assessing against? It may be that both are required, but it is important that an informed decision is made.

2. If the skills are the same, then we can assume that we can demonstrate meeting both competencies at once, hence saving time and effort.

There are clearly many gaps in the mapping, as seen from these tables, but it has to be borne in mind that this is a very incomplete set of mappings and there are many more columns in the actual tables that do provide a lot more coverage of the UKSPEC generic competencies.

**CONCLUSIONS**

This chapter has introduced a number of competency frameworks that are used in a number of different industries. Each of these frameworks has a different scope, purpose and audience. Each of these frameworks is also recognised in its own particular field of interest and can be used, to different extents, as part of continuous professional development.

No single framework will provide all relevant skills for a single person, therefore, in many cases, it may be desirable to choose different skills from different frameworks and to map them together. An example of this was shown using the UKSPEC but, in reality, any source framework could be used or, indeed, a generic framework could be generated to perform this mapping – in fact, this is exactly what is done in the next chapter, where frameworks are mapped onto a generic framework to be used as a basis for competency assessment.

Now that frameworks have been introduced and discussed, it is time to look at how the information gathered from each framework can be used to generate a set of requirements that is needed to perform assessments against any framework.

**REFERENCES**

**Framework information sources**

APM www.apm.org.uk/ (Accessed February 2011). The APM website contains a lot of high-level information about the framework and how to go about accreditation. There are overviews of the Body of Knowledge available for free download, but the full information set is only available to purchase.
APMP www.apmp.org/ (Accessed February 2011). The APMP website contains a lot of high-level information about the framework and how to go about accreditation. There are overviews of the framework available for free download, but the full information set is only available to purchase.

INCOSE www.incose.org/ProductsPubs/products/competenciesframework.aspx (Accessed February 2011). The INCOSE website contains information on all aspects of systems engineering and a high-level description of the framework. In order to download the framework, it is necessary to be a member of INCOSE or contact them directly.

SFIA www.sfia.org.uk/ (Accessed February 2011). This is the website for the SFIA Foundation and contains a colossal amount of information about SFIA. This includes an excellent download section with the specifications, summary booklets and a very useful, if somewhat large, wall chart.

UKSPEC www.engc.org.uk/professional-qualifications/standards/uk-spec (Accessed February 2011). This is the website for the Engineering Council and provides a wealth of information on CPD generally and free downloads of the UKSPEC documentation set.

Other organisations
BCS www.bcs.org/ (Accessed February 2011). The BCS – the Chartered Institute for IT (formerly known as the British Computer Society)


ITSMF www.itsmf.co.uk/ (Accessed February 2011). The IT Service Management Forum

Useful books
accreditation see professional accreditation
acquisitions see bids and acquisitions
APM see Association for Project Management
APMP see Association of Proposal Management Professionals
appraisal see performance appraisal
assessees 60
assessment process 90, 130
pre-assessment preparation 92, 97
assessment see competency assessment
assessment architect 61, 66
assessment definer 61, 78
assessment tailor 61, 70–71
assessors
assessment process 84–86, 89–90, 130
competency of 38, 40, 55, 90, 98–101, 130
primary assessor’s competency profile 98–99, 100–101, 130
recording of evidence 99–100, 130–132
role 61
secondary assessor’s competency profile 99–101
training 40–41
The Association for Project Management (APM) accreditation scheme 27
Framework and Body of Knowledge 12, 23–27
mapping between UKSPEC and APM frameworks 33
website resource 35
The Association of Proposal Management Professionals (APMP) 6, 12, 27–30
accreditation scheme 29–30
website resource 36
audit distinct from assessment 8
BCS, the Chartered Institute for IT 19, 36
best practice in competency assessment 38, 39, 41–52
bids and acquisitions
Association of Proposal Management Professionals (APMP) 6, 12, 27–30
British Computer Society (BCS, the Chartered Institute for IT) 19, 36
business process modelling see modelling business processes
capability
Capability Maturity Model Integrated (CMMI) 5, 39, 107
definition 5
distinct from competence 5–6
Software Process Improvement and Capability dEtermination (SPICE) 5, 39, 107
Capability Maturity Model Integrated (CMMI) 5, 39, 107
website resources 9
case studies
assessments, execution of 121–134
educational framework 134–144
generating new frameworks 103–121, 134–144
Certified Systems Engineering Practitioner (CSEP) scheme 19, 36
Chartered Institute for IT (BCS) 19, 36
CMMI (Capability Maturity Model Integrated) 5, 39, 107
website resources 9
competence
definition 2, 5
distinct from capability 5–6
distinct from competency 2
person’s perception of own 4–5, 27, 40
competence evolution 8
competency
assessors 38, 40, 55, 90, 98–101, 130
definition 2
distinct from competency 2
competency assessment
assessment element in the meta-model 50–52
assessment set-up element in the meta-model 49–50
assessors, competency of 38, 40, 55, 90, 98–101, 130
best practice approach 38, 39, 41–52
case study of execution using INCOSE framework 121–134
distinct from audit 8
educational framework case study 134–144
evidence type, defining in framework 45–47, 70–71, 72, 74–75, 76
framework definition element of the meta-model 41–44
framework population element in the meta-model 44–49
measurability 38, 39
process automation and tools 54–55
rating scheme 47–49, 71, 75, 76, 88
recommendations for success 89–90
repeatable process 37–38, 39
requirements of the process 37–38
self-assessment versus third-party assessment 40–41
tailorable process 38, 39
time and cost 40
tools 54–55
transferable results 38, 39
uses 2–4
see also Universal Competence Assessment Model (UCAM)
competency frameworks 6–8, 11–36
Association for Project Management (APM) 12, 23–27
Association of Proposal Management Professionals (APMP) 6, 12, 27–30
best practice (meta-model) 41–52
case studies on generating new frameworks 103–121, 134–144
choosing between frameworks 30–35
educational case study 134–144
International Council on Systems Engineering (INCOSE) 12, 15–19
mapping between APM framework and UKSPEC 31, 33
mapping between INCOSE framework and UKSPEC 17, 31, 34–35
mapping between SFIA and UKSPEC 31–33
mapping between UCAM terms and other frameworks 43–44
Skills Framework for the Information Age (SFIA) 6, 12, 19–23
UK Standard for Professional Engineering Competence (UKSPEC) 11, 13–15, 30–35
website resources 9, 35–36
see also Universal Competence Assessment Model (UCAM)
competency profile 52–53, 71, 86–89
assessors 98–101
case study of an engineering company 132–133
competency scope 49–50, 78–82, 86–88
assessors 55
case study of an engineering company 125–129
continued professional development (CPD) 3
Association for Project Management (APM) 23–27
pre-assessment planning 92
self-assessment using UCAM 95–96
Skills Framework for the Information Age (SFIA) 20
UK Standard for Professional Engineering Competence (UKSPEC) 11, 13–15
CSEP (Certified Systems Engineering Practitioner) scheme 19, 36
customer stakeholder 60
E-skills UK 19, 36
educational framework case study 134–144
engineering competency frameworks see International Council on Systems Engineering (INCOSE) competency framework; UK Standard for Professional Engineering Competence (UKSPEC)
external stakeholder 61
frameworks see competency frameworks
human resources management see recruitment assessment
IET (Institution for Engineering and Technology) 19, 36
IMIS (Institute for Management of Information Systems) 20, 36
INCOSE see International Council on Systems Engineering information technology see IT Institute for Management of Information Systems (IMIS) 20, 36
Institution for Engineering and Technology (IET) 19, 36
International Council on Systems Engineering (INCOSE) competency framework 12, 15–19
case study using 121–134
evidence type 47
feedback on use of 133–134
mapping between UKSPEC and INCOSE 17, 31, 34–35
website resource 36
ISO 15288 – systems engineering life-cycle processes 43
IT (information technology)
IT Service Management Forum (ITSMF) 20, 36
Skills Framework for the Information Age (SFIA) 12, 19–23
Software Process Improvement and Capability dEtermination (SPICE) 5, 39, 107
management, project see project management
modelling business processes 57–58, 68
seven views approach 12, 58, 68, 149–163
performance appraisal 3
using UCAM 97–98
personal training analysis 3, 94
using UCAM 95–96
PRINCE II 2009 – projects in a controlled environment 43
process modelling see modelling business processes
professional accreditation
Association for Project Management (APM) 12, 27
Association of Proposal Management Professionals (APMP) 29–30
SFIA-accredited consultant 23
UK Standard for Professional Engineering Competence (UKSPEC) 11, 13–15, 30–35
project management
Association for Project Management (APM)
Framework and Body of Knowledge 12, 23–27
post-assessment process 94
promotion opportunity
pre-assessment process 92–93
public sector competency framework 20
recruitment assessment 3
identifying future needs post-assessment 94
job description pre-assessment process 92
Skills Framework for the Information Age (SFIA) 20
using UCAM 96–98
reviewer of assessment 61, 66, 72, 79, 81
school children’s performance case study 134–144
self-assessment
Association for Project Management (APM) framework 26–27
Association of Proposal Management Professionals (APMP) accreditation scheme 29–30
CPD planning 92
using UCAM 95–96
versus third-party assessment 40–41
Skills Framework for the Information Age (SFIA) 6, 12, 19–23
mapping between UKSPEC and SFIA 31–33
website resource 36
Software Process Improvement and Capability dEtermination (SPICE) 5, 39, 107
staff appraisals see performance appraisal
stakeholders in a competency assessment 59–61
standards see competency frameworks
supplier stakeholder 61
systems engineering
case study using INCOSE framework mapped onto the UCAM meta-model 121–134
Certified Systems Engineering Practitioner (CSEP) scheme 19, 36
International Council on Systems Engineering (INCOSE) competency framework 12, 15–19
Systems Modelling Language (SysML) 68
tenders supported by competency assessment 94
tools assessment 54–55
process automation 54
training
assessors 40–41
Association for Project Management (APM) accreditation scheme 27
Association of Proposal Management Professionals (APMP) accreditation scheme 29–30
competency assessment as guide to 3–4, 94
Skills Framework for the Information Age (SFIA) 20
UCAM see Universal Competence Assessment Model
UK Standard for Professional Engineering Competence (UKSPEC) 11, 13–15
benchmark framework 30–35
mapping between APM framework and UKSPEC 31, 33
mapping between INCOSE framework and UKSPEC 17, 31, 34–35
mapping between SFIA and UKSPEC 31–33
terminology 13
website resource 36
Unified Modelling Language (UML) 7, 58, 68
activity diagrams 169–170
class diagrams 164–165
notation 12, 58, 164–170
sequence diagrams 168
use case diagrams 166–167
Universal Competence Assessment Model (UCAM) 2, 39
appraisals using 97–98
best practice approach 39, 41–52
case studies on generating new frameworks 103–121, 134–144
case study using INCOSE framework mapped onto the UCAM meta-model 121–134
educational framework case study 134–144

framework definition process 62–68, 104–118, 121–122, 135–137
mapping between UCAM terms and other frameworks 43–44
measurability 39
the meta-model 41, 52–55, 91
post-assessment process 93–95
pre-assessment process 91–93, 130
recruitment assessment 96–98
repeatable process 39

requirements 58–59
scenarios for use of 95–98
self-assessment using 95–96
‘seven views’ approach to modelling processes 58, 68, 149–163
stakeholders 59–61
support processes 91–95
tailorable process 39
tailoring 91
transferable results 39
Unified Modelling Language (UML) notation 12, 58, 68, 164–170
website resources 9, 35–36
Competency is the ability of an individual to perform their working activities. Many organisations are able to demonstrate capability (i.e. that adequate processes are in place) but struggle to demonstrate that they have the appropriate competent staff to carry out these processes. Successful companies have a strong link between capability and competence. Indeed, competency may be thought of as an enabler of capability.

This book takes a pragmatic approach to assessing competency against various frameworks either individually or in a mix-and-match fashion and introduces one such assessment process, the Universal Competency Assessment Model (UCAM).

Essential reading for IT managers and directors, team leaders, consultants and managers in technical businesses.

- A complete set of techniques for competency assessment and definition
- Introduces the Universal Competency Assessment Model, an assessment method independent of framework or industry
- Covers creating and tailoring competency frameworks
- Includes industry case studies

ABOUT THE AUTHORS
Jon Holt is the Global Head of Systems Engineering at Atego. He is a Fellow of both BCS and the IET and is an award-winning author and public speaker specialising in all aspects of systems modelling, including process, architecture and competency modelling.

Simon A. Perry is a Principal Consultant at Atego and is a member of BCS and the IET. He works on the application of systems modelling to process modelling, enterprise architectures, requirements engineering, capabilities and competencies.