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Framing professional competencies for systems thinking in practice: final report of an action research eSTEeM inquiry

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FINAL REPORT

Project title: Framing professional competencies for systems thinking in practice

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Executive Summary

The eSTEeM project was a 12-month inquiry beginning March 2017 building on an initial eSTEeM project (2014-2016) entitled 'Enhancing Systems Thinking in Practice in the Workplace' reported on in Reynolds et al (2016). The initial report highlighted the challenges of enacting systems thinking in practice (STiP) in the workplace after qualifying with STiP core modules at The OU. Expressions of interest were manifest amongst systems thinking practitioners and employers for having some kind of formalised externally validated 'competency framework' for professional recognition of systems thinking in practice.

The project was carried out by a core team of three academics – Reynolds, Shah, and van Ameijde, associated with the Applied Systems Thinking in Practice (ASTiP) Group in the School of Engineering and Innovation, along with advice and support from other ASTiP colleagues – most notably Ison and Blackmore. The inquiry comprised some desktop research on competency framings, a series of online interviews, the drafting of an interim report, a video recording of employee/ employer interaction regarding application of STiP competencies in the workplace, a workshop held in London Regional Office in June 2017, and follow-up reporting and conversations arising from the workshop. One significant outcome from this activity led to ideas and consultations with Employer representatives, professional bodies and the Institute for Apprenticeships to initiate a Trailblazing Committee for a new Systems Thinking Practitioner apprenticeship Standard.

Compared with the initial eSTEeM research project (2014-2016), the scope of this research was much more limited, and thereby more resource restrictive. eSTEeM kindly provided 10 DL days divided between two ALs (Shah and van Ameijde). The amount of time for the Project Lead was subject to 10 days due to other commitments during the project. There were 7 co-respondents for the initial phase of interviewing. The one-day workshop involved 14 participants including members of the core eSTEeM team, several interviewees from phase 1, along with other special guests invited on the basis of their involvement, support and interest for the framing of competencies associated with STiP.

Aims and scope of the project

The primary aim of the inquiry was to provide STiP alumni with externally recognised institutionalised professional backing for their newly acquired skill-sets associated with systems thinking. The project aimed to design a learning system – through the idea of an action learning lab – for developing a competency framework associated with systems thinking in practice

Three objectives can be associated with this follow-up project. Each associated with the generation of a particular outcome.
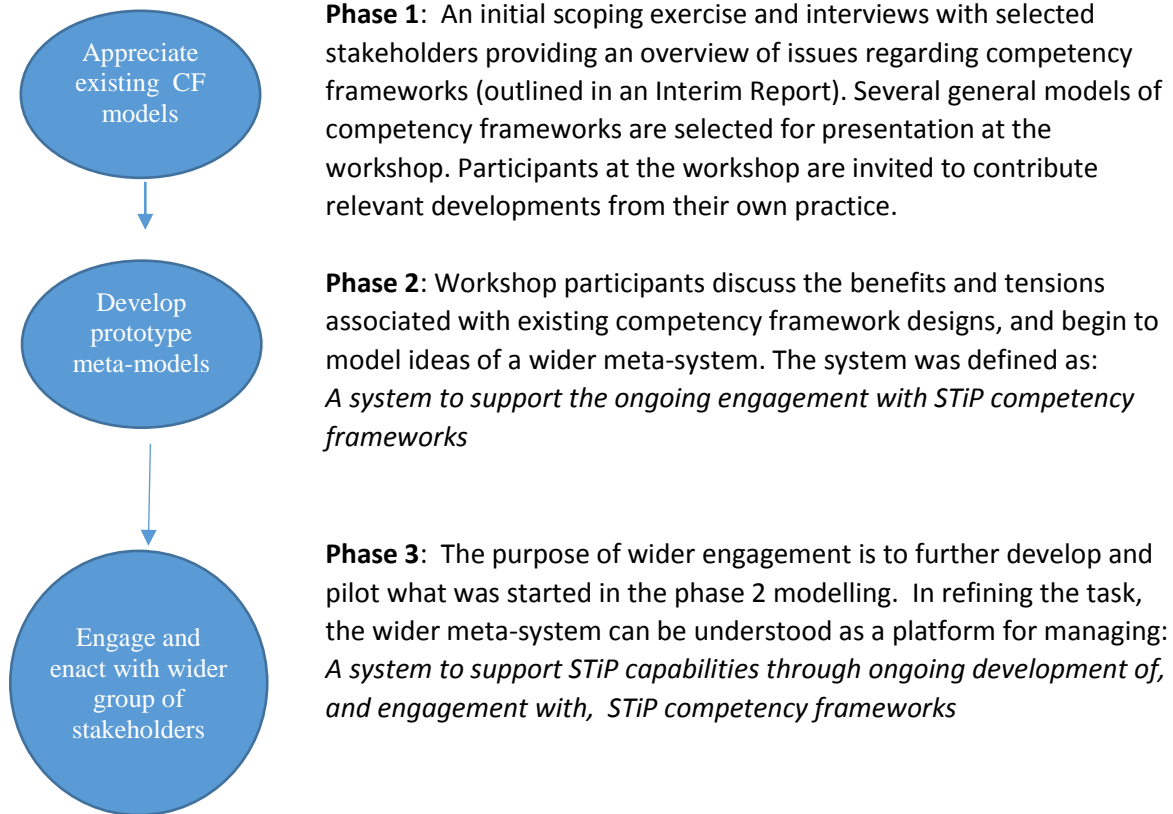
1. A scoping report landscaping some international endeavours/ concerns around institutionalising systems thinking in practice (STiP) at the workplace, and providing recommendations enabling the OU to take a lead in further certifying STiP. In researching on and writing up the report, two communities of practice (CoPs) were to be established and enhanced, one focused upon competency frameworks for professional practice and the other on pedagogy of STiP:
2. Competency framework community of practice (CoP): fermenting dialogue through an international set of partnerships including the International Federation of Systems Research (IFSR), with associated social enterprises, professional bodies, academic institutions, in co-designing a model of STiP competencies that remains true to the core attributes of STiP in being adaptive and emergent
3. Pedagogy of STiP community of practice (CoP) : building on existing relationships of the Applied Systems Thinking in Practice (ASTiP) group at the School of Engineering and Innovation, including STiP central academics, ALs, an established STiP alumni group, and associated partners, in leading on the development of STiP pedagogy arising from recommendations from the eSTEeM report involving a model of pedagogy that involves STiP alumni and workplace employers, as well as ALs and central academics.

Activities

The inquiry consisted of four phases.

1. Phase 1 comprised some desktop research in exploring a range of competency frameworks currently available online and offline which were relevant to systems thinking. This phase also comprised a series of online conversations with six prominent systems thinking practitioners, conducted by Rupesh Shah (Appendix A)
2. Phase 2 was aimed towards fostering online group video conversations on a global basis to explore the systemic desirability and cultural feasibility of designing a definitive STiP competency framework.
3. Phase 3 sought to extend the inquiry with a selective invitation to engage with a one-day workshop in London (see Appendix B for listing of participants).
4. Phase 4 sought to deepen and widen the conversations on framing STiP competencies and capabilities with a view towards developing and enacting a platform for managing systems thinking in practice (STiP) capabilities through ongoing development of competency frameworks associated with STiP.

The four phases were later revised into three phases subject to revision of phase 2 (described in the next section) and presented in the workshop report (Reynolds, Shah, van Ameijde, 2017) as a flow diagram (Fig.1)

Phase 1: An initial scoping exercise and interviews with selected stakeholders providing an overview of issues regarding competency frameworks (outlined in an Interim Report). Several general models of competency frameworks are selected for presentation at the workshop. Participants at the workshop are invited to contribute relevant developments from their own practice.

Appreciate existing CF models

Phase 2: Workshop participants discuss the benefits and tensions associated with existing competency framework designs, and begin to model ideas of a wider meta-system. The system was defined as:
A system to support the ongoing engagement with STiP competency frameworks

Develop prototype meta-models

Phase 3: The purpose of wider engagement is to further develop and pilot what was started in the phase 2 modelling. In refining the task, the wider meta-system can be understood as a platform for managing:
A system to support STiP capabilities through ongoing development of, and engagement with, STiP competency frameworks

Engage and enact with wider group of stakeholders

Figure 1 Flow diagram illustrating three phases of the project (Framing Professional Systems Thinking in Practice Competencies)

Changes to planned schedules

Phase 1 was limited in scope due to limited take-up of invitations to be interviewed. Phase 2 was very much restricted. An online conference was not enacted for several reasons.

(i) Findings from phase 1 (presented as an interim report made available to participants of phase 1 as well as invitees to phase 3) prompted concern regarding a general lack of appetite amongst senior systems thinking practitioners for generating a single definitive framework of systems thinking competencies. Complementing our findings with desktop landscaping of competency frameworks, Interviewees hinted towards a plethora of different framings each relevant to their own professional organisational context of work.

(ii) Orchestrating involvement of viable numbers of video conference participants proved very difficult. Invitees clearly had a preference for face to face discussions on weighty academic issues where online technology was clearly very restrictive.

The eSTEeM core research team was also later subject to changing circumstances regarding, in one case, change of employment status, and in another case, leave of absence due to health issues.

Data sets gathered

The beginnings of a repository of Systems Thinking related competency frameworks have been initiated arising from the desktop research in Phase 1 (Annex D). An earlier version of this repository was

integrated alongside a collation of Phase 1 interviews and presented as an interim report (Appendix E: Shah and Reynolds (2017) *Developing professional recognition of systems thinking in practice: an interim report.* The Open University). A further final report from the workshop (Reynolds, Martin; Shah, Rupesh and van Ameijde, Jitse (2017) *Framing systems thinking in practice competencies: report on systems thinking in practice competencies workshop 10 June 2017.* The Open University) was also published.

Both reports were published and made available on ORO (Open Research Online).

In addition, a short video was produced with assistance from eSTEeM and OU media support, involving the project Lead, Martin Reynolds, with two of the previous (2016) London workshop participants – Barbara Schmidt-Abbey and her line manager, Mattanya de Boer. The video recording was filmed at the UK Evaluation Society London conference on 10th May 2017. It is now part of the 'Scholarship Shorts Series' used as a resource for other eSTEeM projects http://www.open.ac.uk/about/teaching-and-learning/esteem/resources/videospodcasts/scholarship-shorts-series

Findings
The key output from the project was a multistakeholder workshop held at FutureLearn offices in London on 10th June 2017 involving representative employers, non-HEI providers of STiP training, academics associated with STiP at OU and other Universities, STiP alumni, and representatives of the professional body – Systems and Cybernetics in Organisations (SCiO). The workshop was designed and facilitated by the core eSTEeM team – Martin Reynolds, Jitse van Ameijde, and Rupesh Shah – along with support from colleagues associated with previous eSTEeM project – Ray Ison and Christine Blackmore.

The workshop was orchestrated around the presentation of three STiP related competency framings (Appendix E), each from key authors of the framing devices.[1]

- (a) Forum for the Future: Anna Birney
- (b) SCiO (Systems and Cybernetics in Organisations): Niki Jobson
- (c) INCOSE (International Council on Systems Engineering): Ivan MacTaggart

eSTEeM team members Rupesh Shah and Jitse van Ameijde as Associate Lecturers (tutors) for the postgraduate STiP core modules at the OU presented our own ASTiP vision on the role of Universities in framing competencies . The Open University eSTEeM project set out to contribute its own competency framework. In many ways the OU has its own set of STiP competencies as registered in the core set of STiP curriculum learning outcomes. These are associated with conventional learning outcome groups of Knowledge and understanding (core concepts), cognitive skills (reflective practice etc.), key skills (Communicate effectively etc.), and practical/professional skills (design, manage, evaluate etc.). In addition there are underlying heuristics associated with each of the two core STiP modules. The two heuristics are (i) understanding inter-relationships, engaging with multiple perspectives, and reflecting on boundary judgements (associated with module TU811 – Strategic Thinking) and (ii) Being, Contextualising, Engaging, and Managing, as well as with the PFMS model – practitioner, framework, methodology, situation of interest (associated with module TU812 – Managing Systemic Change).

A range of benefits of STiP competency frameworks were explored and articulated. Perceived benefits included:
- Generating demand for STiP development
- Recognition of STiP as a valuable skillset
- Support for the development of STiP skills
- An enabling structure for the provision of learning and development in STiP

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[1] Much of the reporting in this section is documented in the Workshop report Reynolds, Shah, and van Ameijde (2017) *Framing systems thinking in practice competencies: report on systems thinking in practice competencies workshop 10 June 2017.* The Open University

- Fostering organisational receptiveness to STiP by making skills more 'visible'
- Recognising the importance of intervention and application skills; key element of practitioner capability
- A means to validate STiP practice
- A guard against proliferation of some misguided espoused systems practice which damages the reputation of STiP as a skillset

Some key tensions were also highlighted including the following:

(i) Systematic versus systemic framing

Traditionally, competency frameworks tend to be fairly systematic representations of collections of competencies grouped in some meaningful way. There was a significant amount of discussion around what makes a competency framework "systemic". It was noted that even though the competencies articulated within a framework might be considered systemic, by treating competencies as relatively independent components of overall competence in systems thinking in practice, a practitioner could be enacting the individual competencies in a rather mechanistic, technocentric manner. As such, a competency framework for systemic competencies could easily promote non-systemic practice by treating competency in an overly systematic manner emphasising compliance, rather than a more systemic way for nurturing STiP capabilities.

(ii) Comprehensiveness versus usability

The competency frameworks presented by Forum for the Future, SCiO and INCOSE diverged in the level of detail expressed, ranging from a small number of competency areas each broken down into a few indicators, down to a comprehensive collection of systemic models, theories, principles and approaches. Some of the discussion focused on exploring the appropriate balance between ensuring appropriate coverage of the diverse systems field on the one hand and keeping the framework useable and meaningful on the other hand. Each framework has been developed to support specific and different purposes. For example, the framework developed by SCiO is detailed as it needs to be able to identify experts in the broadest 'body of knowledge' for its mentoring scheme; SCiO would not necessarily use this framework if they were running a certification scheme. A conceptual distinction may be helpful; between recognising (the growing multitude of…) 'systems methods' as apart from recognising (the underlying principles of…) 'systems thinking'.

(iii) Plurality versus proficiency

A related tension between privileging breadth of multi-methods as against the depth and adaptive use of relatively few methods was explored during the conversations, and can be understood in the notion of plurality versus proficiency. On one side we can view systemic competence as an ability to draw on a plurality of different systems methods, models, ideas and concepts, whereas on the other hand we can argue that it is not the breadth of methods a practitioner draws on but the systemic proficiency with which they translate a given approach into practice. Depending on how we frame systemic competencies, it would be easy to value plurality over proficiency. Alternatively of course, it is easy to slip into using one tool unreflectively and unimaginatively for a range of tasks that are ill-suited for such use (i.e. using a hammer to crack a nut). Whereas it may be easy to put measures on 'plurality' of methods, it is perhaps less easy to establish measures of 'proficiency'

(iv) Regulatory versus developmental

A fourth tension relates to the enactment of the different competency frameworks and the degree to which these are intended to act as a means of regulating practice versus supporting practitioner development and growth. On the regulation end, competency frameworks act as a means to assess and

control practice to ensure it meets certain standards. Here competencies are associated with the language not only of standards, but of compliance, credentials, yardsticks, accountability etc. On the developmental end, competency frameworks act as a means to identify gaps in skills, knowledge and abilities, and opportunities to address these to support the developmental trajectory of practitioners. The language here is more associated with notions of coaching, nurturing, fostering, nourishing etc. Implications for the design of a competency framework somewhere on this spectrum appear to relate to the language used as well as the level of specificity at which the competencies are articulated. This relates not just to content of a framework but also the process of development in terms of who the 'owner' is, what their role is, and the 'scope' of practice (in terms of range of ways of practice, how far encoded and institutionalised such practices might be, and what built-in assumptions of 'customer' expectations might be, etc.).

(v) Foregrounding versus backgrounding systems practice

(Internal versus external orientation)

When it comes to the development of STiP competency, there appear to be two positions which relate to how STiP competency is perceived in relation to professional practice. One more internally oriented perspective privileges systems thinking itself as a professional practice in the foreground, whilst placing other mainstream professional practices more in the background. The other more externally-oriented perspective places existing mainstream professional practices in the foreground whilst placing the systemicity of practices in the background. In other words, does the competency framework construct/dictate what constitutes systems practice, or does it construct/dictate what makes a particular practice (such as change management, healthcare provision or environmental management) systemic?

Role of Open University
It became clear during the workshop that the eSTEeM team framing of the Open University's role in supporting the engagement with STiP competency shifted from working on the development of a specific competency framework for STiP practice towards the development of a platform to support engagement with STiP competency. The workshop deliberations confirmed this widening potential role for the eSTEeM project. The afternoon session was given to exploring the modelling of this revised role of the University vis a vis professional bodies. The session involved small group work in co-designing different framings for this wider platform for engagement with STiP competency using the Viable System Model, Critical Systems Heuristics, and System Dynamics/ multiple cause diagramming. Some insights derived from this work include:

1. There is significant interest and scope for the various stakeholders involved in the development of STiP competency frameworks to learn from each other in a mutually supportive and constructive way
2. The richness and diversity of the Systems field creates scope for various competency framework initiatives to be able to co-exist, yet there is a danger of fragmentation and a desire to support the development of a unified core from which the different emerging competency frameworks can be seen as branches
3. Two distinct approaches for developing STiP competency can be recognised with one involving the development of dedicated STiP competency frameworks and the other involving the integration of STiP competencies or features in existing professional competency frameworks or standards. The two approaches need not be incompatible but involve different strategies.
4. There is a clear desire to move away from a narrative of difference to a narrative of commonality within the Systems Field and to legitimise a diversity of practices rooted in a common appreciation of the systems idea
5. A key constraint for supporting engagement with STiP competency is availability of resources – including financial capital as well as human, social and political capital

6. There is a need to explore the national and international ecologies within which the emerging platform for engagement with STiP competency framing needs to be both steered as well as needing to be an active agent of steering.
7. If the OU is to focus its energy on the development of a platform to support engagement with STiP competency then there is a need to understand the environment of this platform and how the platform ought to relate to this environment

An increasing demand for some form of visible benchmarking associated with systems thinking in practice is evident amongst providers ('STiP practitioners') as well as users (employers and commissioners and mainstream professional agencies associated with health, education, business, international development etc). There is as yet no one single professional body associated with exclusive and widely legitimised formal accreditation of systems thinking, though there are agencies that have 'systems thinking' as part of their accreditation process (e.g. INCOSE-UK), and there are agencies that provide less-formalised accreditation. Significant work has gone into the development of different STiP related competency frameworks by different bodies promoting systems practice. Forum for the Future, SCiO and INCOSE are just three examples (at the workshop) amongst very many initiatives that have emerged in recent years, along with a growing academic literature on comopetencies and capabilities that have come to the attention of this action research inquiry. The plurality of competency frameworks can be regarded as mirroring the plurality of systems methods associated with systems thinking in practice.

Some questions have emerged from the phase 1 and phase 2 conversations associated with this inquiry:
1. Is there a need for a single authoritative professional body associated with exclusively with systems thinking in practice?[2] How might ISSS (International Society for Systems Science) or IFSR (International Federation of Systems Research) be suitable for such a role?
2. Is there a need for a consolidated competency framework associated with systems thinking in practice or is it more appropriate to retain/ encourage the development of a range of STiP competency frameworks?
3. Depending on the response to questions 1 and 2, what might be the role of different stakeholder groups – employers, existing professional bodies, trainers and educators, membership organisations, charitable agencies, etc.?

The eSTEeM action inquiry team are keen to build on this wave of interest in STiP competency framing in collaboration with colleagues from different stakeholder groups. The team reviewed the resource implications for developing a system to support STiP capabilities through existing development of, and engagement with, a plurality of competency frameworks associated with STiP.

A clear delineation gradually emerged during the course of this project of a distinction between competencies with capacities at one level, and competencies with capabilities at another level. This was later developed and expressed using the following mental image of three component parts of a flame[3] (Figure 2).

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[2] Bodies like INCOSE for systems Engineering (represented by Ivan MacTaggart) and CIEEM for ecological and environmental management (represented by Andy Lane)
[3] The image of the flame was provided by Rupesh Shah
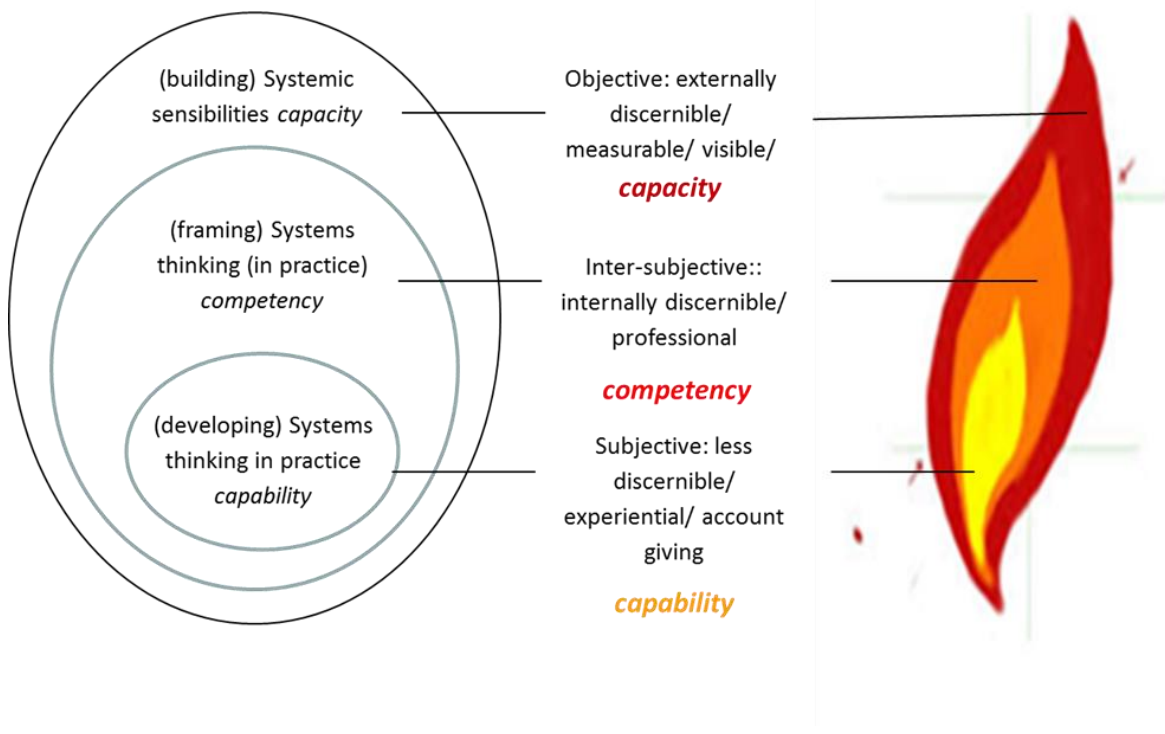
Figure 2 Capacity, Competency and Capabilities associated with Systems Thinking in Practice (an image adapted from an initial conceptual nested positioning between 'systemic sensibilities, systems literacy and systems thinking in practice capability' adapted from Ison & Shelley, 2016 Fig. 1 p.589

Another visual image of a single practitioner's concern for different types of framings is expressed in Figure 3.
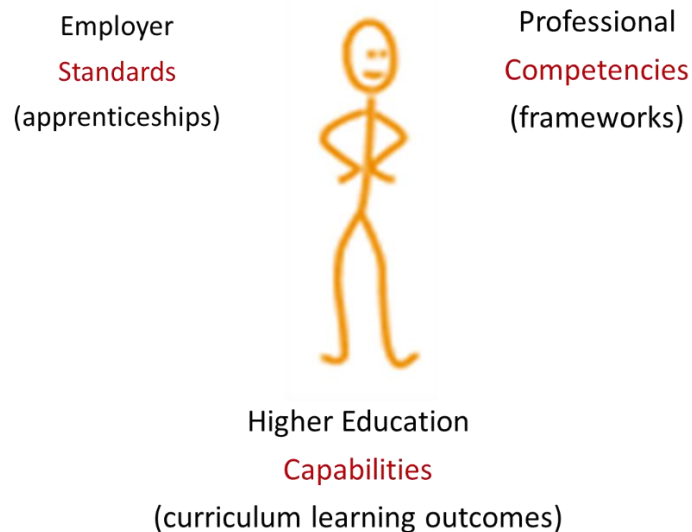
Figure 3: Different framings relevant to postgraduate professional praxis depicting two arms of praxis dealing respectively with issues of professional competence and employer standards, whilst being ideally grounded with support from higher education concerns regarding capabilities to enact competencies in workplace situations

Impact

As with the first phase of the eSTEeM project 'Enhancing systems thinking in practice at the workplace', the findings of this research will inform the future development of the STiP programme, particularly as it unfolds during the approved refresh of the two core modules for 2020. A continued measure of success in undertaking the inquiry is the opportunity to engage with meaningful conversation around pedagogic development at postgraduate level and the wider role of higher education in society amongst four sets of stakeholders:

- STiP educators within and beyond The Open University
- STiP alumni with their benefit of in-work post-study experience
- STiP employers
- STiP related professionals

Each set of respondents demonstrated a keenness to continue with the conversation around clear mutually beneficial initiatives.

Through orchestrated conversations, we will continue developing a platform for managing a system to support systems thinking *in* professional practice and/or systems thinking in practice *as* professional practice. The work here will provide a helpful complement to the development of a postgraduate (Level 7) Systems Thinking Practitioner Apprenticeship scheme being developed and led by Ray Ison and the ASTiP team at OU in collaboration with a consortium of employers from different sectors, with financial and human resource support secured from The Open University. The employer-led consortium will be responsible for setting up Standards for the proposed 'trailblazer' Systems Thinking Practitioner apprenticeship.[4] Figure 3 illustrates the dimensions of Phase 3 modelling.

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[4] The term 'trailblazer' apprenticeship is used by the Higher Education Funding Council in a recent call for proposals to Higher Education Institutions for promoting Apprenticeships.
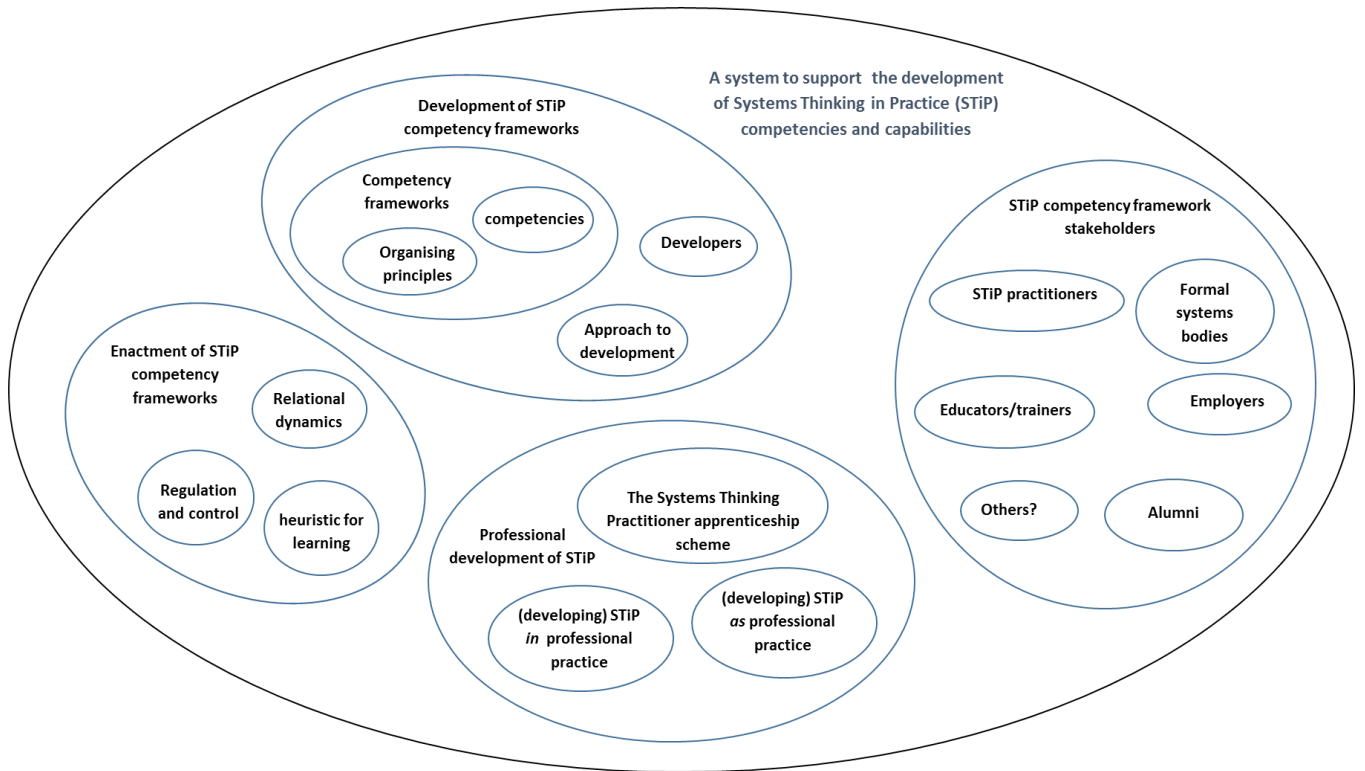
Figure 4 Systems map illustrating a further development of an eSTEeM action research inquiry: a system for managing the development of Systems Thinking in Practice (STiP) competencies and capabilities[5]

Phase 3 consisted of further reporting and dissemination on the workshop to groups and meetings including the 3rd STiP Alumni workshop in Dublin (1st July 2017)[6] and the eSTEeM conference in 2018 (presentation by Rupesh Shah), and a presentation at the joint Citizenship and Governance SRA (Strategic Research Area) and ASTiP 1-day symposium event at Walton Hall entitled 'Governing Complexity: developing appropriate praxis with citizens and organisations' (presentation by Martin Reynolds).

Significant outputs associated with this work include:

(i)   STEM Faculty support for establishing a Trailblazing Committee for generating a Level 7 (postgraduate) Apprenticeship Standard for a Systems Thinking Practitioner (STP). Once a Standard has been approved the OU would be in prime position to provide training against the Standard through it's STiP programme. A Trailblazing Committee is recognised by the Institute for Apprenticeships (IfA) as an employer-led committee which aims towards setting up a 'Standard' in this instance with regards to core STiP competencies associated with uniform IfA standards of Knowledge, Skills and Behaviours (KSBs). On the back of our eSTEeM work, the Faculty has invested in this initiative; internally it is being led by Professor Ray Ison from ASTiP, with project management support and consultancy support from Mike Walker (STiP AL) and Bryan Hopkins (STiP alumnus and independent consultant). The Committee had its inaugural meeting in October 2017 (London), with the nomination of a Chair – Carlton Brown, Senior Manager from Wiltshire Council and a STiP alumnus. Representatives of the eSTEeM team are

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[5] An activity model based on this platform is being developed by the eSTEeM inquiry team in order to guide ongoing inquiry activities

[6] STiP Alumni are a self-organised LinkedIn group of graduates who have undertaken the Open University course in systems thinking in practice.   Since 2014, the group have organised an annual event. A verbal report was presented to the Dublin one-day event in July 2017 by Martin Reynolds

part of the Committee along with a range of employer representatives, representation from IfA (Relationship Manager), representatives of professional bodies, and potential providers of apprenticeship training other than OU. This first meeting in London was followed by two further meetings; one in December (Bristol) and one in January, 2018 (Stockport). A fourth meeting is scheduled for March (Milton Keynes). The aim is for the Trailblazing committee to submit a Standard on STP for approval from IfA by April 2018; thereafter, if initially approved, it is estimated that it will take a year before an assessment strategy is developed and approved and providers (Universities) are identified who may provide the necessary training and assessment against the Standard.

There is a risk that the Standard will not be approved, particularly given the problem of identifying a specific 'occupational role' associated with the systems thinking practitioner. This continues to be one of the formidable challenges in Committee deliberations. Nevertheless the process and actions have arguably had three significant impacts. They have set in motion key deliberations amongst wider stakeholders for the need to recognise STiP competencies; something that is a prime aim of the eSTEeM project. Secondly, the Trailblazing Committee has established a network of stakeholder relations and positioned the OU team in an advisory role and as a facilitator for external relations. A third impact from the Trailblazing Committee for Apprenticeship in STP is an engagement with the wider public through a public facing website that ASTiP is producing on behalf of the Committee which will have not only a closed space for Committee documentation, but open public spaces of resources for the STP which of course will include (amongst resources from other sources) the multitude of STiP resources developed by OU over the past 50 years. There is a potential for building social capital with this venture which may lead to greater capacity to engage with the wider public.

(ii) STEM approval of a refresh of the two core STiP modules – TU811 and TU812 – for renewal in 2020. On one hand work has started on making STiP 2020 more relevant to the workplace through engagement with competency framing (from professional bodies) and some engagement with employers. The STP public facing website will be a key feature of the STiP 2020 provision. On the other hand the team – drawing on understanding gained in the initial eSTEeM research (2014-16) - has also recognised that graduates of the programme may have different concerns to employers, foregrounding issues of practice and personal development of the individual and also attending to 'situations of concern' that may not be best framed as 'workplace-related'. A third perspective is that of ourselves as educators, and the role of Universities in addressing capabilities enhancement. The modules that are being developed will attempt to embody the integration of these differing perspectives on learning.

List of deliverables
The outputs from this research will be presented on two platforms outside of the eSTEeM website: Applied Systems Thinking in Practice (ASTiP) Group in School of Engineering & Innovation, Faculty of Science, Technology, Engineering & Mathematics (STEM); and the Systems Thinking in Practice Alumni Group

Two conference/ symposium presentations have arisen from this work.

- Shah, R., Reynolds, M. and van Ameijde, J. (2018) Teaching of competencies or teaching for capability? Transforming pedagogy in a changing landscape of professional practice. In: *7th eSTEeM Annual Conference 2018: STEM Futures - Delivering Excellence Through Scholarship.*, 25-26 April 2018, Milton Keynes, UK.
- Reynolds, M. and Shah, R. (2018) Researching capability development Developing systems thinking in practice capabilities. In: *Symposium organised by C&G Strategic Research Area and Applied Systems Thinking in Practice (ASTiP) Group on Governing complexity: developing*

appropriate praxis with citizens and organisations , 12th June 2018, The Open University, Walton Hall Campus.

Aside from publication of the workshop report, and in addition to final report from first eSTEeM project, noted above, three other publications have been generated by eSTEeM team derived from, and citing acknowledgement of, this eSTEeM work:

- Reynolds, M. (2016). Towards Praxis in Systems Thinking. In: Frank, Moti; Shaked, Haim and Koral-Kordova , Sigal eds. *Systems Thinking: Foundation, Uses and Challenges.* New York: Nova Science Publishers, pp. 3–33.;
- Reynolds, M.; Shah, R.; Wedlock, E.; Ison, R. L. and Blackmore, C. (2017). From competence to capability: learning laboratories in postgraduate pedagogy. In: *6th eSTEeM Annual Conference 2017: STEM Futures: Supporting Students to Succeed*, 25-26 April 2017, Milton Keynes, UK.;
- Reynolds, M.; Blackmore, C.; Ison, R.; Shah, R. and Wedlock, E. (2017). The role of systems thinking in the practice of implementing sustainable development goals. In: Leal Filho, Walter ed. *Handbook of Sustainability Science and Research.* Springer, pp. 677–698.

A further research inquiry entitled 'Transforming postgraduate pedagogic praxis and workplace capabilities: changing the way the game is played' has been generated from these two eSTEeM research projects.

The aim of the project is to draw on a Capabilities approach towards shifting from developing 'competencies' based on learning outcomes (playing 'the game' better) towards enhancing 'capabilities' - creating innovative space for redefining occupational, professional, and social roles and practices amongst stakeholders in the workplace (changing the way 'the game' is played). Three objectives are associated with the project:

1. Explore systemic governance issues of curriculum design and implementation in relation to supporting part-time postgraduate study for enhancing workplace capabilities

2. Develop a learning system associated with progressing a new Trailblazer Level 7 apprenticeship standard involving multiple stakeholders including employers and professional bodies as well as other HEI providers

3. Leverage experiences of the L7 apprenticeship for postgraduate curriculum design and implementation

In May 2018 eSTEeM approved funding for this third project in this series. Martin Reynolds and Ray Ison are co-Principle Investigators. The 18-month project was formally launched at the Citizenship and Governance SRA/ ASTiP symposium at Walton Hall on 12th June.

Acknowledgements

2. The eSTEeM team are indebted to the active involvement of all participants of the workshop who kindly provided their invaluable time (Appendix A).

3. The research team is also indebted to the co-respondents as part of Phase 1 who agreed to be interviewed for this study and/or provided feedback (Appendix A).

Figures and tables

List of figures and tables provided in the report.

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Appendices (separate attachments)

A   Phase 1 Co-respondents
B   Phase 2 Workshop participants
C   Repository of STiP-Related Competency Frameworks
D   Three Systems Thinking Frameworks (presented at the Workshop)
E   Interim Report on Developing professional recognition of systems thinking in practice