Innovation and Skills

Future Service Science Education

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Maglio and Spohrer (2008) state that a work force that is capable of adaptation and problem solving requires people with capability and unique skills across many areas. While this cannot be disputed, it is clear that we still lack understanding of key skill areas within the service economy and of the relationship between skills requirements and education provision. This chapter describes the range and diversity of service and presents a forecast of the demand for higher level skills and knowledge. It examines education provision in terms of context, content and constructs and discusses the challenge for higher education in meeting the demands of a complex service economy.

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Introduction

Contemporary societies are widely described as service economies and the service sectors comprise the bulk of employment and value-added in most OECD (Organization for Economic Co-operation and Development) countries. Service occupations have risen to the fore across all sectors of the economy, and many firms in manufacturing and elsewhere take their "product services" (advice, after sales and services complementary to the material product) very seriously. Numerous manufacturers see such service activities and products as having displaced the focus on their traditional material product (Spring and Araujo, 2009). The perspective that "service" is the ultimate objective of economic activity has reoriented a great deal of management philosophy. This transformation – the new "service dominant logic" (Vargo and Lusch, 2004) challenges many established approaches and practices. It opens up topics requiring new knowledge, and highlights where existing knowledge should be coordinated and communicated more consistently and more widely via education and training.

The challenge for higher education is to develop a new 'service science' discipline (Horn, 2005) and to design curricula that meet the need of a future service economy. The task is complex, as it requires universities to consider not only future skills requirements but also combinations of skills in a range of future scenarios for work organization.

There are examples of service science programs emerging but many are based on single discipline thinking e.g. service marketing, while others are incremental development of existing programs. It is argued here that more attention should be paid to the design of curriculum to meet the complex needs of the service economy. Service science is inherently multidisciplinary but at the same time service firms need people with in-depth specialist knowledge and with a range of skill profiles. Not all firms have the same requirements, for example, knowledge intensive services, technical services, professional services and business related creative services all provide very different contexts for service education.

The changing nature of work organization presents further challenges for educators; increasing numbers of people working in services develop their skills through innovative project work where work processes are being constantly redesigned. Service activity is increasingly conducted through networks and project-based work with individuals and teams operating across organizational and national boundaries. The challenge for education is to design a curriculum that engenders qualities of flexibility, creativity, innovation and problem-solving, (Maglio and Spohrer, 2008), together with the ability to participate in multiple project teams.

Earlier work conducted at the University of Cambridge (IfM and IBM, 2007) discussed three possible approaches to developing service science as a discipline:

1. 'super' multi-disciplinary – embracing all appropriate, but yet not agreed, disciplines and functions
2. multi-disciplinary – embracing elements of the major disciplines and functions
3. Inter-disciplinary – attempting to unite various areas based on collaboration between disciplines.

This chapter contributes to the discussion on Service Science as a discipline by highlighting the future needs of European service industries and contributes to curriculum by linking future needs to educational constructs.

The chapter is in three parts, the first part describes the diversity of service, the different ways in which services can be generated and the range of service activities. Traditional definitions of service occupations are used to present an analysis of the current level of graduate employment across sectors. However traditional definitions of skills are based on the more technical elements of a job and the level of training required and are no longer adequate for the future service economy. Part two presents a forecast of the demand for higher level skills and knowledge, discusses a number of scenarios for future organization of work and classification of more complex skills profiles appropriate to the needs of the future economy. Part three discuss the challenge for higher education in responding to these needs and in making service science curriculum relevant and worthy of investment for both individual and company.

The Diversity of Service

Services can be generated and supplied in different ways. Much traditional service management is analysis concerned with human-to-human services, where the service interaction is largely between the client and a human service supplier. Human to human service systems inevitably involve more than just this interaction of two individuals – their architecture also involves a "servicescape" of dedicated buildings and physical infrastructure, or support by material tools (such as surgical, teaching, restaurant, and transport equipment). Increasingly service suppliers have moved to formats that link humans with IT systems. In these human-IT formats, people interact with and acquire services from workstations, websites and other IT agents and interfaces – whether or not human beings are involved at some point in approving, packing, dispatching, or delivering the core service. IT systems interact in IT system-to-IT system frameworks famously in "robot trading" in financial services, more familiarly in, for example, search engines automatically updating newsfeeds or other information requests, auction software automating eBay bidding, and so on. It is too simplistic to think that the movement is always from human-to-human to IT-IT services. Innovation often supports trends in this

direction, but there are counter forces (for example, where "high-touch" is valued more than "high-tech") – and innovation can also produce new human-to-human services.

Services are very diverse, and across and within specific services sectors we find considerable variation in the types of service rendered and the means of service production. Within industries (in all sectors) we typically see a mix of the different sorts of service activities, organized into systems of production, regardless of whether the main final product is a good or service. While there are numerous ways of `classifying services – producer/consumer/public services, for example, or "knowledge-intensive" versus "other" services (an approach currently popular with OECD and CEC analysts) – the efforts of statisticians to categorize services sectors provide a very useful starting point. The current industrial classification systems, such as the European Statistical Classification of Economic Activities (NACE), provide much richer accounts of service industries than did earlier frameworks such as the International System of Industrial Classification (ISIC). The highest-level categorization in NACE identifies nine "sections":

1. G: Wholesale and retail trade ("trade services"); plus repair of motor vehicles, motorcycles and personal and household goods.
2. H: Hotels and restaurants (often identified as HORECA – hotels, restaurants, catering).
3. I: Transport, storage and communication.
4. J: Financial intermediation.
5. K: Real estate, renting and business activities. (Often J and K are collapsed together for statistical analysis into the FIRE group. Note that the highly important Knowledge-Intensive Business Services – KIBS - are located here within "business activities")
6. L: Public administration and defence; compulsory social security.
7. M: Education
8. N: Health and social work.
9. Other community, social and personal service activities. (This includes many creative and cultural activities, some of which are KIBS.)

These industries are grouped together, despite being so diverse, because they originally fell into a "residual" sector. They are what was left over, once the statisticians in the mid-twentieth century had classified the sectors that they saw as the main wealth producers. But they do have more in common than not producing raw materials and tangible artifacts in the way that the primary and secondary sectors do. In addition to their common tendency to be concerned with intangible products, to be highly interactive with clients, and so on, we can characterize them in terms of the broad transformations effected. Service activities are typically transforming states, rather than creating raw materials (primary sector) or physical

artifacts (secondary sector). Broadly, there are three major entities whose state is transformed by service processes:

1. **Physical artifacts**, that are moved, stored, maintained, manipulated – by services such as freight transport, repair and maintenance, warehousing, etc. The artifacts may be goods, buildings, even parks.
2. **People,** whose state of health, social welfare, and personal appearance is the central concern of some public and most personal services. Some services perform similar transformations for other biological entities, as in veterinary and some environmental services.
3. **Symbols,** where services are engaged in creating, communicating and processing data, providing and interpreting information, generating and reproducing knowledge – finance services process information about property rights, telecommunications services store and move information, consultancy services attempt to impart advice, and so on.

This simple threefold classification can be employed to differentiate between service industries, where we see both striking differences and commonalities in the types of technological innovation that are relevant to broad sets of services. In particular, across the aforementioned nine service sections, we see that IT plays a central role in information processing and in delivering informational services. Of course, this is particularly marked in those services – especially financial services, communications, and knowledge intensive businesses – whose essence is symbol-processing (Miles, 2008). Since all service sectors have information processes within their production processes (e.g. office work of various forms) and many services are at heart about producing and supplying information to end-users, IT-based innovation in and of services has attracted considerable attention in the both IT and service industries. It effectively became a catalyst for the growing efforts to establish a new discipline around service(s).

Much early work on services focused on relatively low-skill physical and personal services, such as hotels, restaurants and catering, where much "service management" and "service quality" work was traditionally located. Two points should be made here. First, the very different types of service involved in these industries as compared to, say, management consultancy or computer services, helps to explain the fragmentation of the service research field. Quite simply, there was often very little perception of common issues that could be fruitfully addressed. More recently we do see approaches to service quality – such as the SERVQUAL (Carman, 1990) assessment instruments – being applied and elaborated in fields such as ecommerce web pages, and we can anticipate further constructive diffusion of methods and concepts in the immediate and longer-term future.

Second, the important variation across services in terms of skills and knowledge is highlighted by these examples. Some services industries are among those characterized by the greatest proportion of low-skill workers in their labor forces.

This was often seen as part of the explanation for low productivity growth in services, and is probably one reason for the disdain with which service work is often regarded. In contrast, some other service industries are the sectors that are most knowledge-intensive in terms of the proportions of graduates in their labour forces, and we see very clear specifications from industrial sources that there is a very real need to access employees with skills in managing professionals and experts spanning a wide range of specialized knowledge bases. More evidence is required as to the nature of the skills required in many new service operations; there are major deficits in our frameworks for documenting skill profiles and capability requirements. Better understanding of skill requirements, and of how these may be managed, is a priority.

We need to recognize the diversity of foci and approaches, in order to constructively bridge and synthesize their contributions. At present work on services is extremely fragmented, with, for instance, more firm-level analysis of new service development being only occasionally taken on board in (typically more industry-level) service innovation studies. In this context it is interesting to note the appraisal that "the importance of service innovation is not matched by the sophistication of new service development practices and methodologies, in contrast with the variety and sophistication of methodologies for new product development. Much of the research about new service development is critical of current practice" (Ginzberg et al. 2007). This implies that the attention being given to service innovation as an important factor in growth and wellbeing (more remote economic analysis) is not matched by the attention given to how such innovation is, and might better be, conducted (more close-up management studies). We have much analysis of what service innovation management is not (rarely R&D and R&D-type management processes, for example), but much less positive evidence of the forms it takes in empirical circumstances. Yet this is central for the understanding of how service systems are evolving.

This pattern of fragmentation is typical across the bodies of literature examining services from the perspective of different disciplines, or exploring specific types of service in isolation. It has probably been reinforced not just by the diversity of service(s), but also by their relatively marginal position in most disciplines and statistics. It has taken a long time for assertions about the need for SSME, or to adopt a "service dominant logic", to gain much of an audience (Hunt, 2004). Indeed, it is possible to see a shift in debate, with service specialists arguing for the distinctiveness of services, and gradually moving toward a position which argues for a synthesis in approaches to service and manufacturing sectors and activities, reflecting in part the tendency for production chains to engage both services and goods, whatever their nominal final products. This is sometimes captured through use of terminology such as "product-service systems" (though since services can be products as well as activities, this is potentially confusing).

Firms of all types produce services for their internal consumption, and often for their customers and collaborators (from after-sales service to research support services). Service can be used to describe the work that one party undertakes for an-

other (or for oneself, in the case of self-service), or the outcome of this work (the customer being transported, entertained, presented with a requested, repaired, stored or otherwise transformed artefact). The term “services” is even more ambiguous, being applied to firms and industries, as well as products and commodities, and activities and occupations. Service and services are thus remarkably diverse in terms of their occupational profiles: some are low skill activities, while others have the highest share of graduate employees of any sectors (see Figure 1: Occupational data from the UK Community Innovation Survey 2006, http://www.dti.gov.uk/iese/ecslist.htm)

Service work exists everywhere, across and in all sectors. Data derived from the UK Community Innovation Survey 2006 shown in Figure 1 gives an illustration of the proportions of graduates, as percentages of total employee numbers, employed within UK firms by Standard Industrial Classification (SIC) codes. The percentages are particularly striking in technology based and professional knowledge intensive business services. This survey (which is based on employers’ responses) collects information about product and process innovation as well as organizational and marketing innovation during the three-year period 2004 to 2006 inclusive. Most questions cover new or significantly improved goods or services or the implementation of new or significantly improved processes, logistics or distribution methods.

Traditional definitions of skills that were based on the more technical elements of a job and the level of training required are no longer adequate to cover the full spectrum of the abilities needed to perform new roles. It is therefore apparent that the future "service economy" will require different skills and competencies across a wide range of professions (Miles, 2005). A challenge for educators and trainers is to “unbundle” what the required skills and competences are or will be and to respond with appropriate educational practice.

Forecasting the Demand for Future Skills

A recent study for the European Techno-Economic Policy Support Network (Miles et al 2009) was commissioned to consider the research needed to understand future skills needs in a presumed innovative European Services Sector. The study focused on those service activities that have been knowledge intensive service activities (KISA) in the light of technological innovation. The main objective of the study was to raise questions and map out where research is needed to better understand the future skills requirements in KISA. The concept of KISA is relatively new. Knowledge-Intensive Service Activities (KISA) are defined by the Organization for Economic Co-operation and Development OECD as ‘the production and integration of service activities undertaken by firms in manufacturing or service sectors, in combination with manufactured outputs or as stand-alone services’. KISA can be provided by private enterprises or public sector organizations.

Typical examples include: R&D services, management consulting, IT services, human resource management services, legal services such as IP-related issues, accounting and financing services, and marketing services.

The concept of KISA has been introduced in part because of perceived limitations in the widely used construct KIBS – Knowledge-Intensive Business Services. KIBS are firms that specialize in producing services to support the business

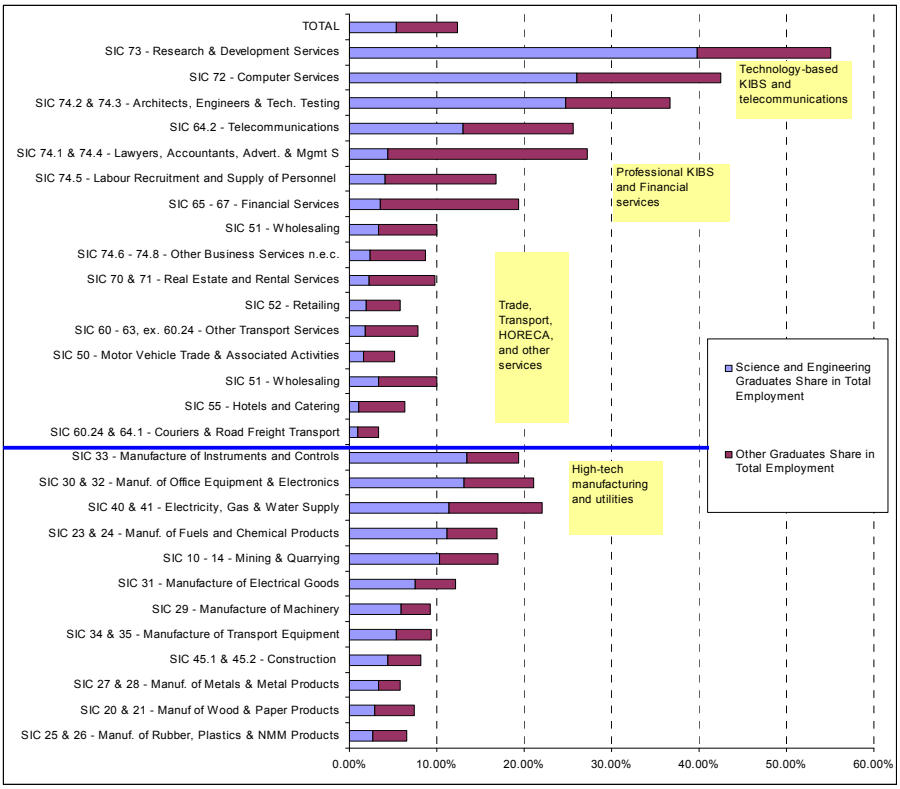

Figure 1. Occupational data from the UK Community Innovation Survey 2006 (from http://www.dti.gov.uk/iese/ecslist.htm)

processes of private firms and public organizations. They fall into three broad categories: i) technical services (computer support, R&D, engineering, industrial product and process design, etc.), ii) professional services (accountancy, legal services, market research), and iii) business-related creative services (advertising in particular, but also elements of architecture and design). The limitation of the KIBS construct is that it deals only with services provided by specialist firms and sold to other organizations and does not consider similar services provided in-house by employees within organizations across the economy. These in-house

services are included in the KISA concept. Indeed most, if not all, professional jobs could be thought of as KISA.

Figures 2 and 3 show employment projections by sector and skill levels. They highlight an increasing need for highly skilled graduates in business, other and non-marketed services (e.g. voluntary services).

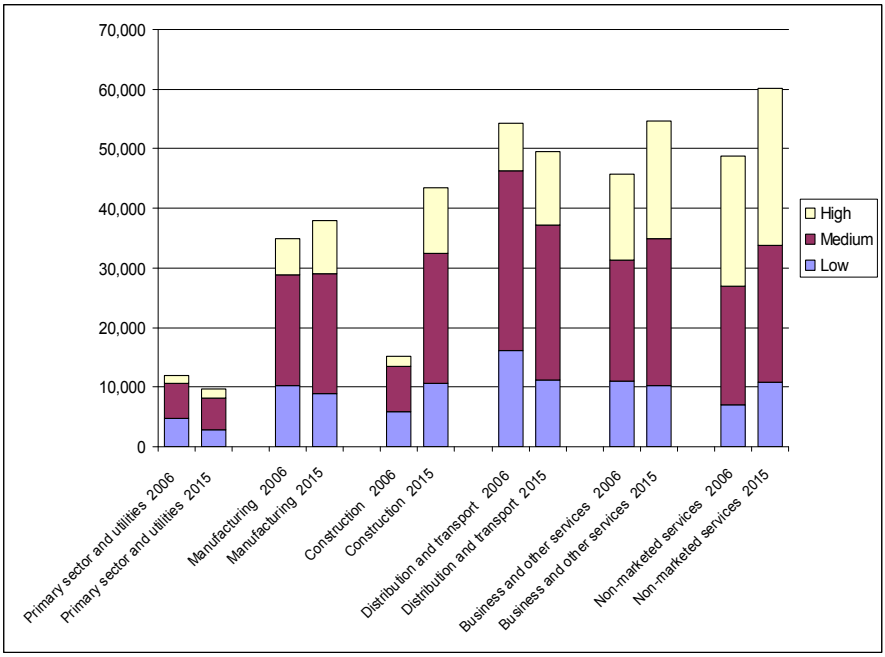

Figure 2. Employment projections by sector and skill levels: Absolute employment numbers and projections, three skill levels high, medium and low. (Elaborated from data in Tables 34a/34b pp 100-103: in, Future Skill needs in Europe Medium term Synthesis Report (2008), CEDEFOP, Luxembourg EC.)

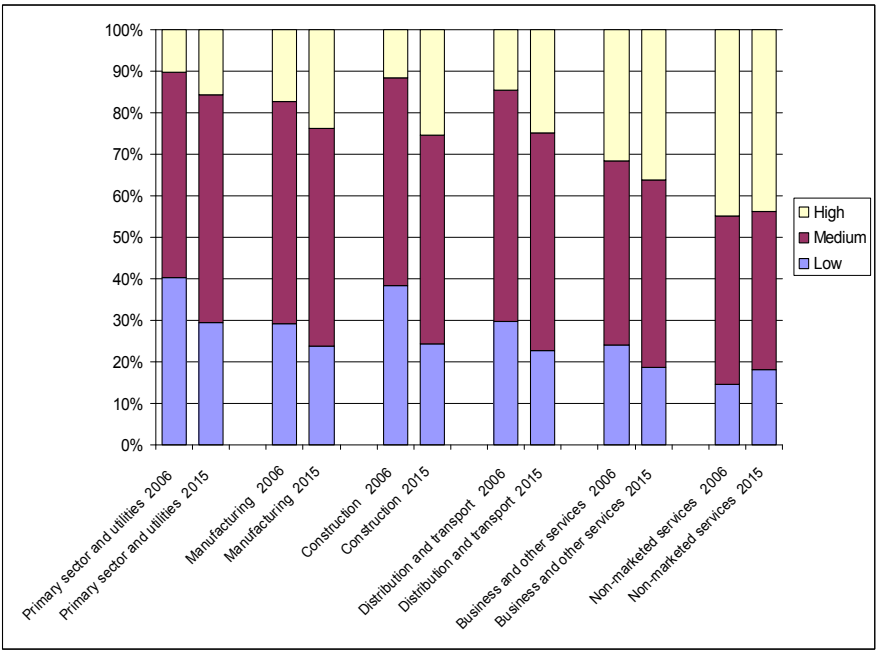

Figure 3. Employment projections by sector and skill levels: Shares of sectoral employment (%), three skill levels high, medium and low. (Elaborated from data in Tables 34a/34b pp 100-103: in, Future Skill needs in Europe Medium term Synthesis Report (2008), CEDEFOP, Luxembourg EC)

In forecasting skill demands the study found that basic modeling of trends in demand for specific professions, or for professional occupations more broadly, is possible. There have been both detailed assessments of quantitative trends in demand for a few professions (mainly ICT-related) and for professional occupations in general. In these cases the main approach has been to simply extrapolate trends or to estimate demand for employees as a consequence of general trends in economic growth and industrial structure. These "independent variables" are conditional on broad patterns of economic development, and recent financial shocks indicate that it is unwise to assume that steady long-term growth is the most probable future. Alternative lines of enquiry could examine changing skill requirements associated with established jobs (e.g. studies of future management skills) or economic sectors (e.g. professions in financial services).

An outcome of the study pointed to a number of drivers that are liable to shape the development of KISA jobs in the future. Broadly, the key drivers can be classified as:

1. The technologies in use for KISA, and the technologies where KISA support is required by clients
2. The organization of the KIBS sector, in terms of the roles of firms (specialization/integration), firm size, and the use of off-shoring
3. Demand for KISA on the part of clients, and client strategies (and management philosophies) in relation to internalization of KISA versus externalization to KIBS, to off-shoring internal KISA and/or using overseas KIBS, and moving into the commercial supply of KISAs to other firms
4. Factors affecting demand such as technological change, regulations, turbulence in markets and levels of economic growth and client firm internationalization
5. The availability and quality of training in KISA skills, modes of provision of training (on-the job and in formal institutions, life-long learning, etc.).

A further interesting outcome of the study concerned KISA in highly innovative service firms. Such firms have teams that produce work patterns, which are not easily formalized or reproducible under different circumstances (however highly specifiable the technical components of the system may be). These innovative service firms have to cope with knowledge spillover as a necessary consequence of the need to develop many aspects of an innovative new system simultaneously. Therefore, any benchmark procedure for evaluating qualifications and skills has to be flexible enough to cover such cases.

It is worth noting that an increasing number of people are employed in services where their skills are developed in and through innovative project work, within which the division of labor is never finalized before work processes are redesigned. The continual change of working practices presents a real challenge for curriculum and training development.

Miles and Jones (2008) identified three scenarios for organization of work associated with services: professional communities, situated clusters and organizational aggregates, each described briefly below.

Scenario 1: Professional Communities: Networking is predominantly organized on a bottom-up basis. Professionals come together to operate as virtual organizations around specific projects. Particular sets of professionals may often collaborate in this way, in changing configurations as projects succeed each other. Collaboration is based on trust, on reasons to believe in each other's competences, track records, originality, etc. Not all players in this scenario would be equal, let alone being single individuals. Some agents would be larger than others; some would act as system integrators, brokers, and clearing houses. But in this scenario, there are many such players, and power is widely dispersed. Professional Communities can be thought of as dynamic networks and can be either local or geographically extended.

Scenario 2: Situated Clusters: In this scenario there is considerable influence from initiatives undertaken by local governments and other regional actors. Such

initiatives lower transaction costs, provide common facilities, and perhaps build on subsidies, procurement, and local comparative advantages. The networks make a lot of use of information technology to liaise and communicate, but the KISA professionals are typically familiar with each other on a face-to-face basis, they (mostly) inhabit the same urban area or region. (There may be mechanisms for collaboration across regional partners, especially where there is a common project or value-chain relation between the economies of the two areas.) Situated Clusters are typically 'local' and stable or static over a period of time.

Scenario 3: Organizational Aggregates: Here long-term strategic partnerships, largely constructed by large business organizations (or groups of organizations) are the basis for establishing networks and developing and diffusing common technologies and standards. Various sorts of business relationship are liable to coexist – ownership and spin-offs, joint ventures, collaboration in large projects for common clients (including public funding agencies), etc. The relationships may be mainly "vertically" organized around value chains, though other structures are possible (e.g. the East Asian zaibatsu and chaebol structures which cover many sectors of the economy). The larger players will play an important governance role, for example in making arrangements about intellectual property, about common tools and standards, and so on. Organizational Aggregates are extended networks but are typically stable or static over a period of time.

In conjunction with the three future scenarios that have been outlined, there is also a need to think about competencies – specific combinations of skills. While there are probably infinite combinations of specific skills, several ideal types of skill profile have been identified (Miles and Jones, 2008). Drawing on efforts to classify skills into various groups, research proposes that there are certain specific skills associated with particular KIBS specialism (accountancy, architecture, computing services, etc), and a range of generic skills associated with management of people, projects, inter-organizational and interpersonal relations, communications, and so on. (These are, admittedly, the specialism of some types of management profession – but they are not typically the activities supplied as services by a specialized KIBS firm to its clients). A set of skills profiles is shown as Figure 4:

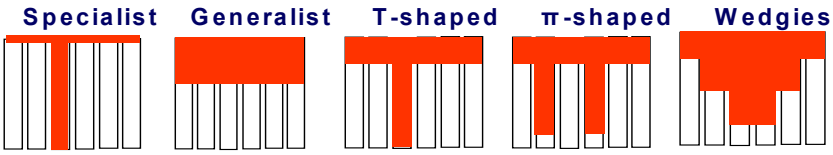

Figure 4. A Preliminary classification of skill profiles (Miles and Jones 2008).

1. **Specialist** - this is the classic highly-specialized professional worker, with huge depth of skill in a particular technical domain – this might be law, computer software, architecture, etc. – but with relatively low levels of other skills required of professionals in the organization, such as project management, marketing, interpersonal communication, resource allocation, etc.
2. **Generalist** - this is perhaps the classic general manager, with a broad range of skills but limited depth in any of them. Such an individual has more than lay knowledge of the specialties that characterize their organization's services, but is also skilled in the range of other activities mentioned above.
3. **T-shaped** - this category considers emerging skills profiles: the industrialists in the workshop stated that they required people whose deep specialist knowledge was complemented with broader generalist knowledge than that of the specialist – people who could manage and market services as well as master the deep technical specificities.
4. **π-shaped** - this hypothetical profile implies individuals who have deep knowledge of one or other of the management and other professional areas, in addition to deploying profound technical skills from a specific technical specialty.
5. **Wedgies** – this profile lies between the Generalist, T-shaped, and pi-shaped categories: it features moderately deep knowledge of several fields, together with more detailed skills in a few, and generalist capabilities as well.

The discussion of profiles effects a helpful clarification of issues around skills and skill combinations, while demonstrating that there is still work required on establishing a framework that can effectively be used across sectors, occupations, and contexts. As skill clusters and the constituents of profiles are constantly being reconfigured by technological and organizational change there is clearly a requirement to avoid treating profiles in too static and rigid a way. In addition to seeing skill profiles and competences at the individual level, it is essential to be able to examine how different skills are put together in workplaces, organizations, groups and teams.

Each scenario also requires specific combinations of skills. Four key skills areas have emerged from recent research as i) generic and specialist skills, ii) managerial and entrepreneurial skills, iii) technical skills: information technology related, iv) technical skills: aspects of professional work other than information technology (Miles et al., 2009). Table 1 maps the skills requirements against the three scenarios identified.

This section has discussed the demand for future skills based on recent European employment projections by sector and by skills; on future scenarios for work organization and on future skills profiles. Forecasting demand is complex and requires further examination, none the less it is clear that there is a requirement for

an adaptable, multi-skilled and highly knowledgeable workforce across a range of service sectors. The challenge for Higher Education is to translate that requirement into a coherent discipline and a portfolio of curricula

Table 1. Future Scenarios and Skills Requirements

Skills	Common Features	Scenarios		
		1 Professional Communities	2. Situated Clusters	3. Organizational Aggregates
Generic/Specialist Skills	Demand for some highly skilled professionals with advanced specialized technical skills; but more generally demand for multi-skilled professionals (T- & π- shaped, and wedgies) with interpersonal and managerial capacities.	Relatively less demand for highly skilled professionals without generic skills, since key requirements are being able to find and fit into evolving teams.	Likely to vary across regions, with requirements for skills being typically between scenarios 1 and 3.	Relatively more demand for highly skilled professionals without generic skills, since they can be mobilized within larger organizations. Scope for higher division of labor means also more scope for associate professions to support advanced professionals. Multiskilled managers of specialist workers required.
Managerial & Entrepreneurial Skills	Generic skills in great demand reflecting need to bring together many tasks in complex arrangements.	Entrepreneurial skills; interpersonal and especially customer-facing skills important. Teamwork and self-organization vital.	Regions vary, depending on specialisation and quality of local decision-making. In general, closer to scenario 1 than scenario 3.	Ability to work within large organization and complex division of labour important.
Technical Skills: Information Technology-related	Increase demand in all scenarios, especially to extent that economic growth and technology change. If technological change slows down, then some specialist technology-related skills should be less	IT-related skills (including those of users of IT systems) are needed on a wide basis, with capability to work with open standards, and design and integrate systems for one's own work, becoming a premium.	In some regions, IT support provided as a service to clusters on a semi-public service basis; growth in need for user skills may then be diminished.	Slower growth in need for user skills as advanced IT-based support systems diffused within organizational networks (though liable to be learning periods where assimilation of new systems requires more skill than anticipated).

	in demand, as these become more part of general competences.			
Technical Skills: Aspects of Professional work other than IT	In all scenarios, increasing demand for advanced professional skills, resulting from challenges and specialized knowledge associated with technical, organizational, and broader socioeconomic change.	Deep knowledge required, but also capacity to combine knowledge from various domains and effect new creative solutions – possibly π-shaped professionals particularly relevant.	In less successful regions, more routine KISA and professional work requirements might dominate; in more successful regions, model might be more similar to scenario 1.	Increased efficiency-led division of labor and in particular introduction of para- and associate professional support to professional workers. Effort to capture specialist knowledge in IT-based support systems.

The Challenge for Higher Education

Education is targeted at the individual with the goal of helping the person to achieve transformation from current levels of knowledge, understanding and capabilities to some future level. The challenge for the educator is to design programmes that meet the needs of the individual as well as the needs of the economy. It is argued here that three major sets of factors should be considered when designing future curriculum (i) the context of the future work settings into which the individual may be placed upon graduation (ii) the content of the material to be taught and the way the material will be delivered that will lead to the individual acquiring appropriate knowledge and skills and (iii) the construct through which learning will occur to enable the individual to move forward from their current level of attainment to the next level.

Context takes account of the future scenarios for work organization and the situations in which service science professionals will operate:

- professionals coming together to operate as virtual organizations around specific projects, within dynamic networks
- professionals working within situated clusters within regions, often within small or medium sized organizations and within networks that are stable over time

- professionals working within long-term strategic partnerships, within large organizations, in extended networks that are typically stable over time.

Each of the scenarios has implications for curriculum design. For example, working in geographically dispersed teams, understanding of inter-organizational working, cultural differences, or knowledge of how networks form and operate.

Particular programs may focus on one scenario to meet the needs of particular groups of individuals, but explicitly addressing the context of future scenarios will help to overcome one of the areas of complexity of service science curriculum design.

The content of the curriculum focuses on the need to design curriculum that meets future knowledge and skills requirements. Glushko (2008) distinguishes between service science as a new discipline or as a new curriculum.

'A discipline is an integrated field of study defined by some level of agreement about what problems are worth studying, how they should be studied, and the criteria by which findings or theories about those problems can be evaluated.' (Glushko, 2008).

Whereas a curriculum is 'a program of study to instil in students some specified body of knowledge or skills' (Glushko, 2008).

Ideally the discipline should come first with major stakeholders agreeing on the body of knowledge, then the curriculum or program of study should follow. In the case of service science there has been a push for curriculum before the key tenets of the discipline have been established or at best they are being defined in tandem.

From the earlier discussion four key areas can be identified:

- The need for multi-skilled individuals with both generic skills and specialist skills.
- The need for people with managerial and entrepreneurial skills, customer facing skills, self organization, team working and interpersonal skills
- the need for people with high levels of both technical skills in IT and profession specific skills
- Service specific knowledge and understanding, for example, of service concepts, methods, systems. Key concepts would include, for example, the service-centered conceptual foundation proposed by Lusch and others (Lusch et al., 2008), service systems as the basic abstraction of service science (Spohrer et al. 2008), service life cycle (Glushko, 2008), and appropriate research methods.

Figure 5 illustrates the service science curriculum content. As discussed in Table 1 the specific requirement for each of these may depend on the scenario and hence curriculum content should be viewed within context.

Educational constructs are internationally understood mechanisms for delivering education to individuals. Key constructs include:

- **Undergraduate** (UG) for developing knowledge and understanding of key principles within in a particular subject
- **Specialist Masters** (MSc) for developing further in-depth understanding within a particular subject area
- **Master of Business Administration** (MBA) for providing a broader understanding of theory and practice within a the business context
- **Executive MBA** for developing further specialist knowledge and understanding linked to specific work practice and requirements
- **Post-experience Masters and Continued Professional Development** Certificates and Diplomas to consolidate and enhance workplace practice and experience
- **Doctoral in Business Administration** (DBA) to conduct in-depth research and discovery within a business context and to contribute to business knowledge
- **Doctor of Philosophy** (PhD) to conduct in-depth research within a specialist subject domain and to contribute original research to that domain.

Each educational construct will typically deliver differing levels of awareness, knowledge, understanding, practical project work, experiential learning, workplace practice and research as shown in Table 2.

These educational constructs can be offered to individuals to help achieve transformation into one or more of the skills profiles identified in Figure 4. Table 3 shows which combinations of constructs will help to deliver the range of profiles

Table 2. Educational constructs and level of awareness, knowledge and understanding

Target market/ Level	UG	Masters	MBA	Exec MBAs	PhD/DBA	Post MSc
Awareness	Yes	Yes	Yes	Yes	Yes	Yes
Knowledge/ understanding	Yes	Yes	Yes	Yes	Yes	Yes
Practical project/experiential learning	Yes	Yes	Yes		Yes	
Workplace practice			Yes	Yes		Yes
Research and innovation					Yes	

Table 3. Relationship between educational construct and skills profiles

Skills profile versus Constructs	New-entrant	Specialist	Generalist	T-shaped	Pi-shaped	Wedgies
Undergraduate	X	X	X	X	X	X
Master	X	X		X	X	X
MBA			X	X	X	X
Executive MBA					X	X
Post-experience Masters		X				
DBA					X	X
Phd		X				

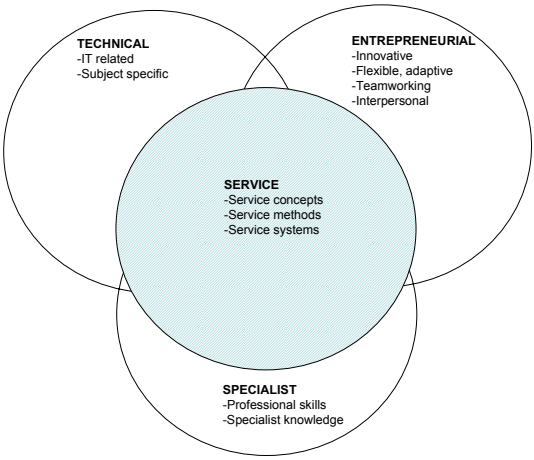

Figure 5. Curriculum Content, adapted from 'A Framework for Service Science Curriculum' 2008, http://www.ssmenetuk.org/docs/ ssme_framework.pdf (BT, HP and IBM, 2007)

One implication of Table 3 is that to achieve the 'T', 'Pi' or 'wedgies' skills profile an individual must have many years of education and experience. Davis (2008) describes business schools today as 'organized by functional departments-such as marketing, finance, and accounting and operations management – with little interaction between them'. This picture is replicated across many university schools leading to 'silo' curriculum and thus an individual must attend courses in a number of separate schools/departments in order to achieve a multidisciplinary

skills profile. Despite continued efforts by Maglio et al. (2006) and IfM and IBM (2007) the need for defining the service science discipline and consequent curriculum is still urgent in order to reduce the amount of time taken to transform a traditionally educated individual into a multi-skilled adaptable service scientist.

Conclusions

The findings of the Cambridge workshop still hold true, that: *'The gaps in knowledge and skills needed to deal with complex service systems indicate that we need to reassess our approach to research and education.'* (IfM and IBM, 2008).

This chapter adds to the discussion by exploring some of the complexities associated with future skills identification, highlighting the context specific requirements of the service industry and identifying the skills profiles required by future service organizations.

Understanding the context of service science education would be greatly aided by a higher level of involvement of public and private sector organizations with universities and by greater attention to the outputs of skills forecasting bodies such as the OECD.

Articulating content for university programs depends of the development of the discipline as a whole and should be research led for example through university research centers and the Service, Research and Innovation Community (www.thesrii.org). There is clearly a need for a community of practice for academics and practitioners to co-create and exchange curriculum content such as that being developed through IBM's Academic Initiative in SSME. New educational constructs may need to be explored to speed up the delivery of service science education, for example, through continued professional development in the workplace, through e-learning or through immersive 3D worlds.

Existing systems of vocational training, professional and academic education and accreditation are the results of deeply embedded systems of governance and widely differing structures of society and the economy. It can be argued that the current approach to service science education is itself product led as it is designed from a university perspective using existing educational products such as MBA. What new service-oriented educational constructs can be envisaged that are more relevant to the complex, ever changing service economy?

This chapter identifies the need for demand-led education that provides the skills and knowledge necessary for the future service economy. The challenge for Higher Education is to make service science curriculum relevant and worthwhile for both the individual and the company to invest in.

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