

Developing a Services Science Graduation Programme at the University of Twente

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Abstract

The recent growth in the services sector implies that more people must be trained in this area. This inspired us to develop a Services Science Graduation Programme at the University of Twente, the Netherlands. We propose a study programme of five years, consisting of a Master phase of two years and a PhD phase of three years. This paper reports on our efforts to develop our Services Science Graduation Programme. Our approach in the development of this programme consisted of two phases: 1. we performed a survey of the programmes of other institutions in order to identify service concerns to be covered, but also patterns and strategies, and 2. we defined a programme with enough coverage, taking into consideration the local resources (course and lecturers) so that the programme can start immediately. In our survey we catalogued 386 courses offered in 35 programmes related to Services Science worldwide. The topics have been organised according to generic service activities, in an attempt to define the elements that should or could be covered by a Services Science programme. We conclude that although we have reused available courses, we have defined a Services Science programme with acceptable coverage of service concerns. Furthermore, specialisation can be attained by means of projects and traineeships in particular areas or application domains.

1. Introduction

Increasingly more people are being employed in the service sector [1]. This trend is starting to influence policy and investment decisions of governments, industries and academia [2]. Academia have responded with the introduction of a new discipline named *Services Science* in which novel teaching, research and publication opportunities should be identified [3].

Services are characterised by their uniqueness, high customisation and value-added personal experience, and are delivered in diverse and dynamic environments [1]. Furthermore, many business services are supported by ICT services. This implies that a science for services has to be multi-disciplinary, professional skills should cover a broad spectrum, and flexibility is a crucial competence to be attained by professionals in this area [4]. The development of these skills directly improves the employability of these professionals [5]. Moreover,

services in different areas and at different levels comply with stable life-cycle patterns that determine the activities to be performed by professionals. From these observations we conclude that service professionals should have a 'T-shaped' profile [6]: they should have general knowledge of multi-disciplinary concepts, techniques and theories in science, management and engineering that are relevant for services, but specialise in some particular aspects in order to make concrete contributions to the field, either in academia or in industry.

Although this profile is quite clear and has been sketched before, recent surveys have revealed some shortage of professionals with these skills and knowledge [7]. Reasons for this shortage include the lack of a general theory of services, underestimation of the importance of the services-related activities, unclear branding of Services Science in the students community, and the inability to claim intellectual property rights of services [2]. This calls for a Services Science discipline as a research field, with its corresponding education programme. This inspired us to develop a Services Science Graduation Programme at the University of Twente, the Netherlands. This five-year programme consists of a Master phase of two years and a PhD phase of three years.

This paper reports on the systematic approach we applied in the development of our Services Science Programme. We developed this programme by following an approach consisting of two phases: 1. we performed a survey of the programmes of other institutions in order to identify service concerns to be covered by our programme, but also patterns and strategies, and 2. we defined a programme with enough coverage, taking into consideration the local resources (courses and lecturers) so that the programme can start immediately.

The paper is further structured as follows: Section 2 introduces the systematic approach we applied for surveying and analysing courses and curricula offered by other institutions in this area. Section 3 proposes a classification scheme for the courses and curricula we identified in our survey. Section 4 discusses the results of our analysis of the existing courses and curricula. Section 5 discusses our Services Science Programme, which has been obtained by taking into account the courses available at our university and some of the findings of our survey. Section 6 gives our final conclusions.

2. Approach

The systematic approach we applied in our review of existing courses and curricula is described below, in terms of our research questions, search strategy and data analysis.

2.1. Research questions

Services Science curricula are already being offered by institutions in different contexts. These curricula are continuously evolving based on experience and the collaborative support of industrial and governmental organisations. When designing a new Services Science curriculum, one can find best practices, trade-offs and strategies by analysing these existing curricula. A systematic review of existing courses and curricula can therefore be useful when designing a new curriculum.

Services Science curricula are already offered by some Business Schools and Engineering Departments as isolated programmes. Since Services Science is an integrative discipline, typically involving at least Computer Science and Business Management, it requires a holistic view to cover all science, management and engineering aspects of services. This integration also enables innovation in this area.

Based on these observations we came up with the following research questions:

1. Which patterns can be identified for the coverage of service aspects by courses and curricula?
2. Which strategies can be identified in the reuse of existing courses?
3. Which skills are pursued in the courses of the different curricula?
4. What are the service concerns covered by these courses and curricula?
5. What are the identifiable trade-offs in the courses offered in these curricula?
6. What are the innovative pedagogical practices in these courses?
7. What are the innovative non-teaching activities in these curricula?

2.2. Search strategy

In our survey, we selected material from the following sources:

- Conference and journal papers from digital libraries.
- Web pages of education programmes.
- Programme brochures and graduate handbooks.
- Books [8] [9] and book chapters.
- Service science portals [10].

We selected courses and programmes that explicitly refer to Services Science in their title. We also selected curricula with courses from the traditional disciplines

(e.g., Computer Science or Business Management) that relate themselves to Services Science. We did not exclude curricula offered by institutions from any specific geographical area or degree level, i.e., all curricula that offer professional certificates, and undergraduate or graduate degrees in Services Science around the world have been included in this survey. However, we excluded some curricula listed on Services Science portals that are not operational yet. Research and internships that cover general topics have been excluded, as well as curricula reported on research papers that are not operational, such as, e.g., [5].

Our survey generated a data set at the granularity of courses from Services Science curricula offered by various institutions around the world. We do not claim to be complete, but we gathered enough information to answer our research questions.

2.3. Data organisation strategy

We presented the data of this survey primarily in tabular form by including the course names and other educational activities. For the analysis, we inserted this data in a spreadsheet. The data extraction was carried out based on the name of each individual course. Therefore, course names have been used as keywords to describe and classify the courses. We realised that these courses could be classified in many different ways, but we decided to group them according to the service activities that are mostly addressed in each course, as shown in Appendix A.

3. Classification

The data set on courses and curricula we collected had to be organised to make it suitable for analysis. Courses related to Services Science can be arranged and classified in many possible ways. For example, the classification could be based on the distinction between (i) different service activities carried out by service professionals in the service lifecycle, (ii) different theories, techniques or management strategies employed in these service activities, or (iii) different service disciplines [11] involved in the application of the theories, techniques or strategies. Since Services Science is essentially multidisciplinary, we realised that (ii) and (iii) are probably not the most suitable approaches for classification. Even at the level of individual course a discipline-based classification may not be appropriate, as multiple theories, techniques and strategies may be used to pursue teaching goals in a single course. This implies that it is hard to classify these courses according to classes identified with approaches (ii) or (iii).

Depending on the granularity of the service activities used as classification schema, this drawback is less

serious if we choose (i) as classification approach. Therefore, we classified the courses based on service activities. We derived the necessary service activities from the professional service skills identified in [4], and placed these activities in the context of a service life-cycle. Our underlying assumption is that our teaching goals should allow the students to pursue these professional skills. In order to judge whether the identified service activities are sufficient we used the service life-cycle that we reported in [11]. This life-cycle is supposed to be general enough to be applied to both social and computational services. Figure 1 shows this service life-cycle.

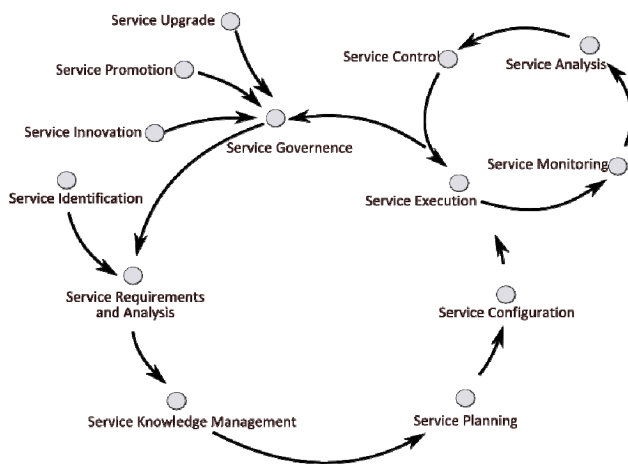


Figure 1. A generic service life-cycle

Each of the service activities shown in Figure 1 is briefly described below:

1. *Service Identification* is related to the identification of actors, resources, processes, environment, boundaries and their inter-relations, and the explanation of their characteristics, intentions, states etc.
2. *Service Requirement & Analysis* is related to the needs of the identified actors, visions and legal obligations.
3. *Service Knowledge Management* is related to the identification of information needs, handling of information sources, and management of service-related information and knowledge.
4. *Service Planning* is related to the estimation of costs, scheduling of service operations, modelling of business logic, resource allocation and management.
5. *Service Configuration* is related to the design, configuration, handling and management of systems, availability of infrastructure and access to partner systems.
6. *Service Execution* is related to the (management of) service operation and its associated aspects.

7. *Service Monitoring* is related to the monitoring, tracking and tracing of service operations and their associated artefacts.
8. *Service Analysis* is related to the analysis of service transactions, monitoring logs and other data sources for reporting and business intelligence.
9. *Service Control* is related to the adjustments and fine tuning of service operations and systems that are performed based on monitoring and analysis results.
10. *Service Governance* is related to policy, risk analysis, compliance and other strategic decisions concerning the services life-cycle.
11. *Service Promotion* is related to marketing and communication.
12. *Service Upgrade* is related to the updating or extensions of the service offerings.
13. *Service Innovation* is related to the innovative methods for designing, offering, delivering, and customizing existing services.

Each of these activities is carried out by corresponding service professionals. These professionals can have various levels of expertise and skills and perform tasks in specific sequences. For example, a service professional responsible for service planning may have skills and familiarity with technology and strategy, and the theoretical knowledge required to lay-out concrete plans for service realisation. A service operator may have only the operational skills that are necessary to perform service operations.

4. Coverage analysis

We classified 386 courses offered in 35 programmes based on the service activities described in Section 3. Appendix A summarises the results of our classification by indicating (in the columns) how many courses in each programme relate to each service activity.

4.1. Courses and programmes

The programmes from the Michigan Technological University, Ohio State University, University of Carlo Cattaneo, University of Washington and Warwick offer mainly courses related to Service Innovation, Service Identification and Service Planning. The Service System Engineering programme from the Michigan Technological University offers courses on *Service System Dynamics and Design*, *Service System Operations*, and *Analysis and Design of Web based Services*. The Certificate in Managing Services Programme offered by the Ohio State University features *Lean Service Operation*, *Strategy* and *Leadership* courses. The University Carlo Cattaneo offers a course on *Service Oriented Process Reengineering* and Warwick introduces

Service Design and Delivery. The GISE Certificate Programme offered by the University of Washington has courses on financial planning, risk analysis and business management aspects of services.

The programmes offered by the University of Trento, Karlsruhe Institute of Technology and EPFL have mainly courses related to computational services and systems. *Service-Oriented Computing, Enterprise and service-oriented architecture, SSME aspects of Cloud Computing, Business on the Internet* and *Application integration and Business Process Management* are examples of courses in which computing technologies are applied in the services context. The *Information and Services Economy* and *Web Architecture and Information Management* courses offered by the University of California at Berkeley could be grouped together with the courses mentioned above.

The Arizona State University offers a programme that focuses on service promotion issues, with courses on *Services Marketing and Management, E-commerce Marketing Strategy* and *Strategic Projects*. The *Capability Improvement for Service Organizations* programme of the Carnegie Mellon University and *Managing Change* programme of the University of Glasgow offer innovative courses in service marketing and management areas.

The Dual Masters Programme of the ‘Bahçeşehir Üniversitesi’ offers courses on *Operations Research in IT Services Management, Introduction to IT Services Management, Project Evaluation and Assessment* and *Project Management Practices*, in which project management is applied to the service activities. The NC State University features courses on *Services Management, Supply Chain Relationships and Project Management* in the Services Management and Consulting programme. The Northern Illinois University offers a Masters programme in Services Science, with courses like *Services Quality, Services Operations, Services Analysis* and *Services Consulting*, with emphasis on operations and management activities. The Masters programme on Services and Manufacturing Systems Engineering from the Rensselaer Polytechnic Institute features *Services Operations Management, Knowledge Based Operations Management, Knowledge Discovery with Data Mining* and other courses that indicate a focus on engineering techniques. The Services Management programme of ‘Tecnológico Monterrey’ features courses like *Administration of Human Talent in Companies of Services, Administration of Service Companies* and *Commercialization Strategies for Services*, indicating a focus on business administration skills.

There are a few programmes that show a balanced coverage of service activities. The Master of engineering services programme of the Geneva Business School includes courses from most of the service activities, with innovative courses like *Financial tools adapted to service companies, Marketing of the service experience,*

Operations Management Services Sustainable management of private and public services. The Master's Programme in Information and Service Management of the Helsinki School of Economics also has a balanced coverage of the service activities, with courses like *Service Operations and Strategy* and *Economics of Technological Innovation*. The Masaryk University offers a SSME Master Study, with courses like *Marketing Strategy in Service Business, Project Management and Service Lifecycle* and *Services: Systems, Modelling and Execution*. Similarly, the Masters in Services Engineering and Management programme of the ‘Universidade do Porto’, the Masters specialisation on Service Systems Engineering of the University at Buffalo, the Masters in Service Science and Management programme of the University of Exeter and the MBA Programme of the University of Pennsylvania are examples of service science curricula with balanced coverage.

Some programmes have introductory courses on Service science. For instance, the Karlstad University, the University of Alberta and the Wright State University offers *Service Science* courses. Similarly, University of Toronto has a course called *An Introduction to Service Science*, and the University of Bridgeport has a course on *Foundations of Service Management and Engineering* and the University of Sydney has offered a course on *IT Professional Services*. We have included these courses in our survey as well since they can be considered as useful building blocks when shaping a Services Science programme.

4.2. Discussion of results

We answered our research questions related to coverage, focus, patterns, trade-offs and best practices of Services Science programmes based on our detailed analysis of the available courses and curricula. Patterns could be identified when considering the coverage of service activities in the courses of different programmes. In Section 4.1 we discussed the programmes by considering their similarities in the dominance of some concerns. Evidence of this pattern can be seen in Appendix A. Some programmes that offer Masters level specialisation have been designed by reusing existing courses in management and engineering disciplines. In certain programmes, the influence of the participating schools or faculties on the nature of the courses offered was evident. For instance, the programmes offered by Business schools and Engineering schools clearly indicate the dominance of business and engineering courses, respectively. We also expect that limitations of the local resources (available courses and expertise of lecturers) make it hard for an institution to cover all the service activities in a single programme. However, the analysis also revealed some innovative courses that could be

considered as best practices. For instance, courses like 'Service Design and Delivery', 'Capability Improvement for Service Organizations', 'Service Operations and Strategy' and 'Economics of Technological Innovation' are related to various service activities and are quite valuable. Apart from the courses, the analysis also revealed unique features targeted to provide hands on experience with service activities, like, for example, 'Service Audit'.

Section 4 mentions a few other exemplary courses that are offered in various programmes on Services Science. A proposal of a new Services Science programme, therefore, should consist of similar courses on theories, techniques and practices of all relevant and applicable disciplines. We argue that in order to be effective, the programme should be carefully designed at the granularity of each teaching module level of all identified courses, also with appropriate involvement of participating departments. For instance, a course entitled 'Service Design and Delivery' should ideally include teaching activities from areas like engineering, technology, marketing, finance, business administration, psychology, philosophy, and economics. In an ideal situation, the participating lecturers should design their teaching modules to fit the overall objectives of the course. However, the implementation of a programme designed in this way would probably introduce challenges and trade-offs between the level of detail and coverage of the course material. Ideally, the programme should be defined with other courses at the same level of detail to cover all the service activities. The challenge would be to have a number of courses that can be taught within the given time constraints.

The programme should also balance teaching, research and practice. Personal professional skills can be acquired in extra-curricular activities like internships, on-site trainings, field surveys, audits, and the like. Active collaboration with government agencies, companies and peer academic institutions could make it possible to realise these activities. An ideal programme should therefore ensure that students have enough offers of extra-curricular activities to select from.

5. Our programme

Unfortunately in our Services Science Programme we could not incorporate all the best practices that we have identified from the survey, because of some practical issues. Our main constraint has been that the body of lecturers of the participating departments is limited and already committed to other programmes. This implies that these lecturers cannot be assigned to develop and deliver new courses like the ones that have been identified in our survey. Furthermore, we are not free to define the programme workload as we wish, since the education load and course periods are already determined by

university regulations. Therefore we could only implement our programme by using existing courses as building blocks and making sure that the programme complies with the rules of the programmes in which these courses were embedded. This pragmatic solution made it possible to implement the programme quite quickly, without increasing the workload of the lecturers and without requiring additional resources (equipment, rooms, etc.). A potential drawback is that the coverage of service activities as discussed in Section 4 cannot be guaranteed.

In a joint effort of the Computer Science Department and the School of Business and Management, we selected existing courses from the Computer Science (CS) and the Business Information Technology (BIT) Masters programmes that cover the service activities identified before. During brainstorming sessions we defined two tracks with mandatory and elective courses that have been chosen from the available courses of the CS and BIT programmes. This resulted in a 5-year graduate programme in Services Science, consisting of a two-year Masters phase followed by a three-year PhD phase, in the format prescribed by the Twente Graduation School, which has recently been established at the University of Twente.

We also decided to make the Masters phase of our programme comply with the requirements of the existing accredited Masters programmes and their tracks. This means that a Master student can follow our Services Science programme and obtain a Master degree from the CS programme (Information Systems Engineering or Software Engineering track) or from the BIT programme. Our Services Science programme consists of a set of compulsory courses, and two alternative tracks, namely a *Services Technologies* track and a *Services in Business* track, which are targeted to the CS and BIT students, respectively.

Figure 2 gives the structure of the Masters phase of our Services Science programme and indicates the courses we selected as mandatory for the whole Masters phase, as well as for each track.

Services Technologies Track	Services in Business Track
1. Service-Oriented Architecture with Web Services 2. Database Transactions and Processes 3. Specification of Information Systems 4. XML Technologies 5. ADSA: Model Driven Engineering	1. Business Process Integration Lab 2. Information & Knowledge Exchange Services 3. Business Development in Networks 4. Data Warehousing & Data Mining 5. Design Science Methodology
Four Compulsory Courses	
1. Architecture of Information Systems 2. Advanced Database Systems 3. E-Commerce 4. Design of Software Architecture	
Five Elective Courses	
Refer program web page for details: http://www.utwente.nl/tgs/programmes/servicescience/	
Other Obligations	
Individual specialization assignment Research orientation/Internship Master thesis	

Figure 2. Masters phase of the Services Science programme

After successfully completing the Masters phase, a student can start the three-year PhD phase. In this phase the student can choose activities from prominent summer schools, symposia and conferences related to Services Science. Students should also select one course and a multi-disciplinary case study, aiming at widening their service skills. Table 1 shows all the activities prescribed in the PhD phase of our programme. The final milestone of this phase is the completion of the PhD research as planned, and successful defence of the PhD thesis.

Table 1. PhD phase of the Services Science programme

1. Educational programme related to research
a. 4 courses chosen from the research schools IPA/SIKS/BETA PhD seminars, or similar b. 2 summer/winter schools, like IPA/SIKS/BETA summer schools, or similar c. attendance of 2 national symposia and 2 international conferences From a list of high-quality symposia and conferences, including RE, EDOC, ICSOC, ICWS, CAiSE, ICSE, BPM, ICIS
2. Educational programme aimed at widening perspective
a. Choose one course form <ul style="list-style-type: none"> – Enterprise modelling – Information & Knowledge management – Professional services management – Financial products b. Or perform a multidisciplinary case study <ul style="list-style-type: none"> – With another research institute or – With another graduate school programme
3. Educational tasks

a. Supervision of MSc and BSc projects related to research topic (2 projects) b. Teaching exercise classes and/or limited lecturing Not obligatory for students with scholarship
4. Personal development
Choose an 8-days programme from UT courses (or equivalent NWO talent classes), covering: <ul style="list-style-type: none"> a. Courses on technical writing / communication skills b. Course project/time management c. Career orientation
5. PhD research, culminating in papers, prototypes, and a PhD thesis
a. Completion of research plan (Month 1-6) b. Development of thesis (Month 7-30) c. Completion of thesis (Month 31-36)

This Services Science programme has been recently approved by the Twente Graduate School of the University of Twente, and is now in the start up phase [12].

6 Conclusions

In this paper we reported on our motivation and approach to develop an academic programme on Services Science at the University of Twente. Our programme has been developed to supply the current demand for service professionals, and is especially important in a country as the Netherlands, which has a long tradition in trading services. In this programme, professionals will be trained for working in the industry and academia in the services area.

We developed our Services Science programme in two steps, namely by (i) performing a thorough survey of existing courses and curricula in the area in order to identify patterns and best practises and (ii) considering the local resources (lecturers and available courses) to implement some of these patterns and best practises in a programme that can start right away. Our survey of existing courses and curricula is in itself a valuable body of knowledge, as it gives a clear picture of the current academic support to Services Science education. We organised the results of our survey in terms of service activities of a service life-cycle, which have been instrumental for us to identify the areas that should be covered by our programme.

Our Services Science programme has been proposed to the Twente Graduate School, which has been recently established at the University of Twente. Our programme has been approved and has just started, which indicates the commitment of the University with the Services Science area. The University of Twente is renowned for promoting entrepreneurship among the graduates, which resulted in over 700 spin-off companies. The proposed graduate programme is expected to foster this success

story, by enabling the establishment of service-related spin-offs.

During their training period, students of this programme will have the opportunity to contribute to in the research projects in which the groups participating in the Services Science programme are engaged, or they will work together with companies or other institutions either in traineeships or joint projects.

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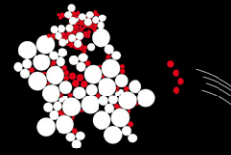
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Appendix A: Courses summary

Table 2. Surveyed programmes and their coverage

Institutions	Service Activities													
	Identification	Planning	Innovation	Requirement	KM	Configuration	Execution	Monitoring	Analysis	Control	Governance	Update	Promotion	SSME General
Michigan Tech.U.	-	3	-	1	-	1	2	-	-	-	1	-	-	-
Ohio State U.	-	1	1	-	-	-	-	-	-	2	1	-	1	-
U. Carlo Cattaneo	-	1	-	1	1	2	-	-	-	-	2	-	-	-
U. of Washington	-	11	-	3	1	-	-	1	-	-	4	-	-	-
Warwick	-	-	1	-	-	-	-	-	-	-	-	-	-	-
EPFL	-	3	-	-	2	6	-	-	-	-	2	-	1	-
Karlsruhe Inst of Tech.	1	1	1	1	2	6	2	-	-	1	-	-	-	1
San Jose State U.	-	2	1	-	-	4	2	-	-	-	-	1	-	-
Singapore Management U.	-	1	-	1	4	4	-	-	2	-	-	-	-	-
Stevens Institute of Tech	-	4	-	2	4	1	2	-	-	1	2	1	-	-
U. of California Berkeley	-	-	-	1	2	3	-	-	-	1	-	-	-	-
U. of Maryland	-	1	-	1	2	-	2	-	-	-	-	1	1	-
U. of Trento	-	-	-	-	3	3	-	-	-	-	1	-	-	1
Arizona State U.	2	-	-	-	-	-	4	1	-	-	1	-	5	-
Carnegie Mellon U.	-	1	1	-	-	-	1	-	-	-	-	1	-	-
U. of Glasgow	-	-	-	-	1	-	-	-	-	-	1	1	-	-
Bahçeşehir Üniversitesi	1	4	-	-	1	1	5	-	1	-	1	1	-	2
NC State U.	1	1	1	1	-	-	3	-	1	-	-	1	3	-
Northern Illinois U.	-	3	-	-	1	-	4	-	2	-	-	-	2	-
Rensselaer Poly. Institute	1	7	1	-	1	1	3	-	5	-	-	-	-	-
RMIT	2	-	-	-	-	1	2	1	-	-	1	-	-	5
Tecnológico Monterrey	-	1	-	-	-	-	3	-	-	-	-	-	-	1
Geneva Business School	1	3	-	-	1	-	2	-	-	-	1	1	1	-
Helsinki Sch. of Eco.	1	7	1	-	5	-	4	-	1	1	3	3	1	-
Masaryk U.	4	5	-	-	11	7	2	-	-	1	1	1	3	1
Universidade do Porto	-	3	2	1	5	2	3	-	-	-	2	1	1	-
U. at Buffalo	-	2	-	1	1	1	-	-	1	1	-	-	2	-
U. of Exeter	2	3	-	-	1	-	1	-	-	-	1	1	1	2
U. of Pennsylvania	1	7	1	1	6	2	8	-	1	-	2	-	2	-
University of Toronto	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Bridgeport	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Sydney	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Karlstad University	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Alberta	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Wright State	-	-	-	-	-	-	-	-	-	-	-	-	-	1

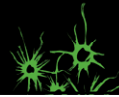
UNIVERSITY OF TWENTE.



DEVELOPING A SERVICES SCIENCE GRADUATION PROGRAMME AT THE UNIVERSITY OF TWENTE

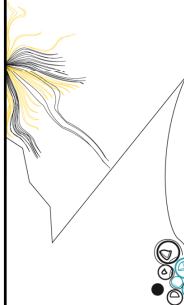
MARTEN VAN SINDEREN

VIKRAM SORATHIA, LUÍS FERREIRA PIRES AND FONS WIJNHOVEN



Outline

- Need for services science education programme
- Survey: Classification and coverage analysis of existing curricula
- Our proposal
- Outlook and conclusion



Shifting Trends

- Services sector is fastest growing industrial sector
 - major source of employment (*for the working population*)
 - major source of revenue (*for corporates and governments*)

- Contributions from research developments in different disciplines
 - computer science: information systems, software engineering, databases, knowledge engineering
 - business administration: business modeling, change management, marketing, financial engineering

Needs and relevance

- Need for research and education programme that bridges between these disciplines
 - *transfer of knowledge from one to another discipline*
 - *creation of new (interdisciplinary) knowledge*
 - *establishment of unified theory*

- Social relevance of education in this area
 - *trained service professionals for the services industry*
 - *knowledge sharing and knowledge transfer*

Some Responses to Shifting Trends

- Research and Academia:
 - *UvA: Amsterdam Academic Centre for Service Innovation - AMSI*
 - *VU: Service Science and Innovation – SSI*
 - *U. Tilburg: European Research Institute in Service Science - ERISS*
 - *U. Singapore, IBM: Service Science, Management and Engineering - SSME*
- Policy
 - *Netherlands Services Innovation Roadmap*
 - *Germany - Funded Innovation with Service*
 - *EU - Networked European Software and Services Initiative - NESSI*
 - *US – America COMPETES Act*

Our Response

University of Twente should meet demand by offering own program

1. *Systematic survey of existing services science curricula:*

- *Data collection and processing*
- *Classification and coverage analysis*

2. *Develop new curriculum based on*

- *Outcome of analysis*
- *Resource availability*
- *Existing academic requirements*

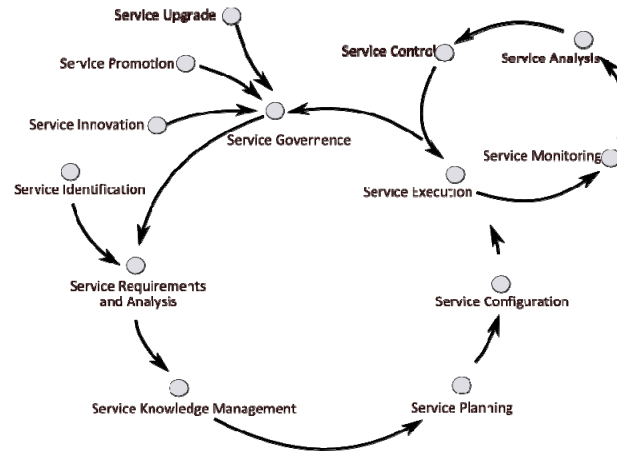
Data Collection

- Programme Selection Criteria
 - *Programmes listed in SSME Portals*
 - *Programmes reported in research papers, books*
 - *Certificate, undergraduate and graduate level programs*
- Courses Selection Criteria
 - *Courses taught*
 - *Excluding research, project or any other specific requirements*
- Outcome **[Not claiming completeness]**
 - *35 Programmes*
 - *386 Courses*

Classification Strategy

- Possible strategies to classify courses
 - *Based on various service activities to be carried out by service professionals*
 - *Based on theories/techniques/strategies employed*
 - *Based on academic disciplines*
- We selected “Service Activity” based classification
- Service activities can be positioned in a service life cycle

A generic service life-cycle



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Surveyed programmes and their coverage

Service Activities \ Institutions	Identification	Planning	Innovation	Requirement	RM	Configuration	Execution	Monitoring	Analysis	Control	Governance	Update	Promotion	SSME General
Michigan Tech.U.	-	3	-	1	-	1	2	-	-	-	1	-	-	-
Ohio State U.	-	1	1	-	-	-	-	-	-	2	1	-	1	-
U. Carlo Cattaneo	-	1	-	1	1	2	-	-	-	-	2	-	-	-
U. of Washington	-	11	-	3	1	-	-	1	-	-	4	-	-	-
Warwick	-	-	1	-	-	-	-	-	-	-	-	-	-	-
EPFL	-	3	-	-	2	6	-	-	-	-	2	-	1	-
Karlsruhe Inst of Tech.	1	1	1	1	2	6	2	-	-	1	-	-	-	1
San Jose State U.	-	2	1	-	-	4	2	-	-	-	-	1	-	-
Singapore Management U.	-	1	-	1	4	4	-	-	2	-	-	-	-	-
Stevens Institute of Tech	-	4	-	2	4	1	2	-	-	1	2	1	-	-
U. of California Berkeley	-	-	-	1	2	3	-	-	-	1	-	-	-	-
U. of Maryland	-	1	-	1	2	-	2	-	-	-	-	1	1	-
U. of Trento	-	-	-	-	3	3	-	-	-	-	1	-	-	1
Arizona State U.	2	-	-	-	-	-	4	1	-	-	1	-	5	-
Carnegie Mellon U.	-	1	1	-	-	-	1	-	-	-	-	1	-	-
U. of Glasgow	-	-	-	-	1	-	-	-	-	-	1	1	-	-
Bahçeşehir Üniversitesi	1	4	-	-	1	1	5	-	1	-	1	1	-	2
NC State U.	1	1	1	1	-	-	3	-	1	-	-	1	3	-
Northern Illinois U.	-	3	-	-	1	-	4	-	2	-	-	-	2	-
Rensselaer Poly. Institute	1	7	1	-	1	1	3	-	5	-	-	-	-	-
RMIT	2	-	-	-	-	1	2	1	-	-	1	-	-	5
Tecnológico Monterrey	-	1	-	-	-	-	3	-	-	-	-	-	-	1
Geneva Business School	1	3	-	-	1	-	2	-	-	-	1	1	1	-
Helsinki Sch. of Eco.	1	7	1	-	5	-	4	-	1	1	3	3	1	-
Masaryk U.	4	5	-	-	11	7	2	-	-	1	1	1	3	1
Universidade do Porto	-	3	2	1	5	2	3	-	-	-	2	1	1	-
U. at Buffalo	-	2	-	1	1	1	-	-	1	1	-	-	2	-
U. of Exeter	2	3	-	-	1	-	1	-	-	-	-	1	1	2
U. of Pennsylvania	1	7	1	1	6	2	8	-	1	-	2	-	2	-
University of Toronto	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Bridgeport	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Sydney	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Karlstad University	-	-	-	-	-	-	-	-	-	-	-	-	-	1
University of Alberta	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Wright State	-	-	-	-	-	-	-	-	-	-	-	-	-	1

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Services Science Courses

- Some noteworthy courses
 - *Service System Dynamics and Design*
 - *Analysis and Design of Web based Services*
 - *Service Oriented Process Reengineering*
 - *Service Design and Delivery*
 - *Information and Services Economy*
 - *Capability Improvement for Service Organizations*
 - *Services Quality*
 - *Services Consulting*
 - *Commercialization Strategies for Services,*
 - *Project Management and Service Lifecycle*

Our Proposal (1)

Constraints

- Limited Staff
- Education System

Opportunities

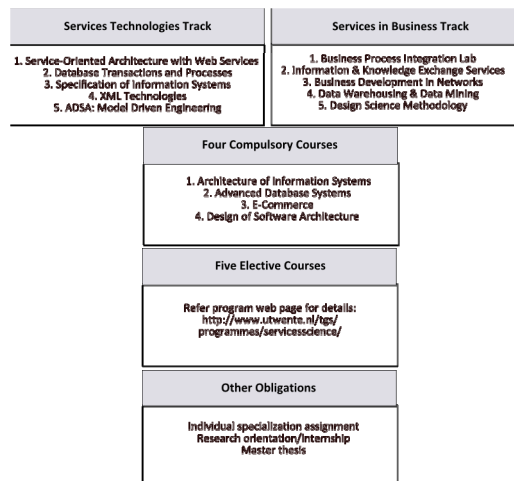
- Existing Programs
 - Computer Science (CS) with Information Systems and Software Engineering track
 - Business Information Technology (BIT)
- Research Orientation

Our Proposal (2)

- Use elective space in existing programs to define a services science 'profile'
 - comply with CS & BIT requirements → obtain master degree
 - service science foundation/specialization → master permits access to service science PhD
 - Benefits: no increase in workload, no additional resources, quick implementation
 - Potential drawback: limited coverage → gradual improvement by future program modifications
- 'T-shaped' profile: general knowledge of multi-disciplinary aspects, deep knowledge in chosen (sub-)disciplines

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Masters phase of the Services Science programme



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PhD phase of the Services Science programme

1. Educational programme related to research

- a. 4 courses chosen from the research schools IPA/SIKS/BETA PhD seminars, or similar
 - b. 2 summer/winter schools, like IPA/SIKS/BETA summer schools, or similar
 - c. attendance of 2 national symposia and 2 international conferences
- From a list of high-quality symposia and conferences, including RE, EDOC, ICDOC, ICWS, CAISE, ICSE, BPM, ICIS

2. Educational program aimed at widening perspective

- a. Choose one course form
 - Enterprise modelling
 - Information & Knowledge management
 - Professional services management
 - Financial products
- b. Or perform a multidisciplinary case study
 - With another research institute or
 - With another graduate school programme

PhD phase of the Services Science programme

3. Educational tasks

- a. Supervision of MSc and BSc projects related to research topic (2 projects)
 - b. Teaching exercise classes and/or limited lecturing
- Not obligatory for students with scholarship

4. Personal development

Choose an 8-days program from UT courses (or equivalent NWO talent classes), covering:

- a. Courses on technical writing / communication skills
- b. Course project/time management
- c. Career orientation

5. PhD research, culminating in papers, prototypes, and a PhD thesis

- a. Completion of research plan (Month 1-6)
- b. Development of thesis (Month 7-30)
- c. Completion of thesis (Month 31-36)

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SERVICES SCIENCE

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Programme

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Outlook

Our plans

- To achieve complete coverage of service life-cycle with identification of new courses
- To initiate research projects in Services Science
- To establish strong network with industry and government
- To initiate regular events attracting international community
- To support new service-based spinoffs from graduate

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Conclusions

- As a response to shifting trends towards service-led economy, we recognized the need to transform existing curriculum
- We carried out systematic review to analyze similar response from academia to discover best practices
- We proposed our plan to introduce new curriculum that can co-exist with existing curricula
- We identified steps for gradually incorporating new courses and supporting activities
- The proposal has recently been approved and can start per September 2010!