

A FRAMEWORK FOR DEVELOPING AN INTERNATIONALISED MANAGEMENT INFORMATION SYSTEMS (MIS) CURRICULUM AT THE BACHELOR'S DEGREE LEVEL

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Abstract: A curriculum is the foundation of the teaching-learning process. It involves developing programmes of study, teaching strategies, resources allocations, specific lesson plans and assessment of students, and faculty development. Management information systems (MIS) are one of rather few interdisciplinary fields of study that integrate knowledge of information technologies with business skills, educating students for professional practice within the fields of information technologies by providing strong conceptual foundations and addressing the deficiency of human resources in the area of information management.

In this study, MIS programmes at the bachelor's degree level, offered by universities in Germany and Turkey, were analysed in terms of general education requirements, degree requirements, and curricula. Based on this analysis and after evaluating reference models for curriculum development, a framework for developing an MIS curriculum with options for internationalisation was drafted. This framework for MIS curriculum development is a modular one, focusing on MIS specialisations, core modules, core courses and optional elective courses. It focuses on the categories programme, courses (main, elective), and majors, recommending (1) to expand courses and curricula offerings, (2) to embed international elements in existing courses and (3) options to establish international connections with reciprocity.

Keywords: MIS, curriculum, internationalisation, management information systems, framework.

INTRODUCTION

The MIS discipline significantly contributes to several domains, such as management, economics, government and business. Information systems, in general, and management systems, in particular, are complex systems requiring both organisational as well as technical expertise for design, development, implementation, management, and termination. These systems affect whole organisational structures as well as the operations of an organisation. The nature of this rapidly changing field requires a unique set of resources (faculty, infrastructure, physical space, knowledge). The field of management information systems is a rapid and changing one; Changing circumstances in society, businesses, infrastructure and technology have an impact on the requirements employers have for graduates in MIS. Therefore, these mentioned changes should also be reflected in higher education curricula development. Universities have mechanisms to maintain curricula in a frequent manner. The questions to be answered are how are 'requirements' for change generated, collected from which sources and when/how are they implemented? Quite often, higher education MIS curricula (as well as those in other fields) are updated according to the requirements of solely local businesses and governments and programme input derived from representatives of local organisations who are potentially those institutions/people who hire MIS graduates. Generally, local employers should not be the sole objective for majors in MIS. MIS graduates qualify for jobs around the world, in widely dispersed geographic

areas. Therefore, the curriculum development approach universities are focusing on should consider local, regional, national and international employment needs and solid knowledge of the MIS field.

LITERATURE REVIEW

An information system is an integrated set of components for collecting, storing, and processing data and for delivering information, knowledge, and digital products. Organisations heavily rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace. Governments deploy information systems to provide services cost-effectively to citizens (AISSAC 2015).

Management Information Systems (MIS) are systems that provide decision makers with the information needed to manage a business effectively and efficiently. They support a broad array of business operations and enable an interaction between an organisation and its stakeholders. MIS systems support both, automated and human decision making. Basically, the following business strategies that drive the development and deployment of management information systems are cost-reduction, revenue growth and quality improvement. MIS systems support decision makers from all managerial levels (strategic, tactical, operational).

A management information systems programme combines a strong business curriculum with the experience and technical skills needed to compete in today's information-based society. MIS programmes are designed to teach students how to utilise software and information technology in business organisation (Lee et al. 1995; Harder and Harper, 2003).

The management information systems field is growing at an exponential rate as organisations struggle to stay current with new and emerging technologies, such as mobile applications and social media. Professionals are needed that can help organisations understand the business potential of these new technologies, how to develop new applications to meet changing market dynamics, and how to secure these systems from threats.

MIS degree programmes prepare students to enter the information systems (IS) and technology profession in a wide variety of positions. While the curriculum emphasises both the managerial and technical aspects of IS and technology, their overall structure is designed to prepare students for a career leading to managerial- and/or executive-level positions related to IS and technology. Students learn to design, implement, and operate information systems with the purpose of providing organisational decision-makers with the information needed to manage effectively and efficiently. In addition, students learn to obtain new business insights by using various business analytics and data management tools (Davis et al. 2002, Gill and Hu 1999).

Students who graduate with a Bachelor of Science in Management Information Systems will understand the development of business information systems and their use in the workplace. MIS is also known in the business field as information technology or information systems. A Bachelor of Science degree in management information systems combines courses from math, computer science and business fields (e.g. information management, statistics, DB systems, systems analysis, computer applications). MIS degree programmes teach students business, technical and interpersonal skills, which provide students with a wide range of transferable skills and more flexibility in their career options (AISSAC 2015).

Students graduating from an MIS programme generally are prepared to enter the workforce ready to tackle complex problems that combine the use of IT to improve business operations, focusing on decision making and quality improvement. These graduates can be seen as a bridge between management, informatics, economics and mathematics, talking the language of those people working in these fields. MIS is where business meets technology and innovation. MIS graduates have a broad knowledge on informatics related topics, have solid knowledge of mathematics and statistics and a good education in management (AISSAC 2015).

A literature review on curriculum development is integrated in the 'study' section.

THE STUDY

Aim of the study

This study reflects the first level of a European wide analysis on MIS (Management Information Systems) curricula, with the target to develop an MIS curriculum framework on a bachelor's degree level, which might be applied by higher education institutions in Europe to develop country and institution specific MIS programmes and curricula. In level two of the analysis, which is out of the scope for this contribution, the number of countries analysed should be increased by 8 and a solid European framework for MIS curricula developed.

Research methodology

In this study, MIS programmes in Turkey and Germany were analysed and compared in order to create a drafted framework for curriculum development. The two countries, Turkey and Germany, were used as a starting point, since both authors are currently teaching for MIS programmes in Turkey, and one author is native German and taught many years in German programmes.

The URAP (University Ranking by Academic Performance) ranking was used to choose universities in both countries, which are offering MIS programmes. In this ranking, the following criteria are applied for universities: (1) number of journal articles, (2) number of journal articles/faculty member, (3) number of cites, (4) number of cites/faculty member, (5) number of scientific documents, (6) number of scientific documents/faculty member, (7) number of PhD students, (8) number of PhD students/total number of students, (9) total number of students/total number of faculty members.

The following Turkish universities were included in this study: (1) BOĞAZIÇI University (rank 12 in total university ranking) with the MIS programme offered by the Applied Sciences Faculty, (2) SAKARYA University (rank 34 in total university ranking) with the MIS programme offered by Management Faculty; and (3) KADIR HAS University (rank 75 in total university ranking) with the MIS programme offered by the Faculty of Engineering and Natural Sciences. Table 1 gives an overview on their general ranking.

Table 1: Ranking of Turkish Universities (general ranking)

Rank / total	University	MIS programme?	Faculty	TP (journal articles)	TP (cites)	TP (PhD students)	TP (Faculty Member/Students)	TP Ranking (2015-2016)
...		-						
12	BOĞAZIÇI University	X	Applied Sciences	143.74	129.92	144.89	57.11	625.17
...		-						
34	SAKARYA University	X	Management	122.24	109.85	130.30	42.25	512.16
...		-						
75	KADIR HAS University	X	Engineering and Natural Sciences	77.74	67.82	97.93	46.80	376.69

TP = total points

Applying the URAP ranking, the following German universities were included in this study: Heidelberg University, University of Cologne and University of Leipzig. Table 2 gives an overview on the German ranking.

Table 2: Ranking of German Universities (general ranking)

Rank / Germany	University	MIS programme?	Faculty/Department	Rank /world	Category	TP (journal articles)	TP (cites)	Information /Computer Science Ranking (world)	Information /Computer Science Programmes Total Score (world)	TP Ranking (2015-2016)
1	Heidelberg University	X	Computer Science	47	A++	88.84	94.62	166	56.58	423.54
20	University of Cologne	X	Faculty of Economics and Social Sciences	202	A+	75.12	74.24	446	52.47	350.36
26	Leipzig University	X	Administration Faculty	273	A	72.54	70.94	287	53.83	336.59

TP = total points

To be able to conduct this study, the different terms related to Management Information Systems (MIS) were analysed. In Turkey, MIS programmes are named (1) Management Information Systems, and (2) Business Informatics. In Germany the following terms are associated with programmes offering MIS relevant content: (1) Management Information Systems, (2) Business Information Systems, (3) Information Management, (4) Computer Science and (5) Business Informatics (German: Wirtschaftsinformatik). Basics on the universities included in this study are given in table 4.

Table 3: Universities included in the study (6)

Country	University	MIS programme	Faculty	Programme	Student quota (TR)	Degree	Duration (semester)	Practical training	Thesis	ECTS
TR	BOĞAZIÇI University	X	Applied Sciences	MIS	62	Bachelor of Science	8	X	X	240
TR	SAKARYA University	X	Management	MIS	41		8	X	X	240
TR	KADIR HAS University	X	Engineering and Natural Sciences	MIS	45		8	X	X	240
DE	HEIDELBERG University	X	Computer Science	Applied Computer Science			6	X	X	180
DE	University of COLOGNE	X	Faculty of Economics and Social Sciences	Information Systems			6	--	X	180
DE	LEIPZIG University	X	Administration Faculty	Business Information Systems			6	X	X	180

Table 4: A comparison on selected criteria

CRITERIA	BOĞAZIÇI	SAKARYA	KADIR HAS	HEIDELBERG	COLOGNE	LEIPZIG
Founded in	1863	1992	1997	1386	1388	1409
MIS programme	1995	2011	2008			
Student quota	62	41	45			
Study duration (years)	4	4	4	3	3	3
Practical training	x	x	x	x	x	x
Practical reports	x	x	x	x	x	x
Thesis	x	x	x	x	x	x
Colloquium	x	x	x	x	x	x
ECTS	240	240	240	180	180	180
Degree	Bachelor of Science	Bachelor of Science	Bachelor of Science	Bachelor of Science	Bachelor of Science	Bachelor of Science
English courses	---	X (1)	X (4)	---	---	---
compulsory	courses	courses	courses	modules	modules	modules
Electives	COURSES Unrestricted: 2 Department: 4	COURSES elective courses to be taken from a whole university pool (9)	COURSES Technical (4) Social (2) Business/M an. (2)	SUBJECTS 2 elective subjects	SUBJECTS 2 elective subjects	SUBJECTS 2 elective subjects
# of IT courses (basic studies) /	19	26	20	23	19	18
# of B/M courses (basic studies)	13	10	9	5	6	6
# of electives (specialised)	18	9	9	6	6	6

COURSE STRUCTURE	
BOĞAZIÇI	<p><i>Compulsory courses:</i> Introduction to Information systems and technology, Programming and Algorithms, object oriented programming, introduction to database, web based application development, computer hardware and software systems, system analysis and design, data mining, database systems, object oriented modelling, business application development, quantitative methods of decision making, enterprise information systems, IS project management, CRM, Decision support systems, seminar, eBusiness management, supply chain management</p> <p><i>Minor compulsory courses:</i> economics I and II, Management and organisation, business mathematics I and II, principles of marketing, financial accounting, statistics I and II, managerial accounting, research methodology, managerial communication, cyber law, finance</p> <p><i>Departmental elective courses:</i> strategic management, Business Applications of AI, Advanced business programming, Evaluation of Software and hardware, electronic business, data mining, simulation modelling and analysis, applied research in MIS, knowledge management, systems dynamic modelling, distributed application development, web applications development, IS project management, internet programming, entrepreneurship in IT, leadership and motivation, financial management, financial information systems,</p>
SAKARYA	<p><i>Compulsory courses:</i> Introduction to information systems, Algorithms and data structures, introduction to programming, operations research, management information systems, Entrepreneurship, process analysis, systems analysis and design, programming languages, visual programming, logistics and supply chain management, Introduction to databases and DB management, Computer hardware and operating systems, system simulation, ERP systems, Human computer interaction, game theory, disaster management, HR information systems, UML modelling, quantitative data analysis, management of IT projects, Queuing theory, network management and security, web design and internet programming, data mining and BI, seminar in MIS, artificial intelligence, Geographic information systems, macro programming in organisations</p> <p><i>Minor compulsory courses:</i> introduction to law, economics, introduction to business, mathematics, management and organisation, verbal and written communication skills, financial accounting, business mathematics, research methods, behavioural sciences, marketing management, statistics and business applications, Human resource management, production management, IT law and ethics, financial management, cost accounting, entrepreneurship, project management</p> <p><i>Elective courses:</i> managerial accounting, management of IT projects, Queuing theory, network management and security, web design and internet programming, data mining and BI, seminar, artificial intelligence, geographic information systems</p>
KADIR HAS	<p><i>Compulsory courses:</i> Introduction to computing, Internet and Web programming, problem solving and Algorithms, Decision Support Systems, Foundations of IS, Visualisation and IT Architecture, Operating systems, DB Systems, Server Side programming, IT Auditing, Data Mining and BI, Computer Networks and Security, Enterprise Information Systems, E-Commerce Systems, Information & Technology Management, IT Innovation and Entrepreneurship, cloud computing, social media and web analytics, information systems analysis and design, IT project management</p> <p><i>Minor compulsory courses:</i> Economics I and II, Mathematics I and II, Management and Organisation, Principles of Marketing, Principles of Accounting, Interpersonal communication Skills, Basic Finance</p> <p><i>Elective courses:</i> Computational Methods and Tools, Telecommunication Systems, Business Data Communication, Business Process Management, Competitive Intelligence, Strategic Management, Disaster Recovery, Entrepreneurial Marketing, Business Continuity</p>

HEIDELBERG	<p><i>Compulsory modules (informatics):</i> practical informatics, programming, technical informatics, Algorithms and data structures, operating systems and networks, software engineering, theoretic informatics, databases,</p> <p><i>Compulsory modules (mathematics):</i> mathematics I and II, linear algebra, analysis, numeric</p> <p><i>Elective specialisations:</i> computer graphics and visualisation, information systems engineering, optimization, technical informatics, scientific calculation</p> <p><i>Elective modules:</i> informatics (python, informatics and society), mathematics (analysis II, mathematical logics, statistics and probability), technical informatics</p>
COLOGNE	<p><i>Compulsory modules (basic level):</i> informatics, advanced informatics I and II, business informatics (basics), advanced business informatics I and II, Business management, mathematics, statistics.</p> <p><i>Electives modules:</i> management (corporate development, finance, marketing, supply chain management), informatics (applied informatics, technical informatics, mathematics I, II and III), business informatics (business informatics I and II)</p>
LEIPZIG	<p><i>Compulsory modules:</i> Business Informatics I and II, DB systems I and II, structured programming, distributed applications, object oriented programming, web techniques I and II, software techniques, Web science, Introduction to Business management, Accounting I and II, Economics</p> <p><i>Optional modules:</i> mathematics for engineers, statistics and probability, law for business managers</p> <p><i>2 elective subjects:</i> course for 10 ECTS each to be taken</p>

FRAMEWORK FOR MIS CURRICULUM DEVELOPMENT

Challenges in designing a framework for an international MIS curriculum are, among other things, the study duration, which might be different in countries who are willing to apply the framework (in Turkey students are studying 8 semester, whereas in Germany they need 6 semester to get a bachelor's degree), the corresponding values for ECTS, and mainly the different possible options for curriculum structure (e.g. elective courses, elective modules, specialisations). To be able to develop a flexible applicable framework for MIS curriculum development in a first step available course development frameworks (computer science, IT, management information systems) were analysed.

Literature review on curriculum development

The ACM, the Association for Information Technology Professional (formerly the Data Processing Management Association (DPMA) and the Association for Information Systems (AIS) have taken the task of developing curricula for information systems for the past sixty years. All of the IS curriculum models have as a common goal to provide advice for university faculty that will guide the preparation of graduates (ACM 1983; Couger et al. 1995, Feinstein et al. 1999, Pierson et al. 2008, Downey et al. 2008).

Generally, forces having an influence on curriculum development are faculty, community, university, students, technology, competitors and organisational constraints (Sandman 1993). Print (1993) defined the following phases for the development of a curriculum: (1) organisation, (2) development and (3) application, focusing on the components (a) analysis, (b) instructional evaluation, (c) learning activities content, (d) aims and goals and (e) objectives (Kung et al. 2006, Apigian and Gambill 2010).

In 2000, Davey and Tatnell developed a Rapid Application Development (RAD) approach to develop MIS curricula in rapidly changing environments, such as information systems, management information systems, or business informatics. They focused on determining the organisational policy (organisational requirements and influence factors from university); determining the nature of the industry (those institutions who have a need for students graduating from the programme); determining physical constraints; determining aim and goals of each single course; formulating teaching and learning principles; determining course content.

Longenecker, Feinstein and Clark (2012) compared 11 available model curricula and broke skills into categories based on their historical placement in various curriculum development models.

Table 5: model curricula (Longenecker, Feinstein and Clark)

category	Skills			
A	21 skills relatively common to all models			
B	14 skills relatively common to later models			
C	53 skills relatively common to later models yet were dropped by IS 2010			
D	11 skills relatively common to all models except dropped by IS 2010			
E	24 skills relatively common to earlier models but dropped in all later models			
F	2 Skills added uniquely in IS 2010			
G	13 Skills based on NICE (2012) specifications but not in any curriculum model			
GROUPED SKILLS				
Group	Skills	grouping	Calculation	#
1	Skills Current Through 2010	C+D+F	53+11+2	66
2	Active Skills	A+B + group 1	21+14 + 66	101
3	New Skills not in any model	G	13	13
4	Retired skills	E	24	24
	TOTAL NUMBER OF SKILLS	Group 2+3+4	101+13+24	138

The Association on Computing Machinery (ACM) and the Association for Information Systems (AIS) developed the IS2000 Curriculum Guidelines for Undergraduate Degree Programmes in Information Systems. Topi et al. (2010) define the following high level IS/MIS capabilities, that a curriculum specifies as the highest level outcome expectations: (a) Improving organisational processes, (b) exploiting opportunities created by technology innovations, (c) understanding and addressing information requirements, (d) designing and managing enterprise architecture, (e) identifying and evaluating solution and sourcing alternatives, (f) securing data and infrastructure, (g) understanding, managing and controlling IT risks. They translated these high level capabilities in three categories of knowledge and skills, which are (1) information systems specific knowledge and skills, (2) Foundational knowledge and skills, and (3) domain fundamentals. Table 6 summarises these knowledge and skills categories.

Table 6: knowledge and skills categories (Topi et al. 2010)

C1 Specific knowledge and skills	
1.1	Identifying and designing opportunities for IT-enabled organisational improvement
1.2	Analysing trade-offs
1.3	Designing and implementing information systems solutions
1.4	Managing ongoing information technology operations
C2 Foundational knowledge and skills	
2.1	Leadership and collaboration
2.2	Communication
2.3	Negotiation
2.4	Analytical and critical thinking, including creativity and ethical analysis
2.5	Mathematical foundations
C3 Domain fundamentals	
3.1	General models of a domain
3.2	Key specialisations within a domain and
3.3	Evaluation of performance within a domain.

The IS2010 curriculum model includes seven core courses: (1) Foundations of Information Systems, (2) Data and Information Management, (3) Enterprise Architecture, (4) IS Project Management, (5) IT Infrastructure, (6) System Analysis and Design, (7) IS Strategy, Management, and Acquisition; and mentions additionally some samples for possible elective courses.

Requirements for the curriculum development framework designed in this study

Derived from the general curriculum models analysed and the analysis of MIS programmes in Germany and Turkey conducted in this study, below general requirements on curriculum development are summarized.

- The framework should be a guide including recommendations for the MIS community (national, international)
- the framework should consider employment requirements (local(if needed), national, international)
- the framework should be used by faculty to design MIS programmes
- the framework should offer predefined course objectives, faculty could choose from and options for faculty to define own course objectives as well.
- Following the BOLOGNA process, the framework should include a MATRIX for matching course and programme learning outcomes
- the framework should have a modular structure
- the framework should define core courses which should be added to all MIS programmes (international oriented)
- the other course should have a modular structure, with elective modules to be chosen by faculty

Furthermore, general characteristics of MIS professionals were defined, to derive concrete course categories:

- MIS professionals can be employed in all types of industries, at different organisational levels and in different positions based on their specialisation focused on during their studies and their business life.
- MIS professionals are flexible, business/industry independent problem solver.
- MIS professionals are familiar with the analysis, design, development, implementation, maintenance and optimization of (management) information systems.
- MIS professionals have strong communication skills and a team player thinking approach

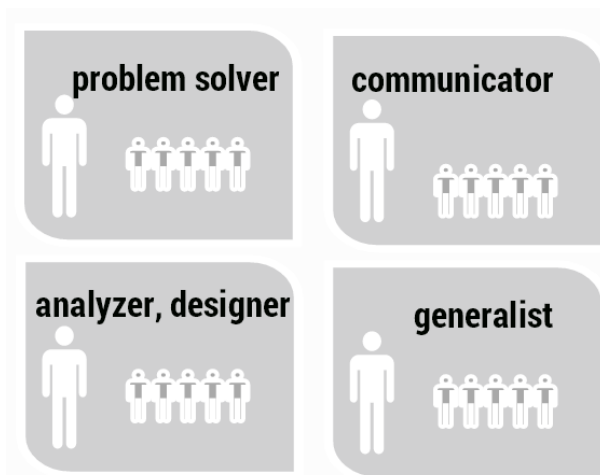


Figure 1: Characteristics of MIS professionals

MIS curriculum development framework

The MIS curriculum development framework is designed as an interactive one. The faculty might choose the one which fits the programme and university needs the best from different options.

In a first step, the faculty selects the duration (in semester) of the planned MIS programme. For each structure (6 semester, 8 semester, etc.) templates for MIS curriculum development are pre-defined. The faculty can choose from the corresponding templates.

After choosing duration, the planned specialisation (main focus) has to be selected. Available options are: (1) Management information systems, (2) Business, (3) Informatics, (4) Mathematics. Based on the selection from several pre-defined templates for MIS curriculum one might be chosen.

For all templates core courses are defined (e.g. Foundations of Information Systems, System Analysis and Design, Information Management, Knowledge Management, Enterprise Architecture; all of them for the MIS specialisation). This list might be customized by faculty.

To the core courses defined, corresponding modules are pre-defined. The modules cover the following areas:

- Strategic Management and Organisational Transformation
- Information and Knowledge Management
- Business Mathematics and Statistics
- Technical Informatics
- Business Informatics/Management Information Systems
- Programming
- Application development
- System Design and Analysis/Modelling
- Data Mining and Business Intelligence

According to the total number of ECTS which the faculty defines for the courses (mainly given by national regulations), different modules are available and selectable. Generally, for each course ECTS are predefined, but might be customised by the faculty. Each module contains several courses. Basically, courses defined might be matched with up to two different modules. There is a restriction that each course can be integrated in one curriculum once. In case the faculty chooses e.g. two modules, in both of them the same course is integrated, and there should be an error message, wherein the faculty has to deselect one of the duplicate courses by choosing a substitute course manually. The number of courses included in a module depends on the template curriculum chosen by faculty. On a whole, the framework can easily and flexibly be adopted for the faculty's needs.

For each programme, depending on the selected specialisation, pre-defined programme outcomes are available (list might be easily customised by the faculty). For each course integrated in one or more curriculum templates, besides the title and ECTS, learning outcomes (at least 3) are pre-defined (customisable).

Additionally, according to the requirements of Bologna, a programme/course matching matrix is defined, showing for any course as to which of the programme outcomes might be addressed (Contribution Level: 1 low, 2 medium, 3 high).

One section in the framework is available for national triggered courses. If needed, this section can be used for specific national courses, e.g. Atatürk's principles in Turkey, or any language besides English.

Another section is reserved for the English language. If necessary, up to four English courses might be included in the curriculum.

Sections which are not used (e.g. national related ones, or language sections) might be filled with elective courses.

For elective courses, the following structures are available and can be selected by the faculty: (1) technical electives, (2) business/management electives, (3) social electives.

The faculty might choose one, two or all three categories of elective courses.

The faculty can choose the number of courses for each section. The framework will show how many of the total ECTS are still available for matching.

The faculty can assign courses to each elective section or use pre-defined lists. Each course might be added to each section but only once in one curriculum.

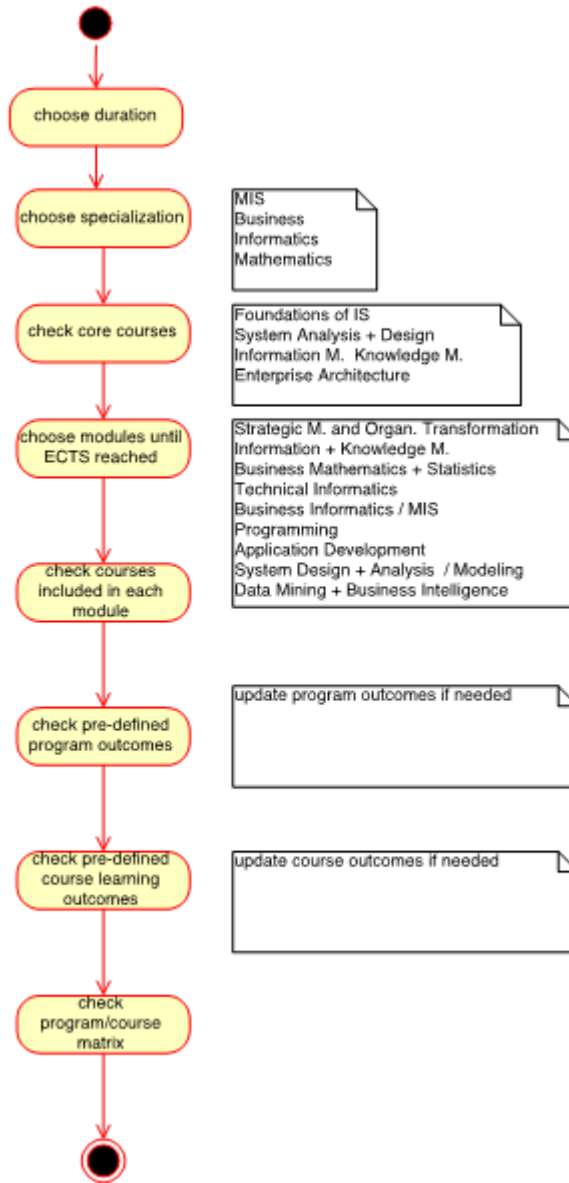


Figure 2: Approach model

Table 7: course- programme outcome matching matrix (sample)

Each course included in the curriculum has to be matched with the programme outcomes.

Code	Course	PC	PO2	PO3	PON
MIS101	Management + Organ.	1			1
MIS342	Data Mining	2	2	3	
MIS543	Technology Management			3	

Contribution Level: 1 low, 2 medium, 3 high

Further studies

In this study, a static framework for MIS curriculum development, based on the analysis of reference models on curriculum development, and the analysis of MIS programmes offered in two countries, Germany and Turkey, was introduced. In a next step, further countries should be included in the analysis: the United Kingdom, Denmark, Italy, and Austria. The findings of this extended analysis should be integrated in an updated version of the framework in which the drafted modules of version 1 should be integrated. The framework should be interactive and easily adoptable for the faculty's needs

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