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Research Article

INVESTIGATION THE ACCREDITATION PROCESS AND DEVELOPMENT AN OBJECT-ORIENTED DATABASE: CASE STUDY FOR DEPARTMENT OF GEOMATICS ENGINEERING

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ABSTRACT

Quality and accreditation are of great importance for organizations that offer services in different areas, in order to demonstrate their differences through an independent evaluation mechanism. This independent evaluation process is self-evident in almost every field. This situation has always tried to lead to better in the cycle of continuous improvement by evaluating the institutions and organizations under specific criteria. No doubt that the field of education cannot be considered separately from this process. This study focused on the preparation of the accreditation applications for undergraduate programs of Geomatics Engineering at Karadeniz Technical University (KTU). Thus, a sample accreditation application experience will be discussed and shared by taking the preparatory work for the accreditation application. With this study, these departments, which were accredited in the field of engineering, can also guide the other programs that want to be included in this process. One of the most critical results from study accreditation process which is independent of individuals, geomatics engineering students, who are in a prominent place in engineering education, can remain ahead of the game against both national and international competitors. It will be beneficial for the non-accredited 17 geomatics engineering departments to take their undergraduate programs in the accreditation process.
Keywords: Accreditation, bachelor programme, quality assurance, geomatics engineering.

1. INTRODUCTION

It is known that "the International Engineering Alliance (IEA) is a global not-for-profit organization, which comprises members from 36 jurisdictions within 27 countries, across seven international agreements. These international agreements govern the recognition of engineering educational qualifications and professional competence. Through the Educational Accords and Competence Agreements members of the International Engineering Alliance establish and enforce internationally benchmarked standards for engineering education and expected competence for engineering practice. The oldest constituent of the IEA, the Washington Accord dating from 1989, is concerned with mutual recognition among its signatories of accredited educational programmes designed to provide the educational foundations for professional engineers. Similarly, the Sydney Accord (2001) and Dublin Accord (2002) are concerned with

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programmes providing the education foundation for engineering technologists and engineering technicians respectively (URL-1, 2017)". According to [1]; since the second half of the twentieth century, "quality in higher education" has begun to be discussed in many countries following the requirements of the new world order. Power (1999) states that since 1980 the supervision community has begun to develop. OECD countries went to establish this control at different levels in 1980, and this movement was called "New Public Administration" [2]. The main components of this reform are a financial support system based on self-regulation, autonomy and product evaluation. As a result of increased self-regulation and autonomy, governments have decided to go to the evaluation and accreditation of universities and faculties. Quality assurance is the continuous assessment of a higher education institution or program according to pre-determined criteria [3] and is mainly conducted in order to provide qualified training of the institution or program. One of the methods used to ensure quality assurance is accreditation. Accreditation is the assessment of the institution or program concerning compliance with pre-determined standards [4].

As stated in the articles that "for more than 80 years, accreditation has provided quality control for engineering education in the United States, seeking to assure that graduates of accredited programs are prepared for professional practice thanks to ABET" [5]. "ABET has recommended a revised set of accreditation criteria that is designed to assure that graduates of accredited programs are prepared to enter the practice of engineering" [6]. Accreditation studies have been carried out not only in the USA, but in Europe and also another part of the world. For example, accreditation of engineering programs is being applied to Taiwan for ten years. In this respect, it is ensured that the quality of engineering education is upgraded. Undoubtedly, quality is closely related to the satisfaction of internal and external stakeholders. Accreditation has been undertaken in this regard, including consideration of the quality of accreditation services of stakeholders [7]. Another selected as a work of literature deals with the Electrical Engineering (EE) program as an example. This study also assessed a high-quality Energy Efficiency program, which is a particular case of this area. Finally, it describes a set of procedures for implementing a system that will lead to ABET accreditation [8]. The similar study was done in 2007 for the department of civil engineering [9].

Apart from the aforementioned, ENAEE (European Network for Engineering Accreditation) was founded on 8 February 2006, at the end of the first EUR-ACE® project, by 14 European Associations concerned with engineering education (ENAEE Statutes). It stemmed from ESOEPE, the "European Standing Observatory for the Engineering Profession and Education," that had been established on 9 September 2000 with the purposes of:

a) Building confidence in systems of accreditation of engineering degree programmes within Europe

b) Facilitating the exchange of information

c) Developing voluntary agreements on accreditation of engineering educational programmes and recognition of engineering qualifications and

d) Development of standards for competency requirements of graduate engineers.

Members of ENAEE are agencies and professional organizations with interest in the education and formation of engineering professionals. ENAEE is the European body responsible for awarding authorization to accreditation agencies to award the EUR-ACE® label at first and second cycle to engineering programmes which they have accredited (URL-2, 2017).

According to another definition, accreditation is the period in which the quality of the institution is confirmed through a continuous evaluation [10], [11] defines accreditation as an external evaluation process for the development of qualifications in higher education programs and universities. Other methods used to provide quality assurance outside accreditation in education; evaluation, control and comparison [12]. Using one or more of these methods, the institution or program can be provided with more qualified training. Quality assurance work can be done for the institution, program or area of the subject. The European Higher Education

Quality Assurance Association (ENQA) report [13] emphases that accreditation process includes the evaluation process, but the evaluation cannot be substituted for accreditation. It is also stated that unlike evaluating accreditation, there is a more limited purpose, such as acceptance or rejection, and the assessment is usually a comprehensive process involving broader objectives. While there is a series of standards in accreditation; some of the evaluation processes may be included in the standards, or the standards may not be included at all. Another method of ensuring quality assurance is "benchmarking." In the accreditation process, the expected minimum standards that the program has fulfilled are determined. However, the benchmarking process is based on "excellence criteria," namely "best practices" [14]. In comparison, the process can be run without any external measures, and good examples are mentioned here [15]. Accreditation is a tool to guarantee the quality assurance; the goal should be determined as the sustainable continuous quality improvement (URL-3, 2017; URL-4, 2017)

Universities and programs within the context of "Involvement of European Cooperation in Quality Assurance" in Turkey have experienced different institutional evaluation and accreditation experiences since the 1990s [16]. The accreditation studies in Turkey began with the accreditation of the engineering faculties by the Accreditation Board for Engineering and Technology (ABET), the international engineering education institution. Between 1994 and 2004, 33 universities (Middle East Technical, Boğaziçi, Bilkent, Istanbul Technical) received a total of 33 engineering programs with ABET equivalence certificates (URL-3, 2007). "Regulation on Academic Evaluation and Quality Improvement in Higher Education Institutions" was put into practice in 20.09.2005 in Official Gazette published [17]. The regulation's aim is given in the first article as "…to establish guidelines for the study and evaluation of quality levels through the evaluation of education, training and research activities and administrative services of higher education institutions, the development of qualifications, the process of independent" external evaluation." Within this regulation, "Higher Education Academic Evaluation and Quality Improvement Commission" (HEB) were established, and its members were determined [18]. In May 2006, YÖDEK published a document titled "Guidelines for Academic Evaluation and Quality Improvement in Higher Education Institutions," which can guide universities in the development of quality and academic evaluation reports. From this date on, "self-evaluation processes" have started to be operated more effectively in universities.

Table 1. MÜDEK's international and national evaluation authorities (adopted from URL-4, 2017)

Date	*Authority*
2003	Beginning evaluation of engineering programs
17 November 2006	To be membership of ENAEE
25 January 2007	Acquisition of legal entity as a non-governmental organization with the name of Engineering Education Programs Evaluation and Accreditation Association (MÜDEK)
16 November 2007	To be recognized by HEB as a national quality assurance body in engineering programs of higher education institutions
01 February 2013	Five-year renewal of HEB's recognition period as a national quality assurance organization
21 January 2009	Authorization by ENAEE until 31 December 2013 to give EUR-ACE Label to engineering education programs to be accredited
16 October 2013	Renewal of the authorization by ENAEE by 31 December 2018
25 June 2011	IEA (International Engineering Alliance) Provisional Status for Washington Accord
15 June 2012	Full Member Signatory to IEA-Washington Accord

In order to understand the start of HEB accreditation studies, it is first necessary to look at accreditation studies in higher education in various countries. Thus, accreditation processes can

be better understood in the UK, the United States, and Japan, which are experienced countries in accreditation in higher education. An independent platform named "Engineering Evaluation Board" was established by the Engineering Deans Council (EDC), consisting of the deans of the faculties that provided engineering education in Turkey and the Turkish Republic of Northern Cyprus in 2002, to organize and implement a detailed program for evaluating the engineering degree programs of these faculties. In 2007, this platform was organized as an association named "Association of Engineering Education Programs Evaluation and Accreditation" (MÜDEK). Nowadays, MÜDEK is an independent quality evaluation organization which is working to contribute to raising the quality of engineering education in Turkey by carrying out accreditation, evaluation and informing activities for various engineering education programs in our country. In this context, MÜDEK is trying to contribute to raising the quality of engineering education in Turkey by carrying out accreditation, evaluation and informing activities for engineering education programs in different disciplines. Thus, the aim is to improve the prosperity of the society by educating engineers who are aware of current and developing technologies, better educated and more qualified (URL-4, 2017). As table 1 shows, MÜDEK provides both ENAEE in the European Union and IEA in the USA. Hence, MÜDEK is also compatible with ABET [19].

MÜDEK Engineering Undergraduate Programs Evaluation Criteria version 2.0.0 was implemented in 2008, version 2.1 in 2014 (URL-5, 2017). It has also been decided to make a general evaluation according to version 2.1 by MUDEK since the evaluation period of 2016-2017. Thus, in this study, it was thought that it would be more appropriate to determine a roadmap according to version 2.1. Although it shows similarities to version 2.1, version 2.0, it can be said that the program output is more complicated. Version 2.1. Included with the criteria in Figure 1 below. The MÜDEK evaluation criteria mentioned here are given on the internet webpage for MUDEK.

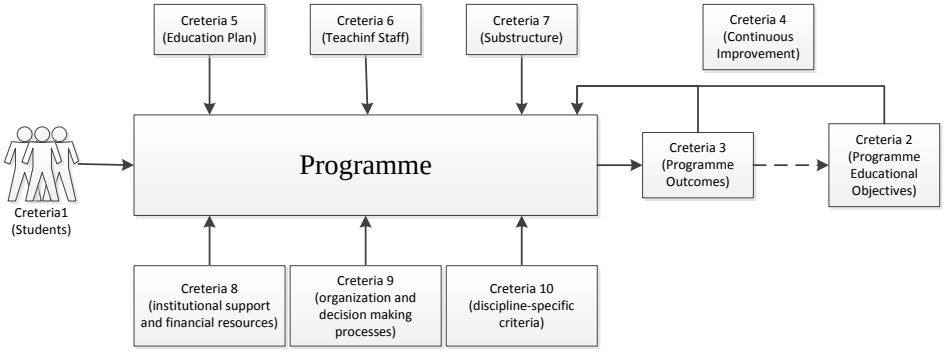


Figure 1. Version 2.1. MÜDEK Evaluation Criteria (adopted from URL-6, 2017)

2. STUDIES

In this chapter; which method of work and which materials will be discussed. In this study, the case study is used as a method. As is known, case studies are frequently used by different disciplines in the literature. Researchers may have special circumstances that lead to "case studies." These conditions may vary from discipline to discipline. Gerring, 2004 stated about the case study “case studies rely on the same sort of covariation evidence utilized in non-case study research. Thus, the case study method is correctly understood as a particular way of defining cases, not as a way of analyzing cases or a way of modelling causal relations. It was shown thanks to the article that this understanding of the subject illuminates some of the persistent ambiguities of case study work, ambiguities that are, to some extent, intrinsic to the enterprise” [20]. The fact

that this work emerges as a case study is based on the following reasons. These are, Examination of the accreditation process discussed in the "case study", the experiences gained from this process, current situation analysis with these experiences, discussion of literature knowledge with this analysis, and all that is presented to the researcher in this regard, as well as creating a resource for interested geomatics engineering departments. As materials, other data will be presented beside the data given in the introduction section. The current situation analysis will also be done. In this part of the work, we have included the following subheadings as materials. These are grade system and e-applications, higher education quality assurance system and quality board, quality management and accreditation in public and private sector, geomatics engineering discipline, the institutional structure of geomatics engineering based on educational institutions, quality management in geomatics engineering. In the findings section of the study, the following subheadings are included as the current education-training plan, the academic counseling form, and the course evaluation form. Finally, the discussion section and the results and suggestions section.

2.1. Grade System and E-applications

It is also necessary to specify that almost all the qualified universities around the world have built their systems on e-applications. So, students and third parties are informed through these applications. Since university grade systems and course systems are also carried out through these e-applications shown in figure 2. Thanks to this system, all operations based on academic performance, individual, grade system, students, etc. can be performed via the internet. E-applications are faster and easier to access and more accessible. In Turkey, all universities use these e-applications. In the case of Geomatics Engineering, the same situation applies again for the country. It is expected that e-applications will be used in accreditation processes. This issue, which will be discussed in the discussion section, in particular, will be discussed during the accreditation process with an integrated process management system and a quicker and easier quality assurance system.

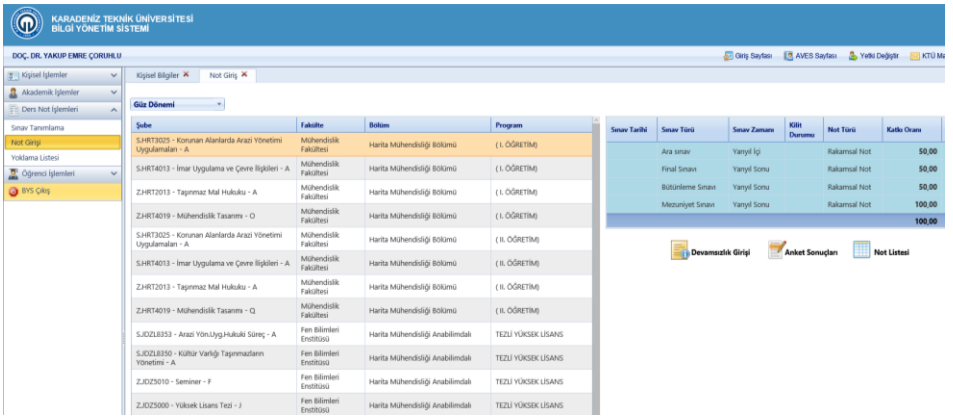


Figure 2. An image from Information Management System from KTU

2.2. Higher Education Quality Assurance System and Quality Board

Authorization for establishing and operating the quality assurance system in higher education has been put forward by the HEB in the 2005 regulation. However, there has been a need for legislative amendments in the name of the authority to use this authority. As a matter of fact, with

the law published in the Official Gazette dated 01 July 2017, some amendments were made with some articles added to the Law No. 2547 on Higher Education. In this connection, annex article 35 "Higher Education Quality Assurance System includes the principles related to the internal and external quality assurance of education and research activities and administrative services of higher education institutions, accreditation processes and authorization processes of independent external evaluation institutions." In the following, it is stated that "public and private institutions which have administrative and financial autonomy to carry out the evaluations according to national and international quality standards regarding the quality levels of education and research activities and administrative services of higher education institutions, internal and external quality assurance, accreditation processes and authorization processes of independent external evaluation institutions Higher Education Quality Board with legal personality and special budget has been established. " Thus, the Higher Education Quality Assurance System and the Higher Education Quality Board were established. Advisory Board on Higher Education Programs, annex article 36 and Vocational Schools Coordination Board were established with annex article 37 [21].

2.3. Quality Management and Accreditation in the Public and Private Sector

The International Standards Organization (ISO) is an international organization established in Geneva in 1946 with the aim of carrying out studies to determine all technical and non-technical standards outside the scope of Electrical and Electronics Engineering, which is entered into the working field of the "International Electrotechnical Commission." The number of countries in the International Standards Organization is 162. The national units, which are members of the Organization, are the most authoritative bodies in their own countries. An authority in the organization represents each country. Because of technological needs, ISO standards are passed on every five years, and necessary changes are made. ISO aims to accelerate the exchange of international goods and services and to develop cooperation in the field of intellectual, scientific, technological and economic activities (URL-7, 2017). The Turkish Standards Institute (TSI) has been established with the law number 132 of 18.11.1960 with the aim of making all kinds of substances and products, procedures and service standards. TSE is a member of ISO (URL-8, 2017). In a study in which "Geomatics Engineering education" is examined for accreditation, the enterprises in the mapping/surveying private sector are working in the field of TSI, ISO, etc., it has been understood that they are 80% accredited by the organizations [22, 23].

In Turkey, the Continuous Enterprise Development Project (CEDP) of the General Directorate of Land Registry and Cadastre (GDLRC), which is one of the most prominent institutions of the mapping/surveying sector, can be taken as an example of quality management in the mapping/surveying activities in the public sector. With CEDP; it is aimed to provide continuity by adding the understanding of high quality and fast service which keeps the satisfaction of the citizen and the employee to the front plan by adding to the institutional structure. With the pieces of training taken in the strategic management system, process management and TS EN ISO 9001: 2008 Quality Management System under the coordination of the Strategy Development Department, business efficiency is increased as well as doing quality work for the institution as a whole. (URL-9, 2017)

2.4. Geomatics Engineering Discipline

The program to be considered in the study is an engineering program known as Geomatics Engineering or named Geodesy and Photogrammetry Engineering at some universities. In this work, some necessary information about this program called Geomatics Engineering will be given, and then the experiences and inferences obtained from the accreditation process of the Undergraduate Programs of the Geomatics Engineering Department of Karadeniz Technical University Engineering Faculty in Trabzon in Turkey will be examined. Nowadays, map making

can come out in many different places. For example, distribution of jaundice disease, the map of Mars planet, or even the gene map of the human body can be extracted. A map is a representation of the physical details of a human being's living or interested area, or of a part or all of it, on a flat surface, usually on an individual scale. The details and information are displayed with symbols and are oriented following orientation and a reference system (URL-10, 2017).

Geodesy, Measurement, Photogrammetry, Remote Sensing, Global Positioning Systems (GNSS), Geographical Information Systems, Cartography, and Cadastre are among the topics of this discipline which are among the fastest developing sectors in the world. In this sense, the theoretical basis of this discipline is mathematics, physics, statistics, astronomy, physical geodesy, satellite/space technology, and land management. Figure 3, which is adapted .from Konecny 2002 this geomatics engineering which is precisely at the intersection of disciplines is given.

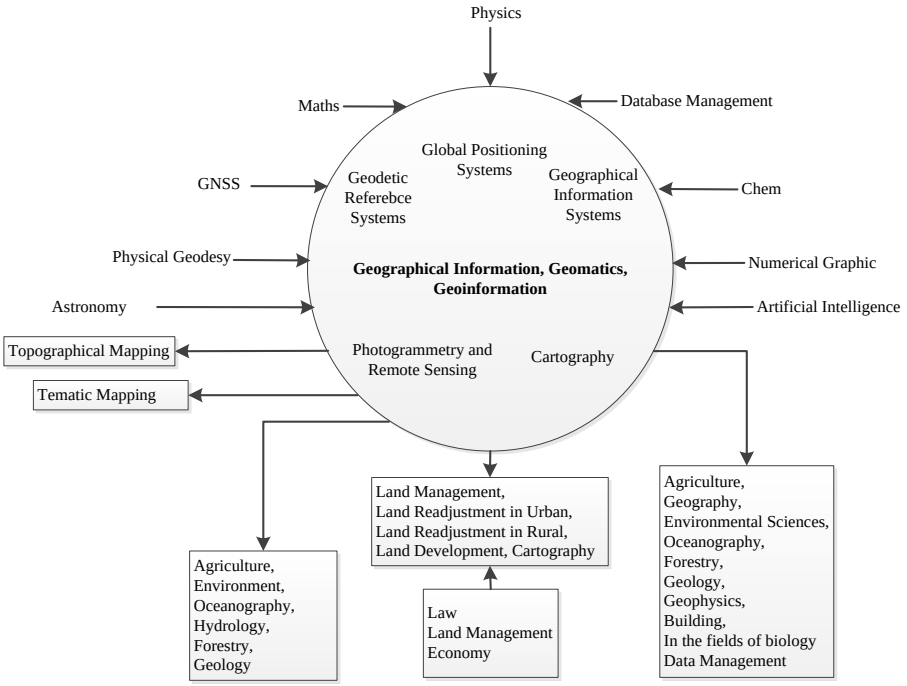


Figure 3. Content of Geomatic / Geoinformatic (adapted from [24])

All this shows the general tendency regarding "quality and accreditation in engineering education" described above. As in other engineering disciplines, geomatics engineering departments are expected to be involved in accreditation processes as well. In this respect, this discipline, which is part of general engineering education, can establish its quality control and assurance system. Thus, for this program's students, lecturers and graduates it is imperative to be an international program and a quality program to be involved in these accreditation processes. As a matter of fact, in many different countries of the world, geomatics programs have considered the accreditation process. Table 2 coming from ENAEE (URL-2, 2017), table 3 coming from ABET (URL-3, 2017) and table 4 coming from ENGINEERS CANADA (URL-11, 2017). In this sense, they are carrying out the work necessary to become accredited. The emergence of quality and assurance systems in the name of accreditation in the world is handled together with engineering

education. This is then analyzed in the context of geomatics engineering. The list of currently available geomatics programs is summarized below. The programs in Turkey where this "case study" is interested are also listed.

Table 2. Geomatics and related program coming form ENAEE

Accreditation agency	*HEB name*	*Degree title*	*Accreditation period*	*Country*
AEER	Kazakh National Technical University	Bachelor of Engineering	16/04/2010 until 16/04/2015	Kazakhstan
AEER	Belgorod State National Research University	Bachelor of Engineering	28/03/2014 until 30/09/2019	Russia
AEER	Samara State Aerospace University	Master of Engineering	11/03/2015 until 11/03/2020	Russia
ANECA	Polytechnic University of Madrid		14/07/2016 until 13/07/2022	Spain
ANECA	Polytechnic University of Valencia	Bachelor	14/07/2016 until 14/07/2022	Spain
ASIIN	The University of Melbourne	Master of Engineering	28/06/2011 until 30/09/2016	Australia
ASIIN	Hochschule Neubrandenburg	Bachelor of Engineering	28/03/2014 until 30/09/2021	Germany
ASIIN	Hochschule Neubrandenburg	Master of Engineering	28/03/2014 until 30/09/2021	Germany
ASIIN	Technische Fachhochschule Georg Agricola zu Bochum	Master of Engineering	25/09/2015 until 30/09/2021	Germany
ASIIN	Technische Universität Darmstadt	Bachelor of Science	26/09/2014 until 30/09/2021	Germany
ASIIN	Technische Universität Darmstadt	Master of Science	26/09/2014 until 30/09/2021	Germany
ASIIN	Hochschule Karlsruhe - Technik und Wirtschaft	Bachelor of Science	28/03/2014 until 30/09/2020	Germany
ASIIN	Hochschule Karlsruhe - Technik und Wirtschaft	Master of Science	28/03/2014 until 30/09/2020	Germany
ASIIN	Hochschule Neubrandenburg	Bachelor of Engineering	28/03/2014 until 30/09/2021	Germany
ASIIN	Hochschule für Technik Stuttgart	Master of Science	30/09/2016 until 30/09/2023	Germany
ASIIN	Hochschule für Technik Stuttgart	Bachelor of Engineering	09/12/2011 until 30/09/2018	Germany
ASIIN	Hochschule für Technik Stuttgart	Master of Engineering	09/12/2011 until 30/09/2018	Germany
ASIIN	Technische Fachhochschule Georg Agricola zu Bochum	Master of Engineering	25/09/2015 until 30/09/2021	Germany
ASIIN	al-Farabi Kazakh National University	Master of Science	26/09/2014 until 30/09/2019	Kazakhstan
ASIIN	al-Farabi Kazakh National University	Bachelor of Science	26/09/2014 until 30/09/2019	Kazakhstan
ASIIN	University of LjubljanaUniverza	University Bachelor	25/09/2015 until 30/09/2021	Slovenia
ASIIN	University of LjubljanaUniverza	Master	25/09/2015 until 30/09/2021	Slovenia
CTI	Higher Education Institution	Master of Science	01/09/2016 until 31/08/2021	Belgium
CTI	Higher Education Institution	Engineering master degree	01/09/2012 until 31/08/2018	France
MÜDEK	Yıldız Technical University	B.Sc.	01/05/2009 until 30/09/2018	Turkey
MÜDEK	Yıldız Technical University	B.Sc.	01/05/2009 until 30/09/2018	Turkey
MÜDEK	Kocaeli University,	B.Sc.	01/05/2014 until 30/09/2019	Turkey
MÜDEK	Selçuk University	B.Sc.	01/05/2010 until 30/09/2018	Turkey
MÜDEK	Selçuk University	B.Sc.	01/05/2010 until 30/09/2018	Turkey
MÜDEK	KTU	B.Sc.	01/05/2010 until 30/09/2020	Turkey
MÜDEK	KTU	B.Sc.	01/05/2015 until 30/09/2020	Turkey
MÜDEK	Bülent Ecevit University	B.Sc.	01/05/2015 until 30/09/2020	Turkey
EngC	Imperial College,London	Civil, Environmental and Geomatic Engineering	2011 - 2015	United Kingdom

Table 3. Geomatics and related program coming from ABET

School Name	*Program and Degree Name*	*Accreditation Dates*	*Date of Next Comprehensive Review*
The University of Akron - College of Applied Science and Technology	Surveying and Mapping, B.S.	10/01/2010-Present	2022-2023
Alfred State College	Surveying Engineering Technology, BS	10/01/1992-Present	2018-2019
University of Alaska Anchorage	Geomatics, BS	10/01/1995-Present	2022-2023
Ferris State University	Surveying Engineering, BS	10/01/1989-Present	2017-2018
Florida Atlantic University	Geomatics Engineering, BSGE	10/01/2010-Present	2020-2021
Texas A&M University - Corpus Christi	Geographic Information Science, BS	10/01/1999-Present	2018-2019
California State University, Fresno	Geomatics Engineering, BS	10/01/1979-Present	2018-2019
University of Florida	Geomatics, BS	10/01/1986-Present	2018-2019
North Carolina Agricultural and Technical State University	Geomatics, B.S.	10/01/2015-Present	2022-2023
Michigan Technological University	Surveying Engineering, B.S.	10/01/2011-Present	2017-2018
East Tennessee State University	Surveying and Mapping, BS	10/01/1992-Present	2019-2020
Kennesaw State University	Surveying and Mapping, B.S.	10/01/2004-Present	2017-2018
Oregon Institute of Technology	Geomatics, BS	10/01/1985-Present	2018-2019
New Mexico State University	Surveying Engineering, BSSREG	10/01/1999-Present	2018-2019
Pennsylvania State University, Wilkes-Barre Campus	Surveying Engineering, BS	10/01/2004-Present	2018-2019
Istanbul Technical University	Geomatics Engineering, B.S.	10/01/2009-Present	2016-2017
New Jersey Institute of Technology	Surveying Option in Engineering Technology, BS	10/01/1992-Present	2017-2018
University of Maine	Surveying Engineering Technology, BS	10/01/2005-Present	2020-2021
Idaho State University	Surveying and Geomatics Engineering Technology, BS	10/01/2004-Present	2017-2018
California State Polytechnic University, Pomona	Geospatial Engineering option in Civil Engineering, BS	10/01/1992-Present	2017-2018
Polytechnic University of Puerto Rico	Land Surveying and Mapping, BS	10/01/2006-Present	2019-2020
St. Cloud State University	Land Surveying and Mapping Science, B.S.	10/01/2004-Present	2017-2018
Nicholls State University	Geomatics, BS	10/01/2008-Present	2021-2022
Troy University	Surveying & Geomatics Sciences, BS	10/01/2010-Present	2022-2023

Table 4. Geomatics and related program coming form ENGINEERS CANADA

School Name	*Program and Degree Name*	*Criteria*	*Date*
University of Calgary	Bachelor of Engineering	Geomatic Engineering	1996- present
University of New Brunswick	Bachelor of Engineering	Geomatic Engineering	1999- present
University of Laval	Bachelor of Engineering	Geomatic Engineering	2007- present
University of York	Bachelor of Engineering	Geomatic Engineering	2007- present

2.5. Institutional Structure of Geomatics Engineering based on Educational Institutions

In Turkey; there are high schools, vocational colleges, and universities which provide education on map and cadaster sectors. High school education is four years, associate degree education is two years, and undergraduate education is four years (URL-12, 2017). At present, the number of faculty members, the language of education and student quotas and the number of faculty members are presented in table 5.

It is also known that there are 16 more geomatics engineering departments has been opened, but no teaching in these departments. These departments together with their universities and the number of lecturers are presented with table 6.

Table 5. Number of faculty members of the departments and student quota information for 2017-2018 (URL-13, 2017)

		Education/Quota		*Lecturers*			
University Name	*Language*	*Normal*	*(Secondary)*	*Prof. Dr.*	*Assoc. Prof. Dr.*	*Assist. Prof. Dr.*	*Total*
Afyon Kocatepe University	Turkish (T)	60	60	-	4	3	7
Aksaray U.	T	60	60	2	5	3	10
Avrasya U.	T	24	-	3	-	-	3
Bülent Ecevit U.	T	70	70	1	3	7	11
Cumhuriyet U.	T	50	-	-	2	4	6
Çanakkale Onsekiz Mart U.	T	50	50	-	-	4	4
Erciyes U.	T	65	-	2	1	3	6
Gaziosmanpaşa U.	T	60		-	1	2	3
Gebze Technical U.	T	40	-	2	3	2	7
Gümüşhane U.	T	60	60	-	1	3	4
Hacettepe U.	English €	60	-	1	1	6	8
Harran U.	T	40	40	1	-	2	3
İstanbul Technical U.	E / T	50/60	-	18	7	10	35
İzmir Kâtip Çelebi U.	E	60	-	-	3	-	3
Karadeniz Technical U.	T	90	90	8	6	10	24
Kocaeli U.	T	60	-	-	1	2	3
Necmettin Erbakan U.	T	60	-	1	1	5	7
Niğde Ömer Halisdemir U.	T	60	-	-	1	2	3
Okan U.	T	20	-	3	-	-	3
Ondokuz Mayıs U.	T	60	-	1	2	4	7
Osmaniye Korkut Ata U.	T	50	-	-	1	2	3
Selçuk U.	T	90	90	3	6	6	15
Yıldız Technical U.	T	100	-	8	11	6	25

Table 6. Departments that have not yet started Teaching

University Name	*Prof. Dr.*	*Assoc. Prof. Dr.*	*Assist. Prof. Dr.*
Recep Tayyip Erdogan U.	-	-	1
Artvin U.	-	1	1
Giresun U.	-	-	1
Atatürk U.	-	-	-
Hitit U.	-	-	-
Bursa Technical U.	-	-	-
Mersin U.	1	-	-
Adıyaman U.	-	-	1
Muş Alpaslan U.			
Sinop U.	-	-	-
Gazi U.	-	-	-
Abant İzzet Baysal U.	-	-	-
Dicle U.	-	-	-
Uşak U.	-	-	2
Fırat U.	-	-	-
Nevşehir H.B.V. U.	-	2	-

2.6. Quality Management in Geomatics Engineering

In our country, the number of universities has increased considerably over the past 15 years, and there are currently 185 universities in Turkey. Re&De and project-based studies in the well-established universities of our country are being carried out today as they are in the past. Along with the increasing number of universities, the number of students and faculty members has also increased considerably. Both the newly established universities and the new departments and the established universities are in a kind of competition in both national and international competitive environment. This race will bring an essential output to Turkey in order to catch up and achieve better. Similar developments in the field of engineering have been experienced and experienced as emphasized above. This has continued with engineering programs falling within the "quality and accreditation process." Geomatics Engineering programs have also taken place in this process, and more and more programs are being added to this process every day. The programs that have ABET and MÜDEK accreditation in geomatics engineering undergraduate programs in Turkey are presented in table 7 below.

Table 7. Geomatics Engineering Programs receiving accreditation certification (URL-3, 2017; URL-14, 2017)

University Name	*Program Type*	*Accredited by*	*Validity Period*
Karadeniz Technical U.	Normal Education	MÜDEK	01.05.2010-30.09.2020
Karadeniz Technical U.	Secondary Education	MÜDEK	01.05.2010-30.09.2020
Kocaeli U.	Normal Education	MÜDEK	01.05.2014-30.09.2019
Selçuk U.	Normal Education	MÜDEK	01.05.2008-30.09.2020
Selçuk U.	Secondary Education	MÜDEK	01.05.2008-30.09.2020
Yıldız Technical U.	Normal Education	MÜDEK	01.05.2007-30.09.2020
Yıldız Technical U.	Secondary Education	MÜDEK	01.05.2007-30.09.2018
Bülent Ecevit U.	Normal Education	MÜDEK	01.05.2015-30.09.2020
İstanbul Technical U.	Normal Education	ABET	01.10.2005-Continuing

3. FINDINGS

Evaluation Criteria for Undergraduate Programs on 23 December 2014 for the evaluation of undergraduate programs Version 2.1 was published by MÜDEK. Especially in version 2.1, the program output has been made more complicated than version 2.0. All future evaluations of all programs, except for programs conducted according to the previous "general evaluation" process version 2.0, will be conducted according to version 2.1. Both versions are considered to have no major differences except for the program output. In this context, the studies made for the accreditation application and the experiences obtained from these studies will be examined within the scope of this study. The general definitions in Version 2.1 are particularly focused on "complex problems," "complex systems, processes, devices and products," "realistic constraints and conditions in engineering design." All criteria for accreditation will not be considered separately in the evaluation process of KTU Geomatics Engineering Bachelor Programs, which are considered as an example for this case study. The critical issues that should be mainly explained are discussed.

3.1. Administrative Works and Procedures

Administrative works of the programs are carried out by the head of the department who are appointed by faculty dean. The duties of the Head of Department are defined in Higher Education Law No. 2547. Head of the department invites the "Academic Board of the Department" to

participate in the meeting to discuss the issues except for administrative work. Academic Board of the Department covers all the academic members of the department [25]. Apart from this, administrative and managerial works are given to the commissions to which head of departments can define the commissions' member from the department academicians. Commissions' decisions taken by commissions are a recommendation for the Academic Board of the Department. Each commission prepares a report on its task area such as; accreditation process, communication with internal and external stakeholders, education and training activities, measurement and evaluation processes, questionnaires applied to internal and external stakeholders in the program, mission and vision of the program, educational objectives of the program, program outcomes, internship procedures and academic consultancy.

This report is presented to the Department Chair. The Academic Board make its decisions from the majority vote based on commission report or without sometimes commission report. This board decides on the implementation of the decisions that are deemed appropriate and determines the roadmap. In this meeting, the participation of internal and external stakeholders or participation in some meetings can be evaluated. In this respect, the opinions of all the graduates who are graduated at different levels of the program are applied at the commissions or on the academic board.

The information about the program; the department's vision, the department's mission, the educational objectives of the department and the programs' outcomes of the department were before defined and expressed via program webpage (http://www.ktu.edu.tr/harita). Here is this information below by translating them from Turkish to English in table 8.

Table 8. Mission and vision, educational objectives and program outcomes

The Department's Vision is defined as.
It is to be a "distinguished and leading" division that stands out in national and international environments via qualified graduates, research and publications, achievements to date for our country and communities.
The Department's mission is defined as.
It is to give undergraduate and graduate students the education required by geomatics engineering. It is ensuring that they are trained in the same qualifications as their international colleagues. It is contribute to the development of "profession and science" by conducting qualified and original research and publications. It is to develop policies in the interests of the country by monitoring international developments in professional subjects. It is to produce solutions to the problems of our country and the environment of the profession. It is to train graduates with academic skills needed by universities and public institutions.
The educational objectives of the department bachelor programs are defined as follows. *A few years after the graduation of department graduates are expected;*
1. They are able to have basic engineering formation and professional equipment required by their professional formation. They can undertake different tasks in public institutions/organizations and domestic/foreign private sector thanks to their ability to adapt to the global changes in the field of geomatics engineering or related area. *2. They can continue their academic and/or continuing education programs with their research skills for their professional and career development.* *3. They can serve in the executive position to play a lead role in their team thanks to their entrepreneurship, self-confidence and advanced communication features.* 4. *They may take part in national and international research/development projects thanks to "Life-long learning and continuous improvement" principle they adopts, social-environmental-economic factors and ethical values they consider.*
The programs' outcomes of the department bachelor programs were adopted the same as MUDEK's outcomes (*http://www.mudek.org.tr/doc/en/MUDEK-Evaluation_Criteria_(2.1.1-11.03.2016).pdf*).

As stated above it has decided to adopt the MUDEK's outcomes into the program. So, it is thought that there is no need to give information in this regard.

3.2. Quality Assurance System / Program Cycle

It is expected to establish a quality assurance system/program cycle from a program in the accreditation process. This cycle proves that "continuous improvement efforts" are made in the light of the results obtained from a measurement and evaluation system. The program has an "education and training plan" in line with the "mission and vision" according to the program's "educational objectives and program outputs." The measurement and evaluation process is already prepared for the program. In this process, the graduate / employer / alumni questionnaire, alumni records, course evaluation form, meetings and workshops with internal and external stakeholders in specific periods of each academic year are planned. All of them are guaranteed with a designed cycle and measurement and evaluation process.

The views of internal and external stakeholders are reported in order for the "continuous improvement cycle" to function correctly. These views are discussed in the committee concerned. This commission decision is forwarded to the academic board. If the Board decides on a non-cyclical issue, the decision will be added to the cycle. This process is a planned process. Appropriate measurement and evaluation activities of the plan are also reported. If there are problems identified during the control phase, the cycle is reconsidered by the board for their elimination or improvement. This cycle, shown in figure 4, can also be called the quality assurance system of the program. This cycle has been established and operated for the program being studied. This cycle must be implemented together with a timeline.

As you can see from the program cycle, mission and vision of the program, the education-training plan, the program outputs, and the educational objectives were defined before the students' entrance to the program. Namely, each student can learn all of this information before entering the program. So each student can have an idea of what the program can win him/her. A minimum of 8 semesters (4 years) is required for graduates from a geomatics engineering undergraduate programs. As can be seen from the program cycle, at the end of this period, the student gains the program outputs as his/her skills. In the accreditation process, educational objectives are determined by those who graduated from the program a few years ago those who graduated from the program 3 to 5 years ago. It is needed at least 7 to 9 years for a full turn of the program circle.

3.3. Program Educational Objectives

The critical commission determined mission and vision of the department at the meetings held with the participation of internal and external stakeholders. Then, the Academic Council shaped the final version of mission and vision via a document, then signed, and announced on the web page of the department. In the same way, educational objectives and program outputs were determined and announced.

Program Educational Objectives can be evidenced by the "graduate questionnaire" applied to the graduate within the last few years of the program and the "employer questionnaire" applied to the administrators at the institutions where graduates work and "alumni records" which is able to show us the situation of graduates in terms of "graduate education" status of graduates, participation status in occupational activities, presence of different learning environments in which they are, occupational or managerial positions etc. The questions on these questionnaire forms are prepared to take into consideration the ones expressed in educational objectives. Questionnaire forms are developed to be measurable for each educational objective. The level of educational objectives is measured by questionnaire forms applied to both graduates and the employers of the graduates. The results of the questionnaire forms are analyzed and reported separately. Besides, legal and postgraduate statuses of graduates and graduates' working lives are also analyzed and reported. With these reports and the graduates' records, it is aimed to prove the program's objectives with the data obtained from graduates 3 or 5 years ago. Thus, it is proved that the aims of education are gained for 3-5 year graduates.

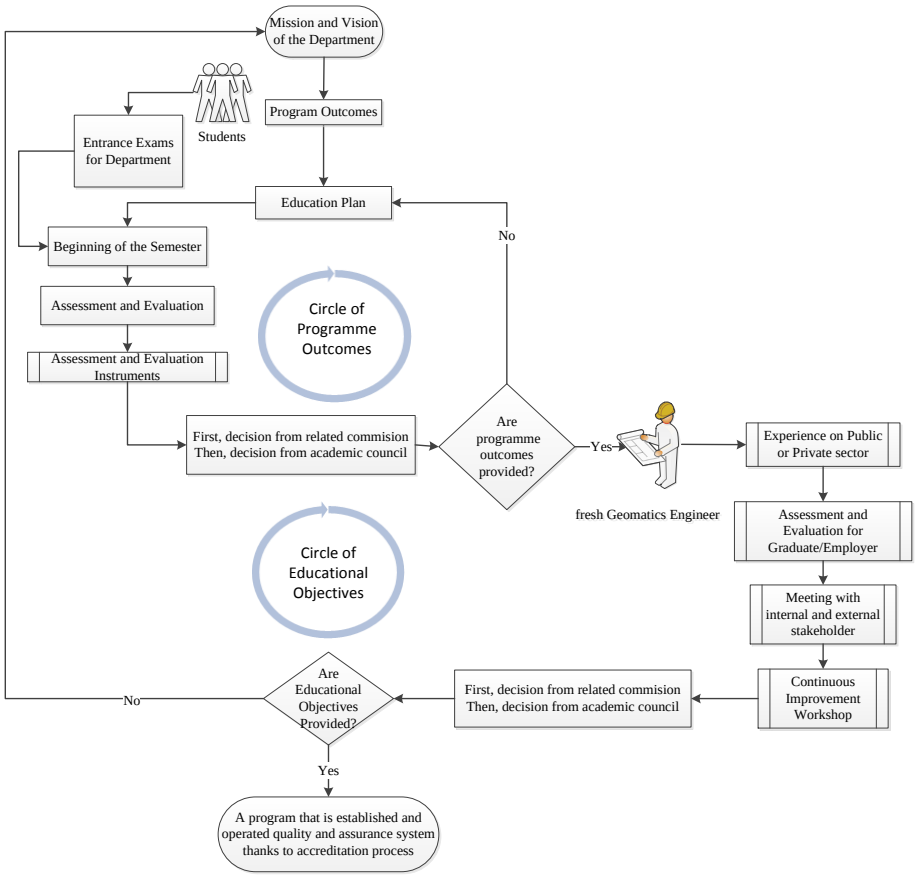


Figure 4. Program cycle

3.4. Program Outcomes

The program outputs were determined by the same methodology both "mission and vision" and "educational objectives." The academic department council decided that the program outputs should be determined according to old version 2.0 because of the sub-evaluation process which is to proceed. In order to evaluate a new program, an application must be made according to current version 2.1. A new output for the program can be added to version 2.1.outputs. The program output has to be proved via the compulsory course, lesson, homework, project, activities, etc. given to all students. However, it is also important to be supported by different techniques besides being measured only through "measurement and evaluation" tools. It is also necessary to prove that program outputs are gained as skills to students. This provenance should be supported in different ways outside the course, lesson, homework, project, etc.

For this reason, a questionnaire form is also conducted for each compulsory facility. In this questionnaire, the output of the program gained through the relevant course is determined by the students. Besides, "Graduation Questionnaire" is applied to the students who graduated. All these data are reported for the rate of getting the "program outcomes" to all students. The relationship between program educational objectives and program outcomes and the flowchart about both of them are designed and presented via the figure 5 below.

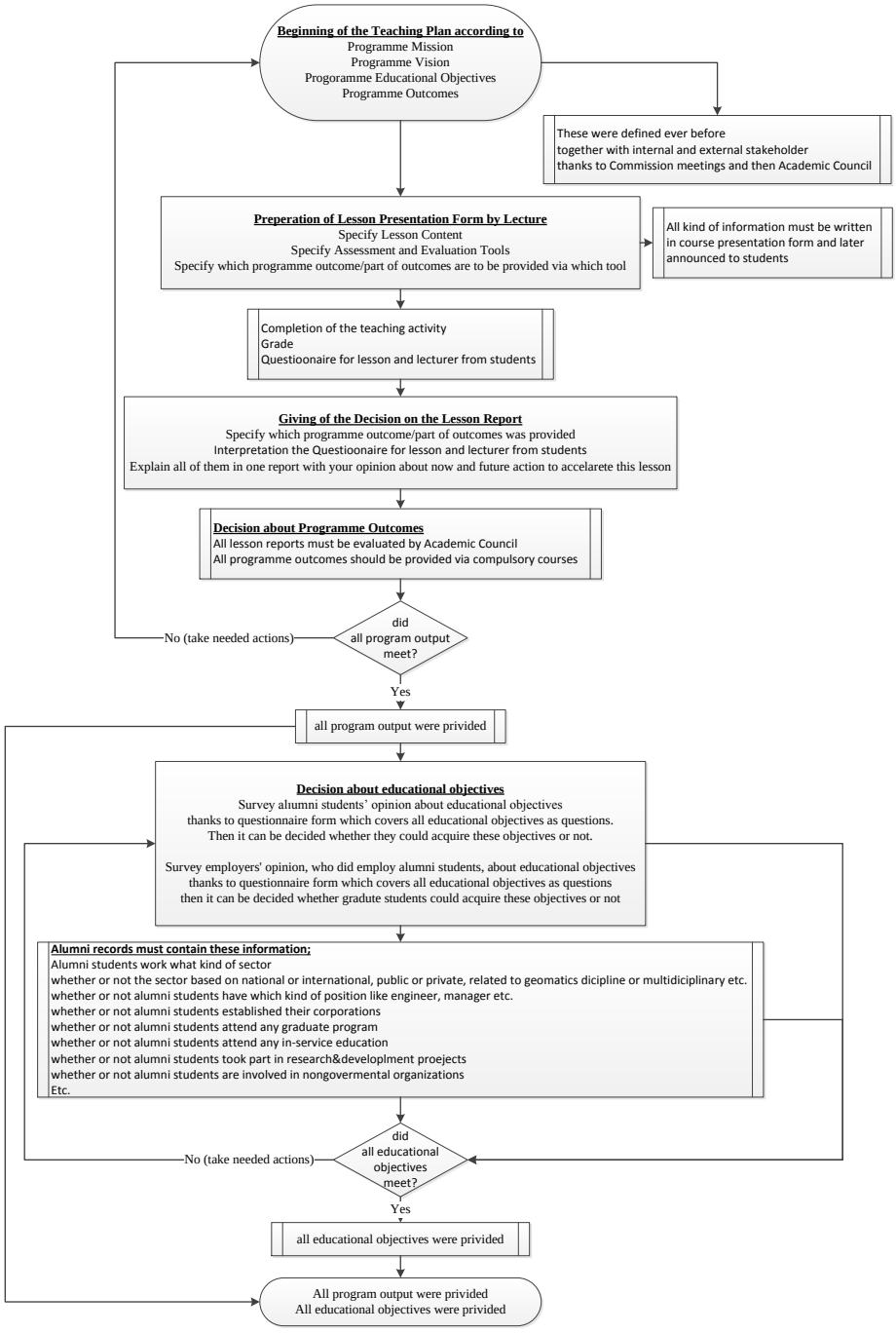


Figure 5. The flowchart for educational objectives and program outcomes

3.5. Course Presentation Form

It is also expected from the accreditation that the success of the students in the lessons is measured by a consistent method that will show the level of achievement of the program output and the proving of these measures. The relevant part of the program outcome/program outcome part for each course in the related program will be announced with the Course Presentation Form (table 9) at the beginning of the term through the relevant faculty member. In this form, which measurement and evaluation tool (exam, homework, oral presentation, written report, etc.) and what program output to meet thanks to which lesson/tool will be specified. In this process, there may be changes to the contents of some lessons, with the critical commission and department academic council intervention being feed backed. Then, the level of satisfaction of the program outputs can be evaluated through the students who have taken the course and have achieved the proficiency. The program output is compared with this evaluation via the course presentation form announced at the beginning of the semester through relevant lecture. As a result of this comparison, if there is a correspondence between the program outcomes and the course presentation form, it is proven that the corresponding program output has been provided. In this process, the Course Presentation Form, given as an example in table 9, takes part in the accreditation process as one of the means of proving the level of meeting the targeted program outcomes.

Table 9. Course Presentation Form

Engineering Ethics Course: Course Introduction Form											
Faculty/ Department	…										
Code/ Name	…										
Year/ Semester	4 / Spring										
Type/Language	Compulsory / Turkish										
Credit/ ECTS	2 / 3										
Type of Lesson	….										
Lecture	…										
Report (R.) Presentation (P.)	**Midterm Exam (R.)**	**Quiz (R.)**	**Homework**		**Project**		**Field App.**		**Lab App.**		**Final Exam (R.)**
			R.	**P.**	**R.**	**P.**	**R.**	**P.**	**R.**	**P.**	
Number	1	-	1	1						-	1
Contribution rate	%25	-	%12.5	%12.5						-	%50
Aim of the Course	…										
Keywords	Visit webpage										
References	Visit webpage										
Course Content	Week 1:										
	……										
	Week 14:										

Relationship between Course and Program Outcomes											
	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Midterm Exam	□	□	□	□	□	□	□	□	■	□	□
Homework	□	□	□	□	□	■	■	□	□	□	□
Final Exam	□	□	□	□	□	□	□	□	■	□	□

The content designed in the course will be transferred to the student and will be tested by midterm, homework and final exam. Thus, it is aimed that students who are successful will be provided exams for PO9 and homework for PO6 and PO7. For the other details please visit webpage:http://www.katalog.ktu.edu.tr/DersBilgiPaketi/course.aspx?pid=12&lang=1&dbid=112040

3.6. The Relationship between Program Outcomes and "Current Education-Training Plan"

Definition of Program Output as mentioned above that it is expressed as the skills of a student who has graduated from the program. It is expected that these outputs will be given to the students through the program. In this process, compulsory courses in the program play an important role. The relationship matrix (table 9) between the program outputs and the compulsory courses is prepared. This relationship matrix forms the Course Presentation Forms to be announced by the relevant lecture at the beginning of the semester. With the Course Presentation Forms, it is determined which course and which program output will be used in which way and which evaluation and evaluation tools will be used. The department's important commission ensures that there are a necessary course presence and a balance between them and all program outputs. If some program outputs are missing, a re-evaluation of the course content and program output is made by relevant lecture. Thus, the relationship between the decision of the academic committee and the course and program output is revealed before beginning the semester as can be seen in table 10.

Table 10. Relationship Matrix between Geomatics Engineering's Program Outcomes and Courses for Some Compulsory Lessons for 2., 3. Classes

	Program Outcomes / Compulsory Courses	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
1. Class	Courses….											
2. Class	A Coded Course	X										
	B Coded Course		X				X					
	HRT 2013 Law Immovable Property											X
	HRT 2016 Cadastre											X
	…	X	X		X							
3.. Class	Courses….											
4. Class	Courses….											

3.7. Academic Counselling Form

One of the goals of accreditation is to provide active academic counseling services to the students. The academic council is pre-determined by which academic advisory counseling is given. For this, all lectures in the program are effectively and equally involved. In order for the students to be able to receive this service reasonably, the equal number of student counseling is given to the lectures from each semester. What the counseling service is and the contents of it are announced to the relevant students at the beginning of each semester. For this purpose, an informative meeting is held for all students with lectures at the beginning of each academic year. It would be useful to have the following information in this form that information about elective courses and compulsory courses, informing about the internship, opportunities for graduate education, opportunities for studying abroad, job opportunities, etc. Academic adviser approval is also required at each stage of course selection and course approval. Signature of the students participating in this information activity is taken. Later, these forms are presented to the Department by lectures.

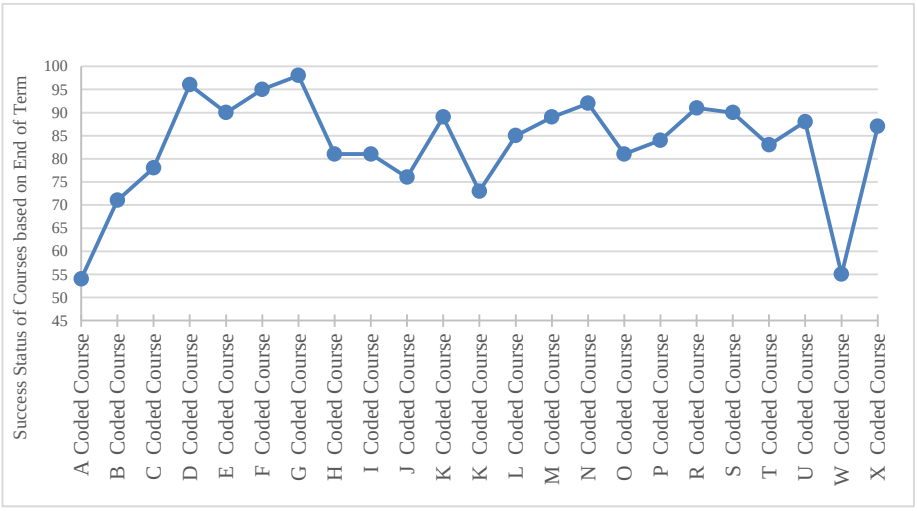
3.8. Course Evaluation Form

The Course Evaluation Form is presented to the Department at the end of each term for each "compulsory course" by the related lecturer. As stated before, at least one or more "program outcomes" can be ensured or provided by a course. The course evaluation form to be prepared according to the program outcomes may differ for each course. In this form, an assessment is also made of the measurement-evaluation tool where each outcome is measured. For example; only one program can only be ensured by exams (midterm and final) within the scope of a course. Alternatively, within the scope of a course, two or more programs can only be ensured by exams' questions. Alternatively, one of the two programs may be covered by one of the examinations (midterm exam and final exam) and the other one from the homework. Alternatively, it may be program outcomes that can be ensured with different measurement-evaluation tools other than homework. All these aspects are indicated in the course evaluation form. This form should also indicate the success of the course. In other words, statistical information is given to the students who succeeded in this course and those who succeeded "CC and above CC." Academic Committee Decision was before defined as the successful evaluation of the course in case the lesson more than 50% of the students who succeeded in CC and above CC. If this is not the case, it must be explained what kind of arrangements will be made to explain in detail in the next period.

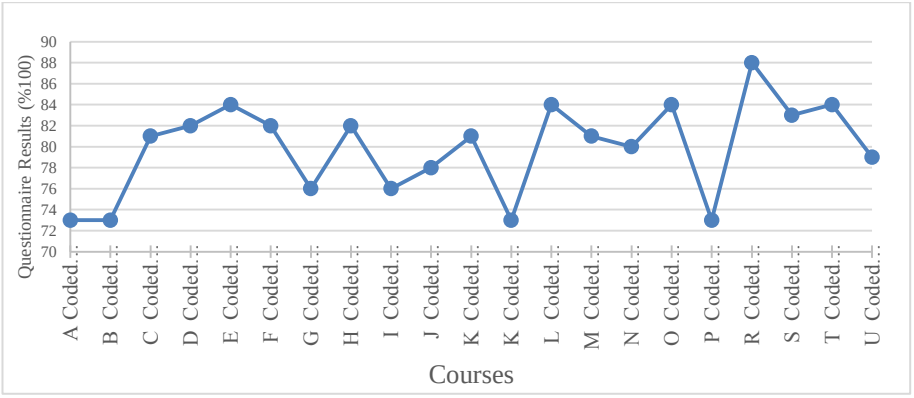
The report also includes questionnaire data. These survey data cover the evaluations about lecturer and course. If all these surveys are individually 50% above, the situation is considered a success. If there is an assessment that is not in this situation, the lecturer explains to eliminate this situation via the new arrangements to be made in this report. Thus, in the next period, it will be explained that these successes will be made to the desired level.

Each lecturer explains and comments on this data report described above. After all the reports have been collected, they are summarized together in a table. The Academic Committee considers all these summary reports as a whole. If there are any changes to be made in the lessons, they will also discuss them. The Academic Committee also takes the necessary decisions and reports them to all lecturers. All these data are given in graphs as an example below in figure 6.

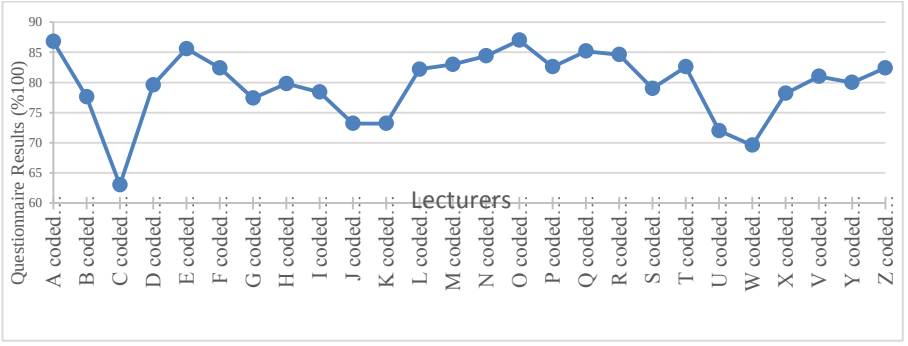
All of these above-mentioned data are explained in the course evaluation report prepared by the relevant lecturer for each course. A sample report prepared in this regard is presented in table 11.



The success status of the courses CC and above CC based on Final Notes



The percentage of success about "course evaluation questionnaire" obtained from students



The percentage of success about "lecturer evaluation questionnaire" obtained from students

Figure 6. Lessons and Lecturers Success in graphs

Table 11. Course Evaluation Form

KTU, Faculty of Engineering, Department of Geomatics Engineering

COURSE END OF PERIOD REPORT

Course Code and Name : HRT 2016 Cadastre Secondary (Class A), Secondary (Class B)
Semester : 2016-2017 Spring
Lecturers : Other Lecturer Education: *Secondary (A)*
Assoc. Prof. Dr. Yakup Emre CORUHLU Education: *Secondary (B)*

A. According to Student Survey Results; Assessment of course and Lecturer
According to the results of the questionnaire, the answers to the questionnaire regarding the evaluation of the course and the lecturer are presented in Annex-1.

(A); Course Success Rate average 89%
Lecturer's Success Rate average is calculated as 90%.

(B); Course Success Rate average 82%
Lecturer's Success Rate average is calculated as 79%.

B. Lecturer's Assessment of Course Success
The end-of-term notes are presented in Annex-2 for the evaluation of the course success according to the end-of-term notes.

Course Achievement = (Number of CC and above students in Final and Makeup Exam) / (Number of students in the course - number of students not taking the makeup exam- number of students not attending classes)

(A); Of the 57 students written in the course, 45 were graded CC and above, and the course success was calculated as 45/57 = 79%.

(B); Of the 55 students who were enrolled in the course, 47 were rated CC and above, and the course success was calculated as 47/55 = 85%.

C. Evaluation
The course was conducted in accordance with the Course Presentation Form. "Survey results that students have rated Lecturer and Lecture" and "Evaluations of Lecturer's letter grade" overlap. The general success of the course was thus provided. As a result, the course is evaluated as having encountered the projected program output.

Assoc. Prof. Dr. Yakup Emre ÇORUHLU Other Lecturer
Lecturers

Attachments:
1: Evaluation Schedules of Questionnaires for Lectures and Lecturer
2: Alphabet Note Sheet

4. DISCUSSION

Accreditation work is a pretension of a claim. When doing this, it is necessary to use a measurable and provable methodology. This can be seen as an essential step towards becoming the "control society" [26], or the "new public administration movement" [2]. For the education sector, these behaviors are expected to be done according to certain criteria and continuously [3]. Here, accreditation plays a role as a tool here [4, 10, 11]. Quality assurance can also be achieved through evaluation, auditing and benchmarking methods out of accreditation [12]. However, accreditation is preferred because it covers both a specific set of standards and minimum standards and also it is a more comprehensive process than the others [14, 15]. Thanks to these standards, qualifications, and accreditation, the program can be accepted as and qualified programme from the other countries, so their alumni can be employed there. Here is a good example from England. The role of the Engineering Council and the UK Engineering Institutions is specifically described in the accreditation of engineering grades. New national and international developments have decided to upgrade engineering qualification standards in the UK for chartered engineers (CEng) or Incorporated Engineer (IEng) registrants. The multilateral agreement on the recognition of the qualifications of the UK was recorded. FEANI holds the title "European Engineer" (EurIng) and "Washington Accord" of FEANI, which includes mutual recognition of the accredited grades in eight countries [27]. It is known that undergraduate engineering programs in Malaysia are pursuing global trends through accreditation schemes to improve the quality of engineering education. In general, accreditation criteria require a range of skills. These skills are; technical problem solving, soft skills and lifelong learning skills. In order

to be fit with accreditation criteria, accreditation schemes have been adopted as a measure of quality assurance. "..., considering the potential benefits posed by accreditation, it seems worthwhile to pursue some remedial efforts for effective implementation of the accreditation criteria" [28].

MÜDEK, which was founded in 2002 in the sense of an idea, became an association in 2007 and pioneered these processes (URL-4, 2017). Some of the leading universities in Turkey, individual programs, have been in this process since the 1990s ([16], 2005; URL-4, 2017). External evaluation studies for this quality assurance system based on "volunteerism" were in force legally in 2005, then the situation started to be implemented from 2006 [17]. These applications are being carried out in coordination with MÜDEK's evaluations. MÜDEK provides both ENAEE and IEA criteria [19]. In the 1990s, this process started with four universities in Turkey and had spread to other universities and programs. Currently, more than 50 universities in Turkey are assessed by MÜDEK for an accreditation network that includes different 60 faculties (URL-4, 2017). In parallel with this, HEB has been established in the Higher Education Quality Assurance System and Quality Board for these evaluation processes based on volunteerism [21]. In this sense, an excellent development has occurred. It was announced that a committee would be formed on behalf of the opening of programs and the determination of quotas [29]. Thus, the legal regulations apart from the voluntary basis in the establishment of quality-assurance systems regarding higher education are evaluated positively. It is also expected that the opening of new programs and the evaluation of quotas will also positively affect these accreditation processes. All that needs to be discussed here is how to implement and control it effectively.

Some services linked to the international standard by ISO are being carried out by the TSE in Turkey (URL-7, 2017; URL-8, 2017). This field is exemplified by the Continuous Enterprise Development Project (CEDP) by the General Directorate of Land Registry and Cadastre (GDLRC), which is geomatics engineering sector specific (URL-9, 2017).

All these data should be discussed taking into account the leading geomatics engineering education in the world given with table 2, 3, and 4. As stated above, in many different countries of the world, geomatics programs have considered the accreditation process in table 1 is coming from ENAEE (URL-2, 2017), table 2 coming from ABET (URL-3, 2017) and table 3 coming from ENGINEERS CANADA (URL-11, 2017). The emergence of quality and assurance systems in the name of accreditation in the world is handled together with engineering education. Well, the question of how is the situation in Turkey explicitly based on geomatics engineering? Can be answered. There are geomatics engineering programs in 23 different universities offering education and training. There are also geomatics engineering programs at 16 universities that have not started teaching-learning. In total, there are a total of 39 universities geomatics engineering programs. However, 6 of them are included in the accreditation process, one coming from ABET 5 of them coming from MÜDEK. The following question should be discussed. What have positive steps been taken for geomatics engineering that is accredited by HEB? Another question that needs to be discussed is whether accreditation contributes to the functioning of these programs or not? How accreditation affects the process of gaining the acceptance by students to these programs? How does accreditation affect students' graduation from these programs? It is necessary to discuss these issues on the upper scale and discuss the establishment of the discussion areas necessary for reaching consensus on a roadmap.

Another issue is the evaluation and analysis of information and documents which is collected and interpreted and discussed in the accreditation process. In their operation, the efficient use of e-applications should be discussed differently from the current application. As it is known that all the universities in Turkey have established "student grade evaluation and announcement systems" on e-applications. The same application is available in the program based on this work. However, it is also known that all the information used in the accreditation process is not in an existing e-application. At that time, it should be made clear in the accreditation process in which information is on e-applications and which are obtained classically. Concerning this, table 12 prepared for the

preparation, storage, and presentation of the data required in the accreditation process is presented below.

Table 12. Preparation, storage and presentation of the data required in the accreditation

	Preparation	*Storage*	*Representation*			
	Paper based	*Computer based*	*On Paper*	*On Web*	*Via Paper*	*Via Web*
Mission	No	Yes	Yes	Yes	Yes	Yes
Vision	No	Yes	Yes	Yes	Yes	Yes
Educational objectives	No	Yes	Yes	Yes	Yes	Yes
Program outcomes	No	Yes	Yes	Yes	Yes	Yes
Program cycle	Yes	Yes	Yes	Yes	Yes	No
Education plan	Yes	Yes	Yes	Yes	Yes	Yes
Course information	Yes	Yes	Yes	Yes	Yes	Yes
Measurement and evaluation tools	Yes	Yes	Yes	No	Yes	No
Academic counselling	Yes	Yes	Yes	No	Yes	No
Course evaluation	Yes	No	Yes	No	Yes	No
Questionnaires	Yes	Yes	Yes	No	Yes	No

The e-turkey application is being used by more institutions every day [30]. At this point, some institutions have started to provide services through e-Turkey in the process of education. How can the integration of the accreditation process, which is the means of improving the quality of education, into the e-government be achieved? It is known that there are e-applications that work on their own even if the universities are not in the scope of e-government. The future integration of these applications with the e-government must be discussed. Besides, the linkage of the accreditation process with e-applications should be discussed. As shown in the above table 12, some data prepared under accreditation are presented. Some of these data are prepared on a computer-based some paper-based.

The United Modelling Language (UML) language is developed in order to be used in software development and is a common language that is used by different disciplines. In recent years, UML diagrams are frequently used in modelling studies conducted in the land administration field. ISO standard status of LADM has a great effect on this condition. Thanks to this standard, communication can be established between land administrations studies conducted with different purposes in different countries. UML is not only a practice structure, attitude or architecture, but also a method that models business processes and data structures [31, 32, 33, 34 35, 36].

UML sequence diagram is an interaction diagram. It shows objects, processes, the time, message or duration of a work conducted by a person or institution. UML use-case diagram is a summary scenario that will realise a single target or duty. The actor in this scenario is the thing that initiates or triggers events. This thing may be a corporation, person or external system. Use-case diagrams are diagrams that explain the things done by the system with the point of view of a third person. UML class diagrams, which allow object-oriented design in model development processes, are used in the study. In addition, UML activity, use-case and sequence diagrams are also benefited. By this way, business processes, beginning and completion points of works, relationship between works, data sets and sources of data are offered as semantics in realisation of database design for accreditation process [31, 32, 33, 34 35, 36].

So there are some flowcharts prepared by using Unified Modelling Language. Thanks to these figures it is easy to proceed this process based on a web-programming. Thanks to the sequence diagram for accreditation process in figure 7, it is now more understandable the accreditation process in legal entities and career plans terms together with some other details. In the same way figure 8 is just created as the sequence diagram for accreditation process and figure 9 served the class and classes' details.

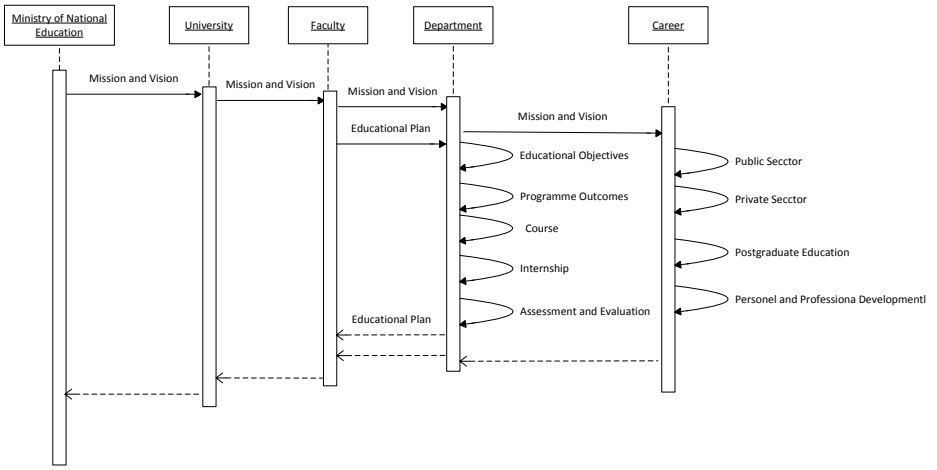


Figure 7. Sequence diagram for accreditation process

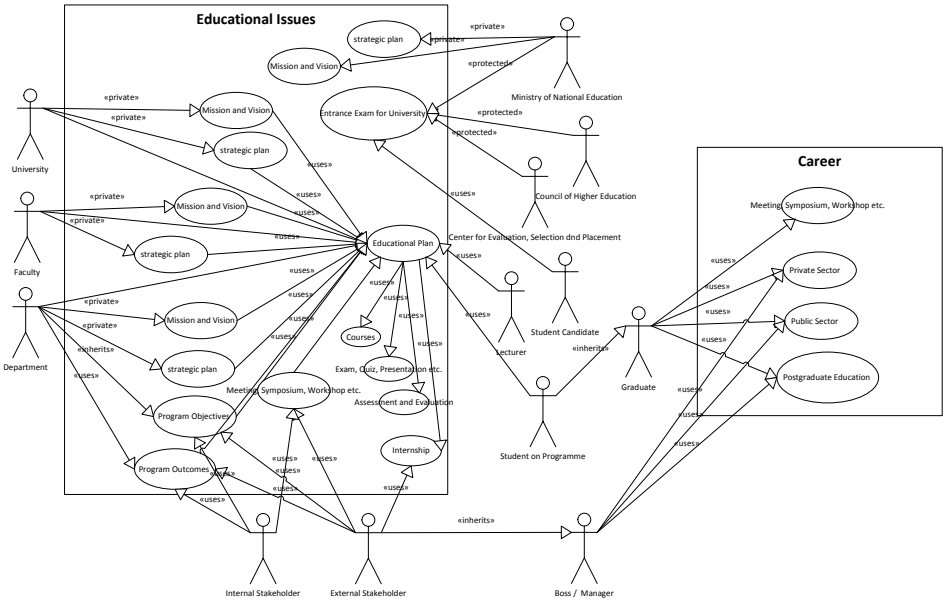


Figure 8. Use-case diagram for accreditation process

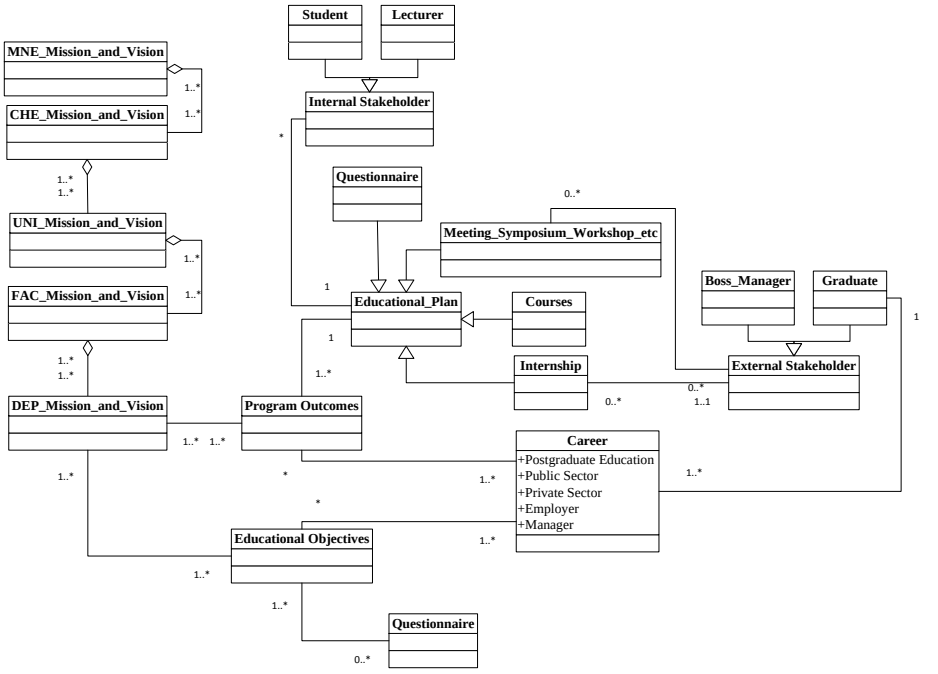


Figure 9. Class diagram for accreditation process

The use of these data in the accreditation process together with UML diagrams is provided via paper and via web. All data used in the accreditation process that should be discussed here should be able to be produced and reported through e-applications. For this reason, first the addition of the ability to present accreditation components on the existing e-application system, second the search for alternative ways of solving this issue, third the possible contribution of all these to the accreditation process, should be discussed.

5. CONCLUSIONS AND SUGGESTIONS

The accreditation processes of the leading universities of our country, the engineering programs launched in the 1990s, have continued and have begun to spread throughout the country in order to provide international competitiveness in the developing world. This process started in 2004 with the ABET accreditation of Istanbul Technical University in the field of Geomatics Engineering, and in 2007, with MÜDEK, the accreditation body of our country, with Yıldız Technical University; Selçuk University, Karadeniz Technical University, Kocaeli University, and Bülent Ecevit University.

The cooperation which HEC developed together with MÜDEK for the engineering field has been hugely successful. Then, the establishment of the Higher Education Quality Board was established in 2017. Thus, until that time, the accreditation process based on voluntariness has gained a legal identity. Also, "Higher Education Quality Assurance System" was established in university education.

The accreditation process also makes it possible to control many internal dynamics such as mission and vision of departments, educational objectives, program outputs, and academic staff. This process is process management conducted between the faculty members and students in the program, the engineers who graduated from the program and the employers who employ these

graduates. These are called internal and external stakeholders. The decision-making mechanisms in the process are not only lecturers but also internal and external stakeholders. All these internal and external stakeholders should be brought together thanks to the facilities such as related committee meetings, academic council meetings and the other platforms such as the "continuous improvement workshop," non-governmental organization meeting, etc. Subsequently, some outputs acquired from these platforms should be inserted into the program. A cycle of "quality assurance system" including program outcomes and program outputs belonging to the program should be established and operated. This cycle must also be linked to a "timeline." Thus, this cycle must be implemented independently and be controllable. Apart from that, some forms and documents can also be defined within the accreditation process. Desirably, all of this is done through the existing education system of the university. That is, to be realized systematically. Also, all these processes must also be operated online. Because the university has an online system that is actively used for course content and grading. Accreditation should also be carried out through this system.

For this reason, it may be suggested to do this regularly as a result of the case study. Some materials such as the course presentation forms, the program educational objectives and the inter-course relationship matrix, the course evaluation form, the counselling form, the final report for lesson, student surveys, student opinions, committee meeting reports, academic council decisions, workshop reports etc. must either be produced by the system or can be able to integrated into the system. In summary, it is proposed to increase the density of e-applications and web environments in the storage and presentation phase of table 12 presented in the discussion section. Thus, a faster, more accessible and more controllable system for the accreditation process can be introduced.

It is also true that some programs which are accredited are not at the same level of belief in this process. In non-accredited geomatics programs, the answer to the question of how to contribute accreditation is sought. For this reason, it will be beneficial to further promote this process with some support and encouragement to programs that are accredited by HEB. In this regard, accreditation of all geomatics engineering programs can be done without any compulsion. As a result, the accreditation process, which is explicitly addressed in the discipline of geomatics engineering, is available in only 6 of the 23 programs that provide active training in our country. The remaining 17 programs should be discussed regarding continuing education-teaching by transforming themselves into a situation compatible with the accreditation process. This will be very useful concerning students who will be graduated from these programs. This process can maybe be expected both HEB and students to work together. Thanks to last regulation and laws about higher education in Turkey, program managers, lecturers, and students must be handled their program situation to cope with another competitive rival. Hence, 16 programs that have not started teaching activity first, have turned into a situation compatible with the accreditation process, then the start of education-teaching should be expected. Establishment of consciousness in the society based on the importance and benefits of accreditation should be provided. For this purpose; it is also proposed to organize some events for employers, trainers, lecturers, and students, and also candidate students and make informative meetings. The web-based programme must be handled to proceed the accreditation process not only for geomatics department both also others.

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REFERENCES

[1] Aslan, B. 2009. Accreditation of higher education in different countries and improvements in Turkish higher education, Journal of Faculty of Educational Sciences 42, 1, 287-309.

[2] Hood, C. (1991). A public management seasons? Public Administration, 69 (1), s. 3-19.

[3] UNESCO- CEPES, (2004). Quality assurance and accreditation: A glossary of basic terms and definitions. Bucharest: CEPES.

[4] Oakes, T. J., (1999). A Guide to Organizations İnvolved with Licensing and Certification of Teachers and Accreditation of Teacher Education Programs. ERIC Number: ED437367

[5] Prados, J. W., Peterson, G. D., & Lattuca, L. R. (2005). Quality assurance of engineering education through accreditation: The impact of Engineering Criteria 2000 and its global influence. Journal of Engineering Education, 94(1), 165-184.

[6] Koehn, E. E. (1997). Engineering perceptions of ABET accreditation criteria. Journal of Professional Issues in Engineering Education and Practice, 123(2), 66-70.

[7] Lee, L. S., Ko, H. M., & Wang, M. T. (2017). Quality of Accreditation Services for Engineering Programs. International Journal of Engineering Education, 33(4), 1335-1344.

[8] Al-Yahya, S. A., & Abdel-Halim, M. A. (2013). A successful experience of ABET accreditation of an electrical engineering program. IEEE Transactions on Education, 56(2), 165-173.

[9] Kelly, W. E. (2007). Certification and accreditation in civil engineering. Journal of Professional Issues in Engineering Education and Practice, 133(3), 181-187.

[10] CRE, (2001). Towards Accreditation Schemes for Higher Education in Europe? Brussel: The Association of European Universities.

[11] CHEA (2017). CHEA Videos on Accreditation, http://www.chea.org/About/accreditation.html, Access: 01.10.2017.

[12] Durman, M., (2007). Quality Assurance in Higher Education and Developments in the Country (in Turkish), Education Faculties and Accreditation Workshop from Educational Science Point of View. AU, Faculty of Educational Sciences Publications, No: 204.

[13] ENQA, 2001. [Hämäläinen, K., Haakstad,J., Kangasniemi, J., Lindeberg,T., Sjökng,M.] Quality assurance in the Nordic higher education. ENQA Occational Paper. Helsinki: ENQA. [ISSN K58-1051]

[14] Danish Evaluation Institute, (2003). Quality procedures in European Higher Education an ENQA Survey. ENQA Occasional Papers 5. Helsinki: ENQA. http://www.enqa.net/files/procedures.pdf, retrieved from Aslan, B. 2009. Accreditation of higher education in different countries and improvements in Turkish higher education, Journal of Faculty of Educational Sciences 42, 1, 287-309.

[15] Kendall, J.S. (2001). A technical guide for revising or developing standards and benchmarks. Washington D.C. US Department of Education Office of Educational Research and Improvement.

[16] National Agency, (2005). 2004-2005 Final Report for the implementation of the Bologna Process in Turkey (in Turkish). Ankara: Punto Tasarım Matbaacılık.

[17] Official Gazette, (2005). Academic Evaluation in Higher Education Institutions and Quality Improvement Regulation, Number: 25942, Date: 20 September 2005.

[18] Higher Education Institution, (2017). History of Higher Education in the World and Turkey, and Present Management Systems, Second Edition, 2003-4. http://www.yok.gov.tr/documents/10279/8348772/ dunyada_ve_turkiyede _yuksekogretim_tar_ve_+bugun_sevk_ve_idare_sistemleri_2003-4.pdf/5a95fbfe-295c-48b9-a61c-37c3b4787771 Access: 07.10.2017.

[19] Turhan, Cigdem, Gokhan Sengul, and Murat Koyuncu. (2015). A Comprehensive Assessment Plan for Accreditation in Engineering Education: A Case Study in Turkey. International Journal of Engineering Education 31.5 (2015): 1270-1281.

[20] Gerring, J. (2004). What is a case study and what is it good for? American political science review, 98(2), 341-354.

[21] Official Gazette, (2017). Amendment Law on Some Laws and Decree Laws in order to support the development of the industry and production, 2017. Number 7033, No: 30111, Date: 01.07.2017.

[22] Yıldız O., Coruhlu YE, Demir O., Yılmaz H., (2016). SWOT Analysis of Turkey Surveying Private Sector, Karadeniz Technical University Scientific Research Project Report (in English abstract), FBB-2016-5469, 41pp.

[23] Yildiz O., Çoruhlu Y.E., (2017). the Turkish Surveying Private Sector, Fresenius Environmental Bulletin, vol.26, no.12A/2017, pp.8008-8022.

[24] Konecny G. (2002). Recent Global Changes in Geomatics Education, The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Vol. XXXIV, Part p, Commission VI, Symposium, September, Sao Jose'dos Campos-Brazil.

[25] Official Gazette, (1981). Higher Education Law, Law Number: 2547, Date: 6/11/1981.

[26] Power, M. (1999). The audit society, rituals of verification. Oxford: Oxford University Press.

[27] Levy, J. (2000). Engineering education in the United Kingdom: standards, quality assurance and accreditation. International Journal of Engineering Education, 16(2), 136-145.

[28] Said, S. M., Chow, C. O., Mokhtar, N., Ramli, R., Ya, T. M. Y. S. T., & Sabri, M. F. M. (2013). Accreditation of engineering programs: an evaluation of current practices in Malaysia. International Journal of Technology and Design Education, 23(2), 313-328.

[29] Official Gazette, (2017b). Regulation about Advisory Board for "Education Programs" of Higher Education, No: 30262, Date: 06.12.2017.

[30] Çoruhlu Y.E., Demir O., (2015). E-Government Servıces on Foundatıon Properties, Sigma Journal of Engineering and Natural Sciences, vol.33, pp.233-249.

[31] Egenhofer, M.J., and ve Frank, A.U., 1992. Object-oriented modeling for GIS. URISA Journal, 4 (2), 3–19.

[32] Page-Jones, M., 2002. Fundamentals of object-oriented design in UML. New York: Addison-Wesley. ISBN 020169946X

[33] Fowler, M., 2003. UML distilled: a brief guide to the standard object modeling language. 3rd ed. Pearson Education, Inc., Boston,
ISBN: 0-321-19368-7

[34] Inan, H.I., et al., 2010. Data model for the collaboration between land administration systems and agricultural land parcel identification systems. Journal of Environmental Management, 91 (12), 2440–2454.

[35] Çoruhlu Y.E., Yildiz O., "Geographical database for object-oriented land division modelling in Turkey", Land Use Policy, vol.68, pp.212-221, 2017

[36] Çoruhlu Y.E., Yildiz O., "Geographical data model for cultural immovable properties", Survey Review, vol.50, pp.487-500, 2018.

URL-1, (2017). http://www.ieagreements.org/, Access: 27.11.2017
URL-2, (2017). http://www.enaee.eu/accredited-engineering-degrees/, Access: 27.11.2017
URL-3, (2017). http://www.abet.org/, Access: 27.11.2017
URL-4, (2017). http://www.mudek.org.tr/, Access: 20.06.2017
URL-5, (2017). http://www.mudek.org.tr/doc/tr/MUDEK-Degerlendirme_Olcutleri_(2.1-23.12.2014).pdf, Access: 20.06.2017
URL-6, (2017). http://www.mudek.org.tr/tr/calistay/201610OD/20161009-MUDEKOlcutleri.pdf, Access: 15.04.2017
URL-7, (2017). https://www.iso.org/about-us.html, Access: 17.04.2017
URL-8, (2017)https://www.tse.org.tr/tr/, Access: 17.04.2017
URL-9, (2017). https://www.tkgm.gov.tr/tr/sayfa/surekli-kurumsal-gelisim-projesi-skgp, Access: 10.03.2017
URL-10, (2017). http://www.hgk.msb.gov.tr/images/egitim/87245f4b1d0d12c.pdf, Access: 10.03.2017
URL-11, (2017). https://www.engineersaustralia.org.au/resource-centre/resource/accredited-program-directory-accredited-engineering-programs, Access: 27.11.2017
URL-12, (2017). https://yokatlas.yok.gov.tr/onlisans-anasayfa.php , Access: 26.07.2017
URL-13, (2017). https://yokatlas.yok.gov.tr/lisans-anasayfa.php, Access: 26.07.2017
URL-14, (2017). http://www.mudek.org.tr/tr/akredit/akredite2017.shtm, Access: 26.07.2017