Evaluation of Software Development Stages for Turkish Cypriot Companies

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ABSTRACT

Software process is a set of activities that are used to produce software. The presentation of a simplified software process is shown in a special perspective such as workflow, data flow and role-action. There are some models designed to follow during this process which helps software improvement such as Waterfall, Spiral, Agile, Scrum and etc. To achieve competitiveness, Capability Maturity Model Integration (CMMI) is another important process model that should be used by companies.

For this study, the aim is to find out the properties of the software sector in Turkish Republic Northern Cyprus (TRNC) and investigate how companies handle their software management process. The 11 companies in TRNC chosen have shared their experience on sector issues. Each of them has given details about their working areas, team, structures and models that are used, the development environment and maintenance policies. They have also shared their opinions about the software sector in TRNC, the problems and shortcomings of this sector and what has to be done to improve it. Common and contradictory points that are shared by these companies are determined.

The results of our analyses showed that the informatics sector in TRNC has some problems and shortcomings. With the recommendations stated, these problems can be eliminated and the industry can be improved.

Keywords: Software process, software process models, CMM, CMMI, the TRNC software sector.

ÖZ

Yazılım süreci, yazılım üretmek için kullanılan bir dizi aktivitedir. Basitleştirilmiş bir yazılım sürecinin gösterimi, iş akışı, veri akışı ve rol eylemi gibi özel bir bakış açısıyla gösterilir. Şelale, Spiral, Çevik, Scrum gibi yazılım iyileştirmeye yardımcı olan bazı yazılım geliştirme yaşam dairesi modelleri vardır. Rekabetçiliği sağlamak için şirketler tarafından kullanılması gereken diğer önemli bir süreç modeli ise Tümleşik Yetenek Olgunluk Modeli (CMMI)'dir.

Bu çalışmadaki amaç KKTC'deki yazılım sektörünü ve şirketlerin yazılım yönetim süreçlerini nasıl yürüttüğünü incelemektir. Seçilen 11 şirket bu konudaki deneyimlerini paylaşmıştır. Her biri, çalışma alanları, ekibi, yapıları ve kullanılan modelleri, geliştirme ortamı ve bakım politikaları hakkındaki detayları paylaşmıştır. KKTC'deki yazılım sektörü ile ilgili görüşlerini, sektörün sorunlarını ve eksikliklerini ve bunu iyileştirmek için neler yapılması gerektiği hakkındaki görüşlerini de sunmuşlardır. Daha sonrasında bu şirketler tarafından paylaşılan ortak ve çelişen noktalar tespit edilmiştir.

Yapılan çalışma sonucunda elde edilen analizlerin sonuçları, KKTC'deki bilişim sektörünün bazı sorun ve eksikliklere sahip olduğunu göstermektedir. Önerilecek tavsiyelerle bu sorunlar ortadan kaldırılabilir ve endüstri gelişebilir.

Anahtar Kelimeler: Yazılım süreci, yazılım süreç modelleri, CMM, CMMI, KKTC yazılım sektörü.

To my family and friends

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INTRODUCTION

1.1 Background

A software process is a set of related activities that include software specification, design, implementation, verification, validation and maintenance. There are other activities such as configuration, change management, quality assurance, and project management and user experience. These activities are called supporting activities. (Gabry, 2017)

Gabry (2017) defines software process model as: "A software process model is a simplified representation of a software process. Each model represents a process from a specific perspective". Waterfall, Spiral, Iterative, Incremental, Prototype, Agile and Scrum are some well-known methods. Waterfall is useful when the requirements are clear and known well at the beginning of the project. It is a step by step approach. Before starting the next step, the previous step has to be done and then documented whether the project will continue. For large projects, it may not be that much suitable, because in long term customer's request may change and this model does not support customer-company interaction.

Spiral model is to redesign the processes of analysis, planning, design, coding and testing for each requirement by dividing the needs of customers into groups. Each group is examined at certain risks. This method is useful for large or highly risky

projects. Gabry (2017) states that “The risks might be due to cost, schedule, performance, user interfaces, etc. Risk analysis requires highly specific expertise, and project’s success is highly dependent on the risk analysis phase”.

In the Iterative model, a part of the software (using essential requirements) is determined and designed as a small application, and this process is repeated with the new version of the software produced at the end of each iteration of the model, by adding more requirements (Temur, 2013).

In the Incremental model, each version of software produced is developed to include an increasing number of functions. Each module's requirements go through the design, implementation and testing phases. It is suitable for projects that may take a long time, when the partially designed system may function with incomplete functionality (Duran, 2009).

In the Prototyping model, the software is developed in pieces. These pieces are then used to evaluate and test some aspects of the system that are relevant to the requirements of the system. This model begins with information gathering and rapid testing, and then prototypes are produced and given to consumers for evaluation. When the customer is satisfied with the produced product, the prototype can be expanded to meet the needs of the whole system, or the prototype can be completely removed (SIRIUS IT, 2015).

The Agile method is efficient for small projects which include change requirements almost in each phase since the interaction with customer is a lot. It is basically similar to the iterative model and it provides improvement by using the human

factor. Throughout the development process, the feedback of the software team is exploited, so it is good for saving time and money for the company.

Scrum is the subset of Agile project management methodologies. It is based on short cycle output generation and feedback. It aims to develop priority requirements for the project. It can easily apply the changes needed throughout the project time. One of Scrum's innovations is the graph that shows the project progress clearly and continuously, so project managers can see the status of the project immediately.

1.2 Thesis Contribution

In this study, the informatics sector is analyzed to examine how the software sector operates in TRNC. According to the findings, there are around 33 informatics companies and 11 of them accepted to have an interview. In addition, 6 out of these 11 companies are bigger companies with more than 8 employees. Interview findings for these companies are stated and recommendations are provided to improve sectoral shortcomings. Since there is no such study before, this thesis is the first study in this area in TRNC.

1.3 Thesis Outline

This chapter introduces the concept of this thesis. Chapter 2 introduces a literature review about software process level improvements. Chapter 3 gives information about the software companies in TRNC. Chapter 4 outlines the results of interviews which are conducted with companies. Chapter 5 gives statistical information about companies which have CMMI certification. A discussion on interview findings is given in Chapter 6. In Chapter 7, recommendations for future works are provided according to the results which are given in Chapter 4. Chapter 8 is the conclusion of this study.

Chapter 2

LITERATURE REVIEW

2.1 Capability Maturity Model (CMM)

CMM is developed for measuring the maturity of a company in software development. Susan (2006) explains the origins of CMM as follows:

> In November 1986, the Mitre Corporation and the Software Engineering Institute (SEI), under the leadership of Watts Humphrey, were tasked by the U.S. Department of Defense to develop a way to assess the ability of its software contractors. The result of this effort was the Capability Maturity Model for Software (CMM). (p. 27)

As a hierarchical model, in CMM, there are 5 maturity levels, 18 key process areas, 52 goals, 316 key practices and many sub-practices and examples (Paulk, 1998). Maturity levels are from 1 through 5; Initial, Repeatable, Defined, Managed and Optimizing, respectively.

CMM has now wide acceptance in the software sector and it is used by many organizations worldwide. It is for any project in any environment. Jiang et al. (2004) indicates "The CMM focus is on 'what' organizations should do and not 'how' they should do it" (p. 286). Jiang et al. (2004) mention that: "One study found that the median time for an organization to move up one level of the five-level CMM is between 21 and 37 months" (p. 280).

Table 1 shows which process areas are involved in CMM at which levels of maturity.

Table 1: Key Process Activities for CMM (taken from Jiang et al., 2004)

Maturity levels	**Characteristics**	**Key process activities**
Level V: Optimizing	Process optimization	• Process change management • Technology change management • Defect prevention
Level IV: Managed	Measuring quality of development process and its product	• Software quality management • Quantitative process management
Level III: Defined	Process engineering	• Peer reviews • Intergroup coordination • Software product engineering • Integrated software management • Training program • Organization process definition • Organization process focus
Level II: Repeatable	Basic project management	• Software configuration management • Software quality assurance • Software subcontract management • Software project tracking and oversight • Software project planning • Requirements management
Level I: Initial	Chaotic, few if any process	• None

2.2 Capability Maturity Model Integration (CMMI)

Due to some change requests by CMM users and in order to integrate various other CMM process models, Software Engineering Institute (SEI) developed CMMI, with funds of the U.S. Department of Defense and the Systems Engineering Committee of the National Defense Industrial Association (NDIA) (Land, 2006). There are 3 versions of CMMI which are released in 2000, 2006 and 2010, respectively. Organizations that want to be successful want to carry out roles, tasks and control processes with systems that are better defined and tracked. Now, CMMI is used by organizations to raise performance in 101 countries.

Table 2 shows which process areas are involved in CMMI version 1.3 in which categories at which levels of maturity.

Table 2: Process Areas, Categories and Maturity Levels of CMMI

Maturity Level	**Process Area**	**Category**
5	Causal Analysis and Resolution (CAR)	Support
5	Organizational Performance Management (OPM)	Process Management
4	Organizational Process Performance (OPP)	Process Management
4	Quantitative Project Management (QPM)	Project Management
3	Decision Analysis and Resolution (DAR)	Support
3	Integrated Project Management (IPM)	Project Management
3	Organizational Process Definition (OPD)	Process Management
3	Organizational Process Focus (OPF)	Process Management
3	Organizational Training (OT)	Process Management

3	Product Integration (PI)	Engineering
3	Requirements Development (RD)	Engineering
3	Risk Management (RSKM)	Project Management
3	Technical Solution (TS)	Engineering
2	Configuration Management (CM)	Support
2	Measurement and Analysis (MA)	Support
2	Project Monitoring and Control (PMC)	Project Management
2	Project Planning (PP)	Project Management
2	Process and Product Quality Assurance (PPQA)	Support
2	Requirements Management (REQM)	Project Management
2	Supplier Agreement Management (SAM)	Project Management

CMMI has 2 types of representation which are staged representation and continuous representation. The difference between them is that organizational maturity pertains to a set of process areas across an organization, while process area capability allows to select a specific process area and make improvements in that area. The staged representation is called a maturity level. There are five distinct level of maturity from 1 through 5; Initial, Managed, Defined, Quantitatively Managed and Optimizing, respectively. It defines an improvement path for an organization. The continuous representation uses capability levels. There are six capability levels from 0 through 5; Incomplete, Performed, Managed, Defined, Quantitatively Managed and Optimizing, respectively.

2.2.1 Maturity Levels (Staged Representation)

Maturity levels help institutions to answer the following questions: "Which processes are best for me? Where should I start? ". The institution chooses which process areas

to target by targeting a maturity level. The level required by the institution is one more than the lowest level of maturity that is available. All institutions meet at least the first maturity level, because to be at the first maturity level, the existence of the institution is enough. Therefore, the lowest maturity level to be targeted is the second maturity level.

Level 1 (Initial): None of the process areas of the second maturity level are implemented in a completely consistent manner. In a company of this level, employees have different ways of doing their own particular business to do the same job. Institutions at this level generally promise more but fail to keep some of their promises. It is normal for employees to be assigned to more jobs than they can handle, and it is often adopted as a management style. Projects are usually completed with more cost and time than estimated. Product faults are found mostly when customers use the product. The maintenance and support costs of the product take more time than to develop the product. This also makes it difficult to plan new projects and keep promised dates. At this level, processes may be defined on paper, but processes may be abandoned in difficult times (Kalaycı, 2007).

Level 2 (Managed): In a company of this level, not all employees of the company have begun to work in the same way, but may work in the same project. To achieve this level, it is necessary to establish senior management and mid-level management (project management) levels within the company. The institutions develop methods to estimate the total cost and duration of the project to maintain their promises. They do not want excessive commitments from employees. Institutional management can focus on the company's long-term strategic goals. Project managers are both

responsible and authoritative and are relied on the solution and management of daily project problems.

At this level, process applications differ between projects. Projects should be allowed to experiment with different process approaches in this period in order to find the most suitable processes for the institution. There is no common process definition at this level. Projects need to know what the institution is prioritizing when defining their own processes. For example, reducing costs for an organization may be a top priority while short delivery times are more important for another company. One of the most important features of this level is that the projects will be reviewed by senior management at certain time intervals and at important stages. The future of the institution as well as the success of the project is always kept on the frontline. A project owner assigned by the top management has an important place in each project that achieves this balance among the project stakeholders (Kalaycı, 2007).

Level 3 (Defined): At this level, a company has formed its corporate identity. Instead of depending on people, the company has a way of doing business. There may be more than one way for the same project, but this difference is definitely less than for a company at level 1. For example, there may be three different methods for small, medium and large projects according to project size.

Companies at this level have common job descriptions throughout the organization. At this level the process definitions such as inputs, outputs, verification points, input-output criteria, roles, metrics, etc. are more detailed. Since the projects are handled in a similar way, it is now possible to make cross-project benchmarks and take advantage of the experience from other projects. These institutions make more use of

past estimates in their cost and time estimates for new projects. They are more conscious of the promises they give to customers. Most of the faults on the product are discovered before submitting to the customer, even in the early stages of the project, for example during the design phase. One of the most important differences of this level is the determination and provision of the needs and expectations that are not expressed by the requirements expressed by the customer (Kalaycı, 2007).

Level 4 (Quantitatively managed): At this level, companies measure and compare the forms of doing business, since the employees work similarly. The focal point is to get similar results for similar jobs. Companies at this level have become able to use numerical methods to manage their projects, with the infrastructure provided by the previous level of maturity. They recognize the problems of performance in their projects using statistical analysis of the early stages of the project, on the basis of the sub-processes they choose.

Cost and time estimates are highly successful. Great success is also seen in predicting the resources to be assigned to the projects as well as accurately estimating the promises given to the customer. Project achievements are much higher (Kalaycı, 2007).

Level 5 (Optimizing): CMMI Product Development Team (2010) indicates as "At maturity level 5, an organization continually improves its processes based on a quantitative understanding of its business objectives and performance needs" (p. 29). For companies at this level, process improvement decisions are based on numerical data. Common problems are identified and common solutions are developed for it. The improvement that will bring the highest return on investment to the institution

can be numerically calculated. With the improvements made, the performance or efficiency of the projects is much higher and the project costs and durations are considerably reduced. Profitability ratios are very high at these level companies. It focuses on the general variability of the sub-processes selected at this level such as statistical averages, lower bound and upper bound limits and provides institution-wide improvements in process outcomes. One of the most distinctive features of this level is the importance given to innovativeness. Innovative improvement recommendations as well as incremental improvements for process improvement work are also encouraged (Kalaycı, 2007).

2.2.2 Capability Levels (Continuous Representation)

When continuous representation is used, individual levels of competence are identified for the process areas. Continuous display is an approach that allows selecting the process areas to improve from process areas for process improvement. The lowest level of competence that a process field can have is "0" (zero). That process area does not exist in the institution or in other words it is not implemented. The highest level of competence is "5" (five). In order to use this type of representation, institution and its process area should be known as well as the relationship between the process areas.

Level 0 (Incomplete): In (CMMI Product Team, 2006), this level is defined as: “An incomplete process is a process that is either not performed or partially performed. One or more of the specific goals of the process area are not satisfied and no generic goals exist for this level since there is no reason to institutionalize a partially performed process.” (p. 33). This level of capability and the first level of maturity are the same.

Level 1 (Performed): In (CMMI Product Team, 2006), it is mentioned that: "Performance may not be stable and may not meet specific objectives such as quality, cost, and schedule, but useful work can be done." (p. 33). In this level, some work is done but there is no proof that it works well for the institution.

Level 2 (Managed): CMMI Product Team (2006) states "A managed process is planned, performed, monitored, and controlled for individual projects, groups, or stand-alone processes to achieve a given purpose." (p. 33). The model objectives and other objectives such as cost, schedule, and quality are managed in this level. Some metrics are consistently collected and applied by the management.

Level 3 (Defined): In (CMMI Product Team, 2006), this level is defined as: "It is tailored from the organization's set of standard processes according to the organization's tailoring guidelines, and contributes work products, measures, and other process-improvement information to the organizational process assets." (p. 33).

Level 4 (Quantitatively managed): CMMI Product Team (2006) states the following:

> A capability level 4 process is characterized as a quantitatively managed process. A quantitatively managed process is a defined (capability level 3) process that is controlled using statistical and other quantitative techniques. Quantitative objectives for quality and process performance are established and used as criteria in managing the process. Quality and process performance is understood in statistical terms and is managed throughout the life of the process. (p. 34).

Level 5 (Optimizing): CMMI Product Team (2006) indicates as follow:

> An optimizing process is a quantitatively managed process that is improved, based on an understanding of the common causes of process variation

> inherent to the process. It focuses on continually improving process performance through both incremental and innovative improvements. (p. 34).

CMMI has two ways of representation as continuous and staged, as explained above.

In addition, the comparison of both representations is shown below in Table 3.

Table 3: Comparison of Using Each Model Representation (taken from Erdoğmuş, 2009)

Continuous Representation	**Staged Representation**
It gives flexibility to make improvements in accordance with job objectives.	Ensures for the institution that a predefined and proven healing program is implemented.
Creates more visible information about the ability of each process area.	Describe the process groups required for the institution to reach a certain level.
Skill leveling is not widely shared with the outside world, it is used for improvement within the organization.	Maturity levels are shared with management and external world.
Recognize different healing opportunities at different speeds for different processes.	Determine the process improvement results in a simple form - the number of maturity levels.
Return of investment (ROI) is not known as the approach is new.	Return on investment (ROI) is demonstrated by experience.
Compatible with the ISO 15504 approach.	Easier to switch from CMM.

Chapter 3

TURKISH REPUBLIC OF NORTHERN CYPRUS (TRNC) COMPUTER SOFTWARE SECTOR

3.1 List of Companies

In this section, a list of software companies operating in TRNC is given. Each company is presented with its major business area.

3.1.1 Analiz Systems

Year	Number of Employees	Founder(s)	Address
1998	12	Sultan Taçyıldız	103 Salamis Street, Yenişehir, Famagusta.
http://www.analiz-systems.eu/			

Analysis systems (ÖZGÜ) Ltd. Information Technology is a technology company operating in the sector. Sale of all kinds of hardware of the firm is guaranteed by sales points of Newtech Technology Market in Famagusta, Nicosia and Morphou. Newtech Technology Market also provides technical service to customers. Producing of software products in several different business areas (Business Operators, Manufacturers, Auto Galleries and Garages, Shipping, Hotel Management, Accountancy etc.) are continued and the required special software is prepared by the software group.

3.1.2 BtDays Technology

Year	Number of Employees	Founder(s)	Address
2005	3	Göker Toplu Ahmet Paralik	Eti Road. No: 11 / 1 Kumsal, Nicosia.
http://www.btdays.com/			

BtDays Technology continues to develop software on payment systems for 12 years.

3.1.3 Comtech

Year	Number of Employees	Founder(s)	Address
1992	-	Hilmi Kansu	11 Memduh Asaf Road, Köşklüçiftlik, Nicosia.
http://www.comtechmax.com/			

Comtech has always been a pioneer in the Information and Communication Technologies (ICT) sector. As the first Internet Service Provider (ISP) company in TRNC, Comtech has been providing system integration solutions, software, hardware and many other key solutions for many years. Comtech is the first technology company that provided services with an ISO 20000 certificate in TRNC.

3.1.4 Denizler Bilişim

Year	Number of Employees	Founder(s)	Address
2014	12	Lisani Deniz	36/B Mimar Mehmet Vahip Street, Nicosia.

http://denizlerbilisim.com/

Denizler Bilişim offers a wide range of services in Cyprus and the opportunity to provide all of the Information Technology services through its experienced service team.

3.1.5 Etesia Software

Year	Number of Employees	Founder(s)	Address
2012	4	Burçin Soyer Şöhret Soyer	Mustafa Kemal Street, Halil Hamza Way, Filo Apt No: 4, Famagusta.
http://www.etesiasoftware.com/index.html			

Etesia Software & Informatics Services is a dynamic, innovative technology company that develops software solutions using the latest technological developments and strategies to meet basic automation requirements.

3.1.6 Figensoft

Year	Number of Employees	Founder(s)	Address
1997	10	3 siblings	EMU Techno Park, Office No: 16, Famagusta.
http://www.figensoft.com.tr/			

The partnership of Figensoft with Turkcell started in 2002. The first office abroad was opened in Baku, Azerbaijan in 2005. The second office was started in TRNC in

2009. Figensoft is a partner of Azercell in Azerbaijan and North Cyprus Turkcell in TRNC. Figensoft has been the business partner of Turk Telecom and Vodafone Turkey since 2008.

3.1.7 GigaByte Ltd.

Year	Number of Employees	Founder(s)	Address
1994	3	Yılmaz Kaygısız	Fener Road, Nicosia.
http://www.gigabyteltd.com/			

In 1997, GigaByte became a company that produces and provides solutions to network and automation solutions. In 1998, it became the first domestic company to produce and support solutions for Market and Store automation. With its IBM solution partnership in 1999, it has developed software solutions for devices such as pricing devices, barcode printers and tagged scales, which are used in the country by serving in the retail sector. In 2003, it introduced solutions for palm-based devices and handheld computers and provided these products for their own market. In 2005, the company expanded its work on mobile applications.

3.1.8 KKTCELL

Year	Number of Employees	Founder(s)	Address
1999	3	Turkcell, Turkey	Salih Mecit Road, No.1, Kızılay, Nicosia.
https://www.kktcell.com/			

Turkcell Communication Services started to serve its subscriptions in TRNC as the 4th external affiliate of Turkcell, Turkey. It continued its development over the years by increasing the diversity of its services based on mobile voice and data communications offered to its subscriptions, increasing its quality and accordingly the number of its subscribers.

3.1.9 Mobilon Software

Year	Number of Employees	Founder(s)	Address
2016	2	Ömer Güveniş	EMU Techno Park, Famagusta.
http://www.mobilonsoft.com/			

Mobilon Software is a fast paced software development company and specialized in developing mobile apps. Team has been in the software development business for almost a decade, and in mobile development for several years. The company is based in TRNC but it works with clients from all around the world.

3.1.10 Outsource Software

Year	Number of Employees	Founder(s)	Address
2009	8	Sultan Taçyıldız Şeren Sözgen	103 Salamis Street, Yenişehir, Famagusta.
-			

In particular; Outsource Software has developed automation software for government offices and continues to develop this type of software.

3.1.11 Sentez Bilgisayar

Year	Number of Employees	Founder(s)	Address
1996	11	Şeren Sözgen	Mehmet Akif Street, Köşklüçiftlik, Nicosia
-			

Sentez Bilgisayar mainly operates in the Finance and Enterprise Resource Planning sector and produces on-shelf software. This company rarely produces special software in the direction of requests, but it is not the main policy.

Chapter 4

INTERVIEW RESULTS

In this part of thesis, the interview questions and results with company executives will be given in a question and answer format. Questions are prepared by me and my supervisor by checking development stages of software project. I am the person asking questions and BK stands for me.

4.1 Questions

1. Do you use CMMI model? If yes, which level do you have?
2. What kind of projects do you work on? (Only on specific topics or any topic)
3. What about the duration of projects, number of people who work and cost of projects?
4. Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)
5. What about the change requests during project? Do you prepare the requirements document before starting the project?
6. Do you have any Research and Development (R&D) project?
7. What development environment do you use? (About OS, UML, programming languages, etc.)
8. Do you work on accounting, stock control and banking packages? If yes, do you update these packages?
9. What is your maintenance policy? (1 year/2 years/every year)
10. What do you think about the informatics sector in TRNC?

11. What are the shortcomings and problems?

12. What can be done to improve the situation?

4.2 Interview with Analiz Systems

ST stands for Sultan Taçyıldız who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

ST: We tried to use it. We have a Level 2 CMMI certification. However, in order to be able to use it in TRNC your company must be large-scale one. Maturity level of the customer is also important. They even do not understand the importance of the system analysis you do at the beginning of the project.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

ST: We have accounting software called Expert for private companies. About 70% of accountants in the finance sector use this software. We also have software for various sectors including stock control. We also develop software for government agencies. We work locally and have no connection with abroad.

BK: What about the duration of projects, number of people who work and cost of projects?

ST: There are only 5 people in the technical support team and 7 people in the software team. We are the most crowded IT Company in TRNC. The package program Expert is our continuous project. We constantly continue to develop it and give support to it. Generally, at the beginning, the size of the project is not clear due to the customer. Usually there is a big difference in the size you set. In the conditions of the TRNC, this difference is more than normal. There are a lot of people who do this job amateurish because of the small market.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

ST: The Scrum method is most suitable. More iteration is required. You have to constantly talk with the customer here and constantly make changes. In TRNC, you cannot start the project by specifying milestones like in CMMI.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

ST: It happens all the time. Even if we do a contract, nothing changes. You prepare the contract and send it for signing, and they say you start without signing. This is the approach in TRNC.

BK: Do you have any Research and Development (R&D) project?

ST: We constantly work with new technology. We improve ourselves, because the sector is improving. We did not even have Windows when we graduated. I think every program; each piece of software is an R&D project. Current projects are constantly improving too. Since there is no copyright law in TRNC, and customers install new operating system (OS) freely on their devices, they want every program for the latest version of OS.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

ST: We usually work with Windows. In previous versions I was using Visual FoxPro. We now develop our new versions in C # and Java. We try to work with SQL. We do not prefer to use Oracle. We also use the Microsoft Azure platform, because we are thinking of moving our software to the cloud environment.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

ST: We left the banking module years ago. We constantly add customer requests to our packages. Our work is software as a service for software package which is called

Expert. We do not sell programs, we sell services to people. We give user support, consulting and make program changes by ordering no extra budget.

BK: What is your maintenance policy? (1 year/2 years/every year)

ST: We have a monthly agreement. There is a service charge. As long as there are no special changes, we cover the necessary program changes with the same budget.

BK: What do you think about the informatics sector in TRNC?

ST: We are very backward. We use the wrong approach. People are not aware of the importance and value of software. They suppose that they use the program to bill out. They do not know anything about project analysis. As the market is small, we are too small in terms of scale.

BK: What are the shortcomings and problems?

ST: We cannot find qualified staff. The qualified staff does not stay here for long. Other staff thinks they are very good. When an applicant comes to you, he first has to know how to act. We started this way. The new staff has to realize that you do not know much and you should try to improve yourself. When you finish the university, you only know basic things about your job. You should not think you know everything. In our university years, our instructors used to tell us that they have given brick and mortar, but we will find how to use them. We can do the small house or the skyscraper. You need to constantly develop yourself. There is a lot of work we need to do in terms of software development and evaluation. We have a disadvantage. A college graduate opens a software company. Then he does a job and he does not know the value of the software himself, so he proposes 1000 TL for a project of 10000 TL. Everyone prefers to give the job to him, but that person cannot handle it. This time they think that in TRNC we cannot do this job. Now they give government projects to Turkey. E-state project was given to companies from Turkey, because

they decided that it cannot be done in TRNC. If you do not show value of the project, it will not end or work well. Even the state solves their own work using Excel. There are many roads to be taken in the TRNC, but first we have to accept the value of software. Gains and salaries are low too depending on it.

BK: What can be done to improve the situation?

ST: I've been working for 25-30 years. You will do the same thing. People need to raise awareness. Computer engineers should stand together for importance of this job. Legally it needs to be regulated. The value of your profession should be increased. It is like everyone can do this job, however software is a serious production type. It's a smokeless industry, and it is not influenced by neither transportation nor the embargoes. Universities and industry are disconnected in TRNC. Let's not let local projects out. I think this profession will come in better in the future. This sector is a sector that can develop. We should work together to grow up. Now my point of view is to enlarge the sector.

4.3 Interview with BtDays Ltd.

AP stands for Ahmet Paralik who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

AP: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

AP: Payment systems and loyalty applications

BK: What about the duration of projects, number of people who work and cost of projects?

AP: We have 3 people in total. The POS development of banking application is about 3 months. There are short term projects and long term projects. For example, we are developing an application for Arçelik. There is a card that keeps spending

points for customers. We are developing computer side applications of it as well. Loyalty applications mean customer loyalty cards.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

AP: We build our own algorithm to know where we will be at a specified point. We share these with the customer so they can follow us. There are institutions we work with. For example, we are developing a self-service payment system project for K-PET (Kıbrıs Türk Petrolleri Ltd.). There is another company that develops software connected with us. They also check if we follow our deadlines or not. If we do not, they will be in trouble. It is same for us too. At this point there is a team work.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

AP: Initially, the system analyst figures out how the project will be. He prepares the necessary documents and whole company starts to develop according to those documents. Depending on the document, we accept change requests, because it has to be done in some way if the customer wants it. If necessary, extra budget is set as man/day and is added.

BK: Do you have any R&D project?

AP: Yes, if we think of our new productions as R&D projects.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

AP: We develop our software on Windows by using Visual Studio C and C++. Mobile software is done by a partner of our company in Turkey. We only do POS machine software here.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

AP: We do not have those software packages. We offer solutions for mostly institutional needs.

BK: What is your maintenance policy? (1 year/2 years/every year)

AP: We do maintenance contracts with banks for each term. Sometimes they do not demand a few years. When something comes up later, they want project-based updates, but we do not have a constant maintenance agreement.

BK: What do you think about the informatics sector in TRNC?

AP: The quality of people is too low. I think that the staff working in institutions and organizations are not qualified enough by information and education as well. The human resources are very few.

BK: What are the shortcomings and problems?

AP: As I said, the biggest problem is the quality of trained staff.

BK: What can be done to improve the situation?

AP: We must open to abroad.

4.4 Interview with Comtech

HK stands for Hilmi Kansu who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

HK: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

HK: First 15 years, of our company, we have worked on every subject up to needs. We made an election program for the high court years ago. Also at that time, there was a demand from the milk establishment for the needs of the animal producers. In addition a bank wanted a banking package. We've been Ericson's partner for 20

years. We conduct projects together in different parts of the world. The goal is to achieve success.

BK: What about the duration of projects, number of people who work and cost of projects?

HK: First I need to know how much man / hour I need. I determine what qualities I want for my staff. I also determine what the hourly payment of that staff. All of this constitutes the sub-structure of the proposal I give to the project.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

HK: I do not believe in such named methods. Before you get a project, you should be a good listener. You take the customer's request and do a very good analysis and determine the real needs of the customer. As an engineer our duty is to report the things that the customer cannot see. This document should be on a level that everyone can understand which is called Layman's language. Then you should be sure to give it to the customer and understand it the same way. Co-compatibility between the customer and you is very important. If you understand each other very well, you must sign a contract. This contract must contain all information about what budget is, when the project will finish and etc.

Our latest European Union project was to transform the entire communication infrastructure of the TRNC into a new generation network. We have done this successfully. For example, Ericson's main headquarters is Sweden, but in almost every country they have a center. If Ericson does not apply project management standards at this point, it will not be able to do it in the whole geography. Otherwise you cannot control any work. Unfortunately, it is difficult to implement these rules in the TRNC.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

HK: Absolutely a contract must be made. Processes, budget, time, delays should be specified in the agreement. Except for structural changes, we increase the price of the work by 25%. If there is a structural change, we evaluate the project from the beginning.

BK: Do you have any R&D project?

HK: We have made changes to Ericson devices that have access to broadband internet in every home to handle TRNC requirements. We would put a box on every street and take a line to every house. Thus each house would have a capacity of 100 MB internet. Each box is capable of supporting 96 homes. However, this project was prevented.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

HK: -

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

HK: When customer requires updates, we do.

BK: What is your maintenance policy? (1 year/2 years/every year)

HK: Yearly.

BK: What do you think about the informatics sector in TRNC?

HK: In the TRNC, there is no way to implement specific types of project management methods. Beyond project management methods, I believe that ISO standards are more important. We have ISO 20000 and 27000 standards. The aim is to keep the service quality given to the consumer high. All processes must be

documented. I think it is necessary to maintain a standard for the services of the whole company when working on project.

BK: What are the shortcomings and problems?

HK: There are problems brought by the small industry. We have been doing projects for many years. In the TRNC you starve if you move on a vertical line (on one subject). For example, I made a selection program and sold it to one institution only. A maintenance contract is needed to make a project sustainable. Since there was no such culture in the past, when you finished the project, you took your money and everything is over.

BK: What can be done to improve the situation?

HK: It's hard to be creative if we do not specialize vertically. It should be concentrated in a single area and around it. The vertical line can be slightly deviated. The goal should be to achieve success, not implementing the rules.

4.5 Interview with Denizler Bilişim

LD stands for Lisani Deniz who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

LD: We do not use CMMI. It is not effective in our country because of small scale of companies. Therefore, companies determine their own methods to do the project faster. The situation is not different in other sectors as there are all small-scale enterprises in the country. CMMI is essential in large-scale projects or international projects. You have to define everything within your duties and responsibilities. Otherwise, you go back or fail in a place that is caused by lack of communication. This causes time and cost. We do not use CMMI, but we do apply features of CMMI to projects we have done abroad.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

LD: We have 2 specific topics. One is electronic payment systems (electronic money), other one is electronic certificate service provision (electronic signature process and its software and applications). We do not have any source to work on for other topics. Nowadays we serve the entire world electronic money or payment systems. We just accept outsource works. The customer is known by the one who gives the job to us. We got the authority of electronic certificate service provider at the end of 2016. We also write applications that are related to electronic signature so that the electronic signature can be generated and integrated. There is an infrastructure. At the beginning of 2017, we started to use e-signatures. They make international money transfers in banks with secure electronic signature. Nowadays, cybercrime has increased and is a serious problem. Documents signed with electronic signature cannot be broken or changed. If it is opened by someone else, it breaks the signature. It is also used on the board of directors of companies. The universities started to use it in their internal correspondence. It makes the paperless environment legal. We work with lawyers who are on the side of information crime or who are experts in information law. The provision of electronic certificate services is an infrastructure that enables all of government jobs such as signatures, e-bills, e-books, e-stamps to be made at legal level. We only provide certificates.

BK: What about the duration of projects, number of people who work and cost of projects?

LD: For e-signature, during the 2.5 years, with 8 people an infrastructure was set up to look after this job alone. It is an investment with approximately 3 million euros. For this job, it was necessary to get some international certification trainings. We worked with 6 lawyers from abroad, 2 of them from Europe, 2 of them from Turkey and 2 of them from TRNC, because you need to pass these standards in order to be

able to give e signature certificate. In your software, ETSI standards must be produced in accordance with the standards set out in the Directives of the European Union. It took 2.5 years for them to be tested. We first wrote the project. We checked the examples in the world and used technology. Then we created the budget, time and human resources to be allocated for this. We got some training about it and got their certification. At the end of the year, we applied the requirements of Information Technology and Communication Board in July 2016. When we started work, we prepared the project document. After that, we applied to the EU program that came out in 2015 and we won. After we finished the main project, we created a team. In 2.5 years we have made the infrastructure. We lacked some equipment for redundancy. So we applied for the grant. After that, we prepared our trainings and documentation in order to get ISO 27001 and ISO 9001 certifications which are the biggest weaknesses in TRNC. With e-signature we take all responsibility, so employees need to take this responsibility as well. According to the recruitment procedure, we receive a CV first. If we think that the applier can do the job, we expect him to fill the documents we give, get a criminal record from the police. The first 3 months are the trial period. There are some stress tests in the first month. In the next two months, he is trained for the subject.

For electronic money, there is a team of 300 people. Only 4 of them are here. They work together. The team here does some team development like improvements and deficiencies in mobile applications and the virtual services. The team created the project, encoded it, supported and tested the site.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

LD: It depends on the project. Each project can be done in different ways.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

LD: There are 2 types of demand. Requests regarding the change of existing status come. For example, you made the project, but some legal regulations were missing. When those regulations come, you have to run them on the project. This means that the current situation changes. Before the project reaches its goal, you must also make changes in the applications that are missing or incomplete. We accept between the rate of 15% and 20% changes in the contract. If this rate goes up to 20%, we stop the project and accept it as a new project with a new budget. The cost is being loaded on the other side. .

BK: Do you have any R&D project?

LD: We do some research. We reveal the possibility of these. After that we make our prototype. We also make the final arrangements according to the opinion and suggestions. Then we design the product according to specifications and turn it into a project.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

LD: UML is being used. They are usually developed with .NET technologies or with C # as language. We also use LINUX and UNIX as well. Now you cannot say I'm just using Microsoft products. At that time, you only need to produce projects on mobile for Android and IOS. The platform does not matter for us. We also work on Android, IOS, Microsoft mobile and web applications.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

LD: We have no such packages.

BK: What is your maintenance policy? (1 year/2 years/every year)

LD: We take the 18% of cost as annual maintenance fee. We make maintenance contracts for up to a year or 2 years or 3 years. Sometimes companies do not want any support. In this case, we deliver the project and say that we have given all the rights for the product and we are now separated. If they want any support later, we take up the project from the beginning.

BK: What do you think about the informatics sector in TRNC?

LD: It's a messy industry. It is a sector that cannot grow because of the small market, but can grow by merging into international projects. It has capacity, but the industry must use this energy properly.

BK: What are the shortcomings and problems?

LD: The biggest problem is that you need to provide a life cycle. If you do not get the necessary maintenance and backups and do not do the updates, you will have trouble. The biggest shortcoming is that industry and universities are not in a business alliance. There are no R&D centers. There is a lack of support and encouragement in the information sector. There are no human resources. There are 11 universities in TRNC. We go to all of them and say that students will not get a job when they graduate, because they do not consider new technology. There is a certain curriculum. For example, they teach C #, but students do not learn what they need to learn exactly. They only memorize. We focus that what a computer engineer should be able to do. But the sector does not see it that way. They think that if a student is graduated from computer engineering, he should be able to code. Actually it is not like that. That person is not a programmer or a coder. He's the one who should design a project. The engineer is not a coder, he is a designer. All software companies make the same mistake. This is the perception in the sector.

BK: What can be done to improve the situation?

LD: Education.

4.6 Interview with Etesia Software

BS stands for Burçin Soyer who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

BS: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

BS: Custom design (tailor mate), software for school (student follow up, payment follow up, homework, attendance, teacher follow up), case follow-up management (litigation detail, calendar follow-up etc.), corporate web sites (product sales, listing, admin panel), dynamic web sites

BK: What about the duration of projects, number of people who work and cost of projects?

BS: Totally we are four people. Generally three people work in the project. One person is analyst and works on database, one person is user-interface and graphic designer and one person is coder. Design and code part of the project work together in the testing phase. The school software takes 2 months and the websites take 2-3 weeks. Budget is prepared with man/day calculation.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

BS: We use Scrum Agile. Before this, everyone used to do everything and then we were joining them.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

BS: Extra budget is offered. We move according to the contract. After the business analysis we analyze the bids about module structures and database.

BK: Do you have any R&D project?

BS: We made an online portal using Customer Relationship Management. It took 3 months.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

BS: Web, mobile (java, responsive), cloud based, Windows, SQL Server, asp.net mvc, C#, JavaScript (jQuery (client side))

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

BS: There are customer input-output revenues for the school. It's used for 4 years.

BK: What is your maintenance policy? (1 year/2 years/every year)

BS: Monthly (between 50 TL - 150 TL)

BK: What do you think about the informatics sector in TRNC?

BS: There are areas to develop. There is legal shortcoming. As people, we are not ready for the new technology. Only Facebook is known. As for technological talent, we are too low.

BK: What are the shortcomings and problems?

BS: There are internet connection and electrical power distribution problems because of island conditions. We do not have our own servers.

BK: What can be done to improve?

BS: We have to go abroad. Technological competence should be increased. As I said, we should have our own servers.

4.7 Interview with Figensoft

OG stands for Ömer Güveniş who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

OG: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

OG: We work on database and mobile technologies. We are partners with one GSM operator. We are trying to market packaged products.

BK: What about the duration of projects, number of people who work and cost of projects?

OG: There is a team of 10 software engineers working together from İstanbul, Ankara and TRNC. The budget varies from 10,000 to 400,000 TL depending on the project.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

OG: Since I am not the one who manages these things, I do not know.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

OG: The requirements document is being prepared for large projects. Requests for change are assessed up to situation.

BK: Do you have any R&D project?

OG: I do not know.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

OG: We use Microsoft products, SQL server for database and Visual Studio for coding. For IOS, we use Object C.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

OG: We did not have a project in this area.

BK: What is your maintenance policy? (1 year/2 years/every year)

OG: We have a compulsory support period of 1-2 years.

BK: What do you think about the informatics sector in TRNC?

OG: No big companies. No job.

BK: What are the shortcomings and problems?

OG: Necessary attention is not shown. People are not open to newness. No investment. Unfortunately, no support is shown by the state. On the contrary, the state is making a hitch.

BK: What can be done to improve the situation?

OG: The sector should receive government support.

4.8 Interview with GigaByte Ltd.

YK stands for Yılmaz Kaygısız who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

YK: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

YK: Actually, we're not just a software company. We are an informatics integration company. We install automation systems, especially barcode automation system in the retail sector such as markets, stores, pharmacies. Each of these is a short-term project. We have data center services. We provide hosting services to overseas or local companies. We have areas such as stock management, personnel management, and accounting. Apart from these, we have technical service. We install the integrated system of our own products for website or mobile. They all vary

depending on the size of the project. For us, starting from the point of sale to the point of the process is a project.

BK: What about the duration of projects, number of people who work and cost of projects?

YK: It may take 3 days or 6 months or 1 year up to the project. For example, our customer requested a module. We had a 20 day business process. We delivered it within 30 days because of work intensity. After that we did our setup and customer tests. We have 3 software developers. The software project's budget is determined by the man / day rate.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

YK: I cannot say that we follow any specific model. We move on coding part after we have passed the steps of project analysis, screen and database. However, development testing takes an important step. User tests are being performed on our side. Then the software life cycle begins. It is determined by the customer's request. After the project is completed, it is delivered and customer tests begin.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

YK: We definitely prepare a request document. Then we give our offer. We get to work after we get confirmation. However, during the project you can get a new request that was not considered in the beginning by customer. It is necessary to demand a new budget but it is not possible. They usually make a problem for additional budget. These requirements analysis are very useful when they ask for an additional module in the future. However, there is no need for a risk analysis since the projects are not comprehensive. You can also run your project or your team

personally. Projects must complete their life after a certain period of time to ensure better performance against new equipment. For example, Microsoft constantly releases a new operating system and they say that there will be no longer support for Windows XP. Soon they may say that they will not give support for Windows 7. When the project is over, you have to resume this process with both support and development, but you need to set a lifetime which is determined up to needs and operating systems.

BK: Do you have any R&D project?

YK: For us, software development is also an R&D. We provide solutions for hardware. We sometimes bring hardware and software together and give solutions up to the needs of our customers. An irrelevant product can turn into a completely different product. For example, a tablet can turn into a price reader device. We have work on IOS and Android.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

YK: Our old software was developed on Delphi. In the past, there were solutions we developed for palm-based mobile devices that we call Satellite form. We currently develop on the Microsoft .Net platform using C #. We use Linux and Windows as our operating system, but the applications are always on Windows. Linux is being used for server services. On the IOS and Android side, we do not yet have a project.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

YK: We still update accounting and inventory control packages but we do not have banking packages.

BK: What is your maintenance policy? (1 year/2 years/every year)

YK: We carry out maintenance-support agreement with our corporate customers. We demand half of the budget we receive at the beginning of the project for maintenance-support, the other half for development. We apply an annual maintenance contract. We do not require this every year, but after a while some customers come for that project. For this reason, we intend to make the annual maintenance agreement compulsory.

BK: What do you think about the informatics sector in TRNC?

YK: It is too bad and will continue to be like that. It is because of our own people and companies. I saw many people who started a project without any requirement analysis and without making proposals. You go to one of your friend and ask for a project that you need. He tells you that it is very simple for him, but it does not work out, he cannot even finish it. In that case the programmers are being mentioned as bad guys who cannot do it well. When you ask to prepare the analysis document, they may say that there is no need for that simple request.

BK: What are the shortcomings and problems?

YK: The information sector is unorganized. There is an Informatics Association. Computer engineers also have association. In other association, there are also sections for informatics. Unfortunately, these associations, which are rooted in the general sense of association in the country, do not represent me at all. For example, since I am not a computer engineer, they do not let me be member in that association. Computer Engineers' association should be the association of Informatics, because there are many branches under informatics.

BK: What can be done to improve the situation?

YK: Universities should work together with the private sector. The academy cannot see the way private sector does. Correct dialogues are established and these problems are solved step by step through mutual work.

4.9 Interview with KKTCELL

SC stands for Serap Çatalbaş who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

SC: No. We got Project Management Institute (PMI) training.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

SC: Information Technologies and Communications Agency (BTHK) tendered projects, Customer Relationship Management (CRM) screens (design, account, and shake-up applications), sales improvement projects, and customer based projects, mobile number transfer (MNT).

BK: What about the duration of projects, number of people who work and cost of projects?

SC: A team of 10-50 people. For cost, what to expect from the Information Communication Technology (ICT) team, what to expect from the network team are checked. Every team calculates a man / day account. If there is a supplier company, that process starts.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

SC: It depends on job status and expectations. If we can divide the project we apply Agile model, for some parts we apply Waterfall model.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

SC: We receive a requirements document. There may be a change request depending on the situation. Additional costs are calculated. If there are 5 features at the beginning, and then if it becomes 10, the situation is checked again.

BK: Do you have any R&D project?

SC: We work on projects to improve ourselves. There is a business alliance with universities. Idea field project (Fikir Tarlası) is one of them.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

SC: Windows predominantly, Linux, Visual Studio .NET, PL / SQL

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

SC: No. We only write code for ourselves.

BK: What is your maintenance policy? (1 year/2 years/every year)

SC: Annual maintenance contracts are usually made with suppliers.

BK: What do you think about the informatics sector in TRNC?

SC: Regulative situations are developing. The cyber-attacks started intensely. The related laws, regulations are started to be used.

BK: What are the shortcomings and problems?

SC: Supplier companies may not be in the TRNC branch. There may be no trained staff.

BK: What can be done to improve the situation?

SC: There should be more support. People need to be encouraged to this sector.

4.10 Interview with Mobilon

BG stands for Barış Güveniş who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

BG: No.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

BG: Ordering system in mobile application. We have a water selling application. We are preparing a restaurant ordering system similar to a food basket application.

BK: What about the duration of projects, number of people who work and cost of projects?

BG: Usually 2 people start-up in 4 months.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

BG: Our work style is closer to improving agility, but we do not think about it while preparing the project.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

BG: There is no legal document. We agree via email. There is a system based on trust with the intermediary company.

BK: Do you have any R&D project?

BG: We are developing an application that will be our own product. We are working on a social media application for businesses.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

BG: We use cross platform, html, JavaScript on client side for mobile application ANDROID and IOS. We develop with the Cordova framework.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

BG: We did not have a project in this area.

BK: What is your maintenance policy? (1 year/2 years/every year)

BG: We have 1 year support period.

BK: What do you think about the informatics sector in TRNC?

BG: Pretty weak. The number of employees is very small.

BK: What are the shortcomings and problems?

BG: There is no industry and being not much connected to abroad is a problem.

BK: What can be done to improve the situation?

BG: It needs government initiatives. Support for informatics should be increased.

4.11 Interview with Outsource Software

HS stands for Hasan Sarper who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

HS: Yes, we have CMMI certification at Level 2. The advantages of the certificate would be for non-TRNC marketing but there is no benefit in TRNC. Getting the certificate was very expensive. We paid € 50000 for certification and training. However, there is no professionalism in the island.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

HS: We develop automation projects such as writing information to the database and getting information from the database in accordance with our abilities, and a system which keeps all information such as citizenship-passport application, student permits for the immigration department. We did a project for the general register office. We have made a mobile application for Kıbtek including all services used by the electrical institution. In the field of accounting we have software called Expert. It is being used by about 200 private sector companies. We made a fingerprint system for bank employees to check in and out.

BK: What about the duration of projects, number of people who work and cost of projects?

HS: We have a total of 8 software developers are working. 6 of them are developers and 2 of them are managers.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

HS: We use the Scrum method of the agile development. The products which are made in a day are checked and then position is taken. We do not spread it over long periods like Waterfall. CMMI for Waterfall is handy. We have tried CMMI a few times, but you run one person like 5 people and we have not got any yield. Since the coder is also the project manager, the document manager and the quality manager at the same time, how you can expect him to finish everything up to procedure. For CMMI, there must be separate individuals for each assigned task.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

HS: In extraordinary level with the percentage of 300 and even 500, change requests come. At first they go far beyond what they say. At this point we meet with the customer and try to increase the duration and cost. Sometimes we achieve this. We do not accept extra requests when they do not accept the extra budget. Customer does not know exactly what he really wants. Sometimes they want to have an access for everything. The requirements document is prepared just to have the document. Therefore, CMMI does not work at this point.

BK: Do you have any R&D project?

HS: We try to give importance to R&D studies over time, because we have to follow up as a company since technology continues to be developed. The program or

language being used must already be developed and available. In fact, we use R&D while doing the project. We try to find how we can improve ourselves.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

HS: We prefer Microsoft technologies for desktop and web (C # .NET). We develop apps for ANDROID and IOS for mobile, and we use more Java. On the database side, we prefer Microsoft SQL Server. We have also done projects with Oracle. Particularly in the TRNC, the banks do not accept any other databases except Oracle.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

HS: We did it all. We are not just in banking. We have a partner company. We are interested in the human resources module of banking. We do not make calculations or rates. We need updates for 200 companies that use our expert application live.

BK: What is your maintenance policy? (1 year/2 years/every year)

HS: It is usually monthly maintenance. We charge a monthly maintenance fee for the expert application. In this way, the availability of the program continues.

BK: What do you think about the informatics sector in TRNC?

HS: Local software has gained importance in Turkey, but there is no such vision in TRNC. Here, they care about choosing cheap software.

BK: What are the shortcomings and problems?

HS: The crush of the industry is that people prefer cheaper software. They think it's easy to use the software.

BK: What can be done to improve the situation?

HS: The people in the position of the manager need to make the right decisions. For example, they stated that the e-government project is not able to be written in the

TRNC, because of that, the tenders were not opened in the TRNC. Narrow market share shrunk sharply. The growth of the companies is thus blocked. Each company can try to get a certain number of projects in order to provide opportunities to each firm. There is logic of choosing the cheapest software instead of local software. In this way they are reducing the sector. Instead of growing company A or B, the sector needs to grow. The sector that will not be embargoed abroad is software sector. It should be even before the tourism or university sector. The state should have a software policy.

4.12 Interview with Sentez Bilgisayar

SS stands for Şeren Sözgen who answered the questions.

BK: Do you use CMMI model? If yes, which level do you have?

SS: No. Our partner company Outsource Software has CMMI with level 2.

BK: What kind of projects do you work on? (Only on specific topics or any topic)

SS: We have certain sectors like financial, trade, check, indenture, and accounting. We are working on a certain 5-6 sectors that we have determined. We also do custom software but we do not prefer much because of the intensity of our work in other sectors. We usually transfer them to our partner company Outsource Software. We also transfer public projects to them.

BK: What about the duration of projects, number of people who work and cost of projects?

SS: The situation in private sector projects and public sector projects is different. The budget is not too much. High-budget projects are usually directed to Turkey. Our projects are not high budget. These are actually the projects we have done before, ready for sale. We are a team of 11 people consisting of support and software team.

BK: Which project management model do you use? (Waterfall, Prototyping (incremental), Agile development and etc.)

SS: I can say that we use Agile model. We prefer the Spiral method. Even those who demand it do not know what they want. Iteration is more effective at this point. Waterfall is an old model now. You get requirements at the beginning of the project and then you start to write. When you finish the project and deliver it, they may tell you that it is not what they really wanted. With Agile, you can turn the project into small pieces and design the requirements right away. Even if they are incomplete, you can immediately get confirmation from the customer and make corrections. In this case, you may lose more time, but it gives better result.

BK: What about the change requests during project? Do you prepare the requirements document before starting the project?

SS: At the beginning, we prepare a requirements document. However, we get a lot of change requests to requirements such as "I forgot to say this module" and etc. Since we have gained experience in this sector, we started to reduce these demands.

BK: Do you have any R&D project?

SS: We can say yes. There is no separate team for this. I do some research with some people from the team. But we do not allocate a separate budget for it. We do small work on mobile devices.

BK: What development environment do you use? (About OS, UML, programming languages, etc.)

SS: We use Microsoft products. We code with C # and VB. As a database we use Oracle since we are the solution partner of Oracle. There are situations where we use Microsoft database too.

BK: Do you work on accounting, stock control and banking packages? If yes, do you update these packages?

SS: Yes.

BK: What is your maintenance policy? (1 year/2 years/every year)

SS: Monthly.

BK: What do you think about the informatics sector in TRNC?

SS: Hard. The lack of software piracy laws affects the industry. People do not want to pay for software.

BK: What are the shortcomings and problems?

SS: There are also difficulties in finding staff. There are no laws. The state does not disseminate high-budget projects to local firms.

BK: What can be done to improve the situation?

SS: Copyright law must come out. The government should focus on domestic companies. Universities should update their curriculum in a timely manner.

Chapter 5

EVALUATION OF COMPANIES WITH CMMI

According to the results obtained in Chapter 4, two companies said they are at CMMI level 2. These companies are Analiz Systems and Outsource Software. Actually, these companies can be considered as a single company, because they have common management. A total of 18 questions from (Kalaycı, 2007) were formulated to cover the seven process areas of CMMI maturity level 2 and were asked to companies. Table 4 shows the questions that are asked to the management of these companies. Two answers were provided, on for the year 2011, when they were using CMMI requirements, the other for 2017 when they stopped using CMMI requirements in project management.

Table 4: The Process Areas and Related Questions (Areas are explained in Table 2)

Process Areas	**Questions**
REQM	Is there a mechanism to check for changes in software requirements?
REQM	Do you provide double-sided traceability on the requirements?
REQM	Do you identify inconsistencies between project plan and products according to the requirements?
PP	Do you prepare the work breakdown structure that contains the work packages?
PP	Do you define project life cycle steps?

PP	Do you estimate size, effort, and cost for software projects?
PP	Do you identify project risks?
PMC	Are the commitments and project risks being traced according to project plan?
PMC	Do you identify and resolve the problems?
SAM	Do you determine the methods to be used in the purchasing of a product and product components?
SAM	Do you prepare formal contracts with suppliers?
SAM	Do you follow the processes of the suppliers?
MA	Are you giving a course to the people regarding statistical methods, data collection, and analysis and reporting processes?
PPQA	Do you have any quality assurance activities for software projects?
PPQA	Do you make the necessary records for quality assurance studies?
CM	Do you have any general configuration management policy of the institution?
CM	Do you accept change requests?
CM	Do you perform configuration management records and audits?

Table 5: Possible Answers and Points Assigned

Choice of Answers	**Points Assigned**
Definitely yes	4 points
Usually	3 points
Planned but not applied	2 points
Not sure	1 points
Definitely no	0 points

There were five possible answers to each question and each answer is assigned points as shown in Table 5.

CMMI Level 2 process areas are weighted according to their importance among themselves. Table 6 shows the number of questions and their weights for each process area.

Table 6: Number of Questions and Weight Percentage for Each Process Area (Yücalar, 2008)

Process Area	Number of Questions	Weight Percentage
REQM	m=3	18%
PP	n=4	18%
PMC	p=2	18%
SAM	q=3	7%
MA	r=1	7%
PPQA	s=2	14%
CM	t=3	18%

The sum of the answers given to the questions of each process is multiplied with the process weight. The sum of the results obtained for each process field gives the weighted sum. Calculation of weighted sum is shown below (Yücalar, 2008).

$$\text{Weighted Sum} = 0.18 * \sum_{i=1}^{m} REQM_i + 0.18 * \sum_{i=1}^{n} PP_i + 0.18 * \sum_{i=1}^{p} PMC_i + 0.07 * \sum_{i=1}^{q} SAM_i + 0.07 * \sum_{i=1}^{r} MA_i + 0.14 * \sum_{i=1}^{s} PPQA_i + 0.18 * \sum_{i=1}^{t} CM_i$$

, where m=3, n=4, p=2, q=3, r=1, s=2, t=3 (number of questions)

Best score is to be taken in case the firm says "absolutely yes" to all answers. According to the answers given to the questions, the maximum score that can be taken is 10.88. Then calculation of success rate is done as follows (Yücalar, 2008).

$$\text{Success \%} = \frac{\text{Weighted Sum}}{Best\ Score} * 100$$

Table 7: The Average Points Received by the Company in Each Process Area

CMMI Process Areas of Maturity Level 2	**2011 - With CMMI**	**2017 - Without CMMI**
REQM	2.16	1.26
PP	2.88	1.98
PMC	1.44	1.08
SAM	0.77	0.56
MA	0.14	0.14
PPQA	1.12	0.56
CM	2.16	1.44
Weighted Sum	10.67	7.02
Best Score	10.88	10.88
Success %	98.07	64.52

Table 7 shows that, companies with CMMI are much closer to CMMI requirements.

Chapter 6

DISCUSSION

6.1 CMMI Owners

As a conclusion from the interviews there are only 2 software companies have a Level 2 CMMI certification in North Cyprus. In addition, one company said that although they do not have CMMI certification, they sometimes apply the features of it if the project has to be done abroad.

6.2 Team Numbers

In TRNC, the number of employees in the project teams is usually small. Many companies have less than 10 people in their software development teams. Only KKTCELL has a large software project team, but they did not mention the exact number of persons. Comtech also did not share the number of their employees. The number of employees for each company except KKTCELL and Comtech is shown below in Figure 1.

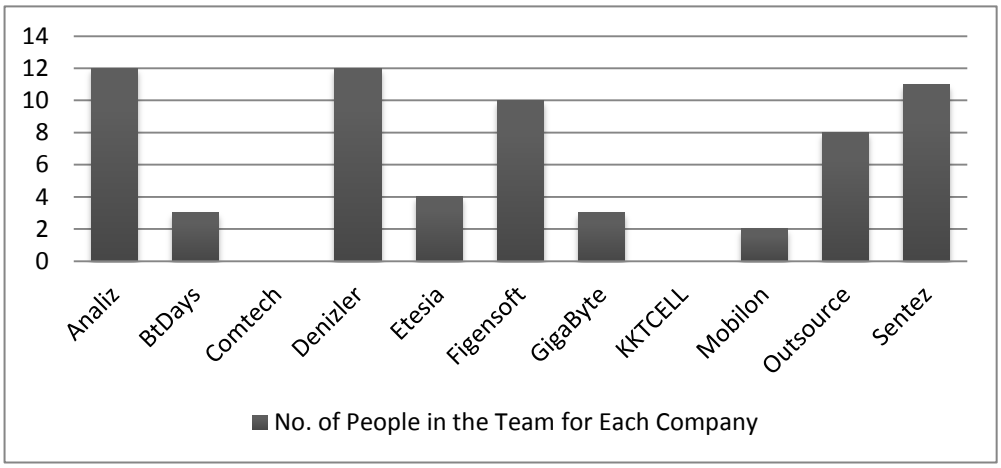

Figure 1: Number of People in the Team for Companies

6.3 Company Project Scope

There are some companies that only work on specific type of projects. For instance, one company works only on POS machine software. Another company works on e-signature and electronic money transfer only. A third one develops software only for financial sector. Besides these companies, others develop automation systems for necessary needs. Out of 11 companies, only 3 of them do not develop an application for mobile devices but they work on mobile devices for R&D.

6.4 Tool Usage

As a programming language, C# is the most frequently used one by 6 out of 11 companies. Java is the second common language, and it is used by 3 companies. Then, Java Script is preferred by 2 companies to develop some of their applications. Visual Basic (VB), C/C++, HTML and Object C are the least preferred programming languages/environments. In addition, Visual FoxPro and Delphi were used to develop the projects some years ago by 2 companies.

6.5 Operating System/Database Usage

The results show that the most common operating system is Windows. Six companies only work on Windows. Two companies prefer both Windows and Linux up to the project, and one of these 2 companies can develop on UNIX as well. For database systems, four companies prefer Microsoft SQL Server. One company works with Oracle since they are the solution partner of Oracle, and one company uses only PL/SQL. These results show that Microsoft products are preferred more by software developers in TRNC.

6.6 Software Development Life Cycle Models

Considering software development models, 2 out of 11 companies prefer the Agile development model. 3 companies prefer the Scrum model which is a subset of the

Agile model. Some of other companies prefer their own methods and some did not mention any information about this issue.

6.7 Documentation

Interview findings show that except two companies, the others prepare the requirements document at the beginning of the project as a contract. One company prefers to prepare the requirements document for the large projects only and one other firm makes the agreement via e-mail. Although there are legal documents, all companies complain about change requests throughout the project, because they say that they get too many requests that are not considered at the beginning of the project by customers.

6.8 Change Request

Due to change requests, many companies mentioned that they accept customer's requests until the rate of 20 percent. When it gets more, they ask for extra budget. 3 companies did not mention anything about extra cost, and one company said that it is necessary to ask for extra budget but sometimes it is not possible since customers make a problem for that.

6.9 Maintenance

Maintenance policies differ between the companies. In 4 companies, this policy is yearly, in other 4 companies it is on a monthly basis, in another 2 firms it changes from 1 to 3 years according to customer request, and one company has no constant maintenance policy.

6.10 R&D

The interview findings show that companies in TRNC show some attention for R&D. 10 out 11 companies have their own R&D researches in different areas.

6.11 Copyright Policies

Companies also state that there is no copyright law or legal policies to protect the copyright of software. Customers do not know its importance too. However, only one firm stated that related laws and regulations about the informatics sector are recently passed and are being used in TRNC.

6.12 Communication between Industry and Universities

Another common point is that there is not enough communication between industry and universities. Academicians prepare students according to their curriculum. Industry complains that universities do not concentrate on practical issues for developing software. They claim that, as a result of this, graduating students have hard time at the beginning of their business life.

6.13 Other Issues

Low human resources and island conditions follow these problems as mentioned by some companies.

Table 8 shows the summary of features that is mentioned above for each company.

Table 8: Summary of Company Features

Companies	CMMI	Team	Development Model	Operating Systems	Database	Programming Languages	Mobile	Maintenance Policy	Contract	Extra Cost for Changes
Analiz Systems	Yes	12	Scrum	Windows	SQL Server	C# FoxPro(before)	Yes	Monthly	Yes	-
BtDays	No	3	Own method	Windows	-	C/C++	No	Not constant	Yes	Yes
Comtech	No	-	-	-	-	-	No	Yearly	Yes	Yes
Denizler Bilişim	No	12	-	Windows Linux UNIX	-	C#	Yes	1year/2 years/3years	Yes	Yes

Etesia Software	No	4	Scrum	Windows	SQL Server	C#, Java JavaScript	Yes	Monthly	Yes	Yes
Figensoft	No	10	-	Windows	SQL Server	Object C	Yes	1year/2 years	Yes	Yes
GigaByte	No	3	-	Windows Linux	-	C# Delphi(before)	No	Yearly	Yes	No
KKTCELL	No	10-50	Agile Waterfall	Windows Linux	PL/SQL	-	Yes	Yearly	Yes	Yes
Mobilon	No	2	Own method (like agile)	-	-	HTML Java Script	Yes	Yearly	No	-

Outsource Software	Yes	8	Scrum	Windows	SQL Server	C#, Java	Yes	Monthly	Yes	Yes
Sentez Bilgisayar	No	11	Agile	Windows	Oracle	C#, VB	No	Monthly	Yes	-

6.14 Evaluation of Companies that have CMMI Level 2 Certification

As it is shown in Table 8, there are 2 companies that have CMMI certification with level 2. Additional questions have been selected for these companies that have a single management. A questionnaire method was used for quick self-assessment of whether level 2 has been achieved by the management or not. The questions were chosen according to CMMI level 2 process areas and TRNC company structure. A total of 18 questions were identified. The number of questions can be increased further in the literature based on CMMI's structure. The questions are divided into groups according to process areas. Each answer maps to 0 to 4 points as explained in Table 5. The weighted sum is calculated and according to the results, the success rate of the company is calculated.

The management of the two companies has applied for CMMI certification for their software projects in 2011. However, currently they do not use it. Therefore, evaluation of those seven process areas was determined based on whether CMMI is used. As shown in Table 7, the companies clearly have high success rate with the percentage of 98.07 while using CMMI for their projects. Currently, it is shown that companies have a low success rate with the percentage of 64.52 for carrying out important process areas of maturity level 2. On the other hand, while using CMMI in 2011, the company was within reach of a maturity level of 3 since they got a very high success rate.

Chapter 7

RECOMMENDATIONS FOR THE FUTURE

The IT sector is an emerging field in TRNC, although it is not at a very good level currently. However, this can be improved with some necessary improvements. Companies have different recommendations about this. First of all, the importance of this sector is not known well by people. Awareness should be raised. The knowledge of people needs to be increased as well. Almost everyone use new technology easily, but they unfortunately think that developing software is as easy as using it.

There are no copyright laws and regulations as some companies mentioned. Due to this, people can install newest software on their devices without paying a copyright fee. Customers usually prefer the latest versions when they need a program from companies, but when they face with the high cost of project, they easily complain since they are not aware of the cost of software development.

One other common view of the firms of the informatics sector in TRNC is that it is hard to find qualified staff. There are many graduate students but they do not stay on the island for long. They prefer to move on to their countries or others which give better opportunities. Unfortunately, TRNC has a small computer market. As many firms mentioned, the software sector has no support by state in TRNC. They claim that the government does not show necessary attention to the sector.

Another important point is education. Young people should be encouraged more to join this sector. The informatics sector can be introduced to them as one of the most important future sectors. Universities need to follow the new technological developments, as well. Their curriculum should be updated frequently. While students learn basic knowledge, they should also be prepared for the business life. At this point, industry plays an important role. Universities and industry should be communicating often, as the industry can explain what business life is actually.

It is really important to follow the symposiums, panels and conferences attended by representatives of relevant academics and industry associations to follow up on sectoral issues and critical points. In TRNC, incentives should be increased for the information sector, like in Turkey and Europe. The state should make right decisions for this industry. Local firms should have the priority first. The state should believe that the software sector in TRNC can undertake projects. For government, priority should be local companies, but these companies should open to abroad as well. If necessary, they should know how to work together in the same projects. As one of the companies mentioned, the goal should be enlarging the sector.

The rapid development of software and the knowledge gained in previous software development activities and the re-use of established infrastructures are becoming increasingly important. Due to continuous improvement of computer hardware and software technology, both organizations and users need to improve themselves to follow the recent innovations. This requires higher degrees of dependence on the use of improvements and techniques in software development processes and methods. Sometimes this adjustment process is not easy, as the user needs change very quickly. One method used in one project may not always be useful for other projects.

Rawson (2016) states that: “Just because certain methods have worked in the past doesn’t mean they always will. Processes of evaluation and refactoring allow your team to maximize efficiency by reviewing what worked well”. Companies should also increase their R&D studies and let their staff improve their skills. The software sector needs qualified employees who are open to innovation.

Companies should focus on understanding customer requests in early stages of projects. Since customers may not think the way engineers do, at the beginning of the project, they may not consider all the requests due to having less knowledge about the problem. Therefore, before starting any project, the project analysis should be done perfectly. As an engineer, we should guide customers. The company and the customer need to agree about the requirements of the project together. Here, the requirements document plays an important role.

To achieve a successful project, the team’s success is crucial. If the team is under good leadership, having a success may be easier. The team and the project manager should be communicating constantly each other. Holding daily/weekly meetings may let them see the process of project. Other teammates may have some interesting ideas you would have never thought, so considering those suggestions, problems will be solved a lot faster. The team should also document solutions and share them to save valuable time for everyone. Better readability of code is significant, because it is necessary for maintainability.

Nowadays, many companies develop software, but the important point is to develop qualified software. It’s important to be able to measure the quality of product to make improvements as well. Wailgum (2010) states that Visitacion and Gualtieri

conclude: "Managers must make quality measurable and incent all roles on the team to improve it".

Besides all these, companies should give importance to CMMI studies especially for organizations that are active in system engineering and software disciplines and that want to achieve advanced competitiveness. CMMI has the aspect of providing means of self-improvement for organization. For companies, software can be developed to measure CMMI levels. Consultancy companies can be established or services can be purchased to raise the CMMI level. With CMMI certification, necessary regulations can be done to have the way of selling software to abroad. Universities can also be incorporated into this work.

Chapter 8

CONCLUSION

Today, software is employed in many products and everyone has to know that it is one of the most important sectors of the future. The main aim of this research was to determine the current status of the informatics sector in TRNC. To undertake this task, 11 out of 33 software companies were chosen to conduct interviews and examine their software project management policies.

The first significant point was to see whether the firms follow any model for software process, as it is hard to make improvements to lead efforts without a model. It's better to follow a model that shows how the organization works, which functions are needed and how those functions interact. It helps companies to discuss what needs to be improved and how to achieve them.

The software development industry in TRNC has a small scale. To be competitive on the global market, companies need international contracts, so they need to follow the international standards. One challenge is to meet some CMMI level requirements. However, meeting CMMI requirements is an expensive process to have, since companies should send employees for training and get necessary certifications. Still, it is obvious that a CMMI certificate gives a chance to the company to be more competitive globally. Of course, having CMMI is not enough for company to have

shares in the global market, as two companies have CMMI in TRNC but it did not turn out to be effective for them yet.

The results of interviews show that the TRNC software sector is not in a sufficient status, but we should know that TRNC is on an island but the informatics sector is a sector that may not be affected much. For that, to improve the sector up, many things need to change: people, companies and the government.

In my opinion, first of all, organizations in TRNC need to follow a suitable software process model according to the type and size of the project. Interview findings show that companies in TRNC work on projects either using their own methodologies or without following any formal models.

One other point is that companies should prepare the requirements document after negotiating with the customer. Necessary preliminary designs should be done and showed to the customer for approval. They should also emphasize that they will do neither less nor more according to the requirements document. It is important to agree with the customer at the beginning of the project not to get any future change requests during the project. If the customer requests changes, they should be informed by firms that there will be extra cost for that.

Another important point is that the reason of unsuccessful projects may be due to the lack of follow-up meetings. The manager, designer, programmer and tester should be communicating with each other. There may be daily, weekly or monthly meetings according to the project size. The manager should organize these meetings to work faster and have successful projects.

The questions asked to the common management of two companies with CMMI level 2 certificate shows that when they stopped applying CMMI requirements, the success rate fell down from 98% to about 65%. This shows the importance of following CMMI requirements for better projects.

The Turkish Cypriot government should start to take necessary steps passing and deploying necessary laws to support local companies for software projects. This will encourage the companies in the North Cyprus software sector.

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