A MODEL FOR ASSESSING PROJECT MANAGEMENT MATURITY LEVEL OF ARCHITECTURAL DESIGN OFFICES (ARCH-PMM)

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ABSTRACT

A MODEL FOR ASSESSING PROJECT MANAGEMENT MATURITY LEVEL OF ARCHITECTURAL DESIGN OFFICES (ARCH-PMM)

The aim of this dissertation is to develop a model to assess "The Project Management Maturity Level of an Architectural Design Office" (Arch-PMM). The purpose of ARCH-PMM is to develop an environment for productive and efficient design conditions. By increasing the levels of ARCH-PMM, architectural design office will create opportunity to focus on its concerns for high quality architectural design process. To determine whether Arch-PMM assessment methodology is working properly, a semi structured survey is conducted with selected architectural design offices. This study is the first attempt that focuses on architectural design offices' PM practices and processes.

A 5 leveled PM Maturity Model is developed to assess architectural design offices' current PM Maturity level. Maturity levels are assessed vis a semi-structured survey. 71 Members of the Association of Turkish Independent Architects (ATIA) participated to semi-structured survey to validate the model. A list of demographical questions was asked to draw the demographical picture of the architectural design offices. Both, maturity levels and demographical data are analyzed.

The results of the assessment provide the necessary information for the architects to improve their PM processes and activities. Project Integration Management was highly mature among the other function areas and it's followed by Project Scope Management. The least matured function area was the Project Risk Management. High correlation values between the number of staff and all PM function areas are also observed. Yearly income level and overall maturity level of the architectural design offices are found to be related at correlation high levels (r=0.73). The well defined structure of architectural design process seems to support project management culture and have potentials of high project management maturity levels.

ÖZET

MİMARİ TASARIM BÜROLARININ PROJE YÖNETİMİ OLGUNLUK SEVİYELERİNİ ÖLÇEN BİR MODEL (ARCH-PMM)

Bu tezin amacı, "Mimari Tasarım Bürolarının Proje Yönetimi Olgunluk Seviyeleri"ni (Arch-PMM) ölçen bir model geliştirmektir. Arch-PMM'in amacı ise, verimli ve etkili tasarım için elverişli bir ortam oluşturmaktır. Arch-PMM seviyesini arttırmak, mimari tasarım bürosunun, yüksek kaliteli mimari tasarım süreci için gereken kaygılara odaklanmasını kolaylaştırır. Arch-PMM ölçüm yöntembiliminin doğru olarak çalışıp çalışmadığını belirlemek için, seçilen mimari tasarım büroları ile kısmi yapılı bir anket yürütülmüştür. Bu çalışma, mimari tasarım bürolarının Proje Yönetimi uygulama ve süreçleri üzerinde duran ilk denemedir.

Mimari tasarım bürolarının güncel Proje Yönetimi Olgunluk seviyesini belirlemek amacı ile 5 aşamalı bir Proje Yönetimi Olgunluk Modeli geliştirilmiştir. Türkiye Serbest Mimarlar Derneği'nin (TSMD) 71 üyesi ile, modelin geçerliliğini denetlemek amacı ile kısmi yapılı bir anket gerçekleştirilmiştir. Mimari tasarım bürolarının demografik yapısını resmetmek amacı ile bazı demografik sorular yöneltilmiş, böylece hem olgunluk seviyesi hem de demografik veriler incelenmiştir.

Ölçümün sonuçları, mimarların Proje Yönetimi süreç ve faaliyetlerini geliştirmek için gereken bilgileri sağmaktadır. Proje Entegrasyon Yönetimi olgunluğunun diğer işlev alanlarında oldukça yüksek olduğu görülmüştür ve bu, Proje Kapsam Yönetimi tarafından takip edilmektedir. Olgunluk seviyesi en düşük olarak gözlemlenen alan Proje Risk Yönetimidir. Tüm Proje Yönetimi işlev alanı ile çalışan sayısı arasında yüksek değerde korelasyon olduğu da gözlemlenmiştir. Çalışmaya göre, yıllık gelir düzeyi ile mimari tasarım ofislerinin genel olgunluk seviyeleri de birbirleriyle yüksek değerde ilintilidir (r: 0.73). Mimari tasarım sürecinin iyi belirtilmiş yapısının proje yönetim kültürünü desteklediği ve proje yönetimi olgunluk seviyesi adına potansiyeller taşıdığı görülmüştür.

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CHAPTER 1

INTRODUCTION

Project Management (PM) is becoming increasingly recognized as the subject develops and more organizations began to reap the benefits. The popularity of PM is growing in an increasing rate during the last decade on generally every field like engineering and construction, manufacturing industries, computer software development, etc. The technologies that affect the processes of organizations are continuously changing. Effectiveness of PM technologies depend on the PM systems. Without a developed PM system, organizations cannot profit fully from the benefits of PM. In order to survive and develop and not to loose its competence, an organization should continue its improvement.

To improve the PM processes, the organization should assess its maturity while managing its activities. Continuous improvement can only be achieved by measurement of performance and goal setting. We can say that continuous improvement is related to the effectiveness of projects that are undertaken for an organization.

When organization realizes the need for self improvement on its activities, it will also need to know potential development areas. There are many different ways to assess how well an organization manages its activities. Project Management Maturity is one of the effective methods to assess this.

Organizations are widely accepting PM tools, techniques, and practices. Moreover, the level of PM Process Maturity has grown increasingly sophisticated. PM Process Maturity is a well defined level of sophistication that assesses an organization's current project management practices and processes (Kwak 1997).

Project Management Maturity is the progressive development of a project management strategy, methodology and decision making processes. In other words, PM Maturity is a kind of development tool for PM processes.

1.1. Problem Definition

Organizations started to recognize the power of PM for their processes and related activities. Managers are becoming aware of the importance of the PM Maturity Models for their companies' structural improvement.

Many different maturity models have been developed (Paulk et al. 1993; Karandikar et al. 1993, De Graaf and Sol. 1994, Bergman and Ohlund 1995, Wognum et al. 1996, Kwak and Ibbs 1997, Finnemore and Sarshar 2000, Brookes et al. 2000, Hillson 2001, Harigopal and Satyadas 2001, Froese et al. 2001, IACCM 2003) recently to meet the needs, drawing on established concepts from existing models. These new models are utilized and experienced on many different fields.

Many organizations have turned to the Software Engineering Institute's (SEI) Capability Maturity Model (CMM) to improve their software engineering processes by setting goals to achieve higher SEI levels. This has created the need for an instrument and a process that can be used to evaluate an organization's current status relative to these goals. At Motorola, a method is developed for assessing progress to higher SEI levels that lets engineers and managers evaluate an organization's current status relative to the CMM and identify weak areas for immediate attention and improvement. This method serves as an effective means to ensure continuous process improvement as well as grassroots participation and support in achieving higher maturity levels (Daskalantonakis 1994).

Organizations conduct assessments for a variety of reasons. A new organization may want to understand where their major opportunities lie so that they can get started with an improvement program. An experienced organization may want to measure the effectiveness of their improvement activities to date and develop plan for future work. A mature organization may need to demonstrate its capability in a formal manner as a requirement to win business or as part of a corporate maturity initiative (McKeever et al 2004).

Munns and Bjeirmi say that the growing popularity of PM theories seems to stem not only from their ability to bridge the gap between theory and practice on those "one of a kind" endeavours, but also from the fact that in such situations there is evidence that they are more efficient, effective and economic relative to normal organizational approaches (Munns and Bjeirmi 1996).

Daskalantonakis discusses the importance of PM and maturity models for Motorola Co as follows: “In addition to Motorola’s Cellular Infrastructure Group, several Motorola business units have adopted the use of SEI Progress Assessments, including product groups within the Satellite Communications Group, Semiconductor Products Sector, the Land Mobile Products Sector, and the Automotive and Industrial Electronics Group (Daskalantonakis 1994).”

Daskalantonakis also adds as follows: “Having already achieved SEI level 2 in the second quarter of 1993, work is already in progress for achieving SEI level 3 within the Cellular Infrastructure Group (CIG), with the SEI Progress Assessment process continuing to be the key driver (Daskalantonakis 1994).”

1.2. Background

Project Management is not a new subject. Like all management disciplines, it is one that has developed and grown. It is widely believed to have been used firstly and developed as a management science by the military during the Second World War.

Since then, it has been developed further through a number of stages which includes:

- Critical Path Planning and Network Planning techniques (1950’s and 60’s)
- Planning and tracking integrated time, cost and quality, using integrated computer systems (1970’S)
- Matrix Management and training in the role of the Project Manager (1980’S)
- The Project Management competencies (1980’s and 90’s)
- Project Management Bodies of Knowledge (1980’S)
- The other PM roles of Sponsor and User (1990’s)
- The measurement of project success for each role (1990’s)
- Management by Project and its use in the management of change (1990’s)
- Programme Management and Project Benefits Management (1990’s and 2000’s)
- Maturity Modeling (2000 and beyond)

The figure below shows the development of Project and Program Management in the last five decades.

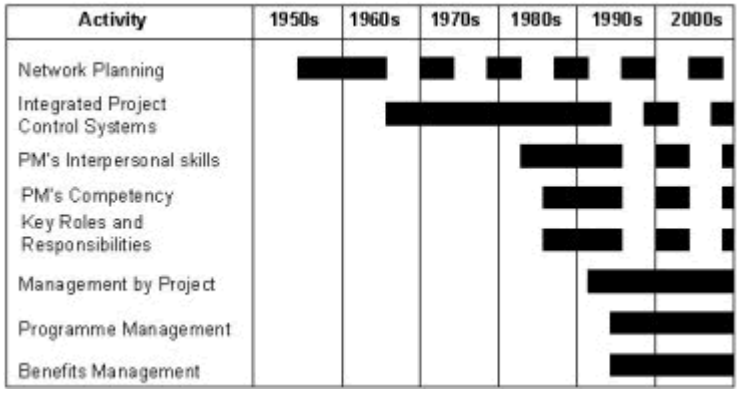


Figure1.1. Project and Programme Management in the last five decades
(Source: Harpam 2004)

1.2.1. Project Management and Quality Management

Quality can be defined as meeting the legal, aesthetic and functional requirements of a project. Requirements may be simple or complex, or they may be stated in terms of the end result required or as detailed description of what is to be done. But, however expresses, quality is obtained if the stated requirements are adequate, and if the completed project conforms to the requirements (Arditi, D and Günaydin H.M. 1997).

Quality Management became the main criteria on processes and Quality Control became very popular all around the world in the 80's. By 90's, production quality control and new generation management systems became very popular and they started to play very important roles on building production processes, because in project production process there 4 main components which are content, time, cost and quality. Content, time and cost are directly connected with each other and quality lies in the middle of them. If we shorten the time, cost increases or if we diminish the scale of the content the cost will decrease but we have no chance to make any changes on the quality. The quality is the equilibrium point and making concessions will affect the whole equilibrium. As we understand from the figure below, quality doesn't mean high cost; actually because of balancing the customer satisfaction, quality means cost saving. In other words, balance of time and content establishes the optimum quality. Beside all

these factors, we shouldn't neglect the human factor. We should also count the human factor when we are planning the process.

Project Management is a system which needs a systematic approach and profession. This profession needs information and adequacy under 9 different functions.

These are listed (PMBOK 2004) in Table 1.1. below:

Table 1.1. Project Management Knowledge Areas
(Source: PMBOK 2004)

Project Management Knowledge Areas (PMBOK 2004)
Project Integration Management
Project Scope Management
Project Time Management
Project Cost Management
Project Quality Management
Project Human Resource Management
Project Communications Management
Project Risk Management
Project Procurement Management

During planning a project, there are 5 managerial process groups (PMBOK, 2004) which are shown below in Table 1.2.:

Table 1.2. Project Management Process Groups
(Source: PMBOK 2004)

Project Management Process Groups (PMBOK 2004)
Initiating Processes
Planning Processes
Executing Processes
Controlling Processes
Closing Processes

Until just a few years ago, the concept of "maturity" was seldom used to describe the state of an organization's effectiveness at performing certain tasks. Today, we find this maturity concept being used increasingly to map out logical ways to improve an organization's services-particularly across the software industry. Why has this evolved in this industry-why not in other areas? And why is this of interest to the project management profession? (Crawford 2006)

Architectural design offices perform majority of their activities in project environments. Each architectural design is a unique project. However, most of the offices are not prepared enough to handle their PM processes professionally. This might be because of the lack of awareness for PM concepts. Another reason could be inadequate training of architects both at undergraduate level and after graduation. On the other hand, architectural design projects are becoming more complex. Besides, professional construction companies are increasingly demanding more professional approach from their architectural design counterparts. Also integration of construction processes makes professional PM approach a must for construction industry.

PM Maturity Models might provide an excellent tool for PM process development in architectural design offices. However literature does not record such a study.

1.3. Objectives

The aim of this dissertation is to develop a model to assess "The Project Management Maturity Level of an Architectural Design Office" (Arch-PMM).

The purpose of ARCH-PMM is to develop an environment for productive and efficient design conditions. By increasing the levels of ARCH-PMM, architectural design office will create opportunity to focus on its concerns for high quality architectural design. The first function of ARCH-PMM is to provide a measurement tool for PM processes in architectural design offices. The second function is to provide a strategic development tool for PM processes used in design offices. Third function is to help architectural design offices to provide an appropriate creative environment for architectural design.

1.4. Research Motivation

PM and the problems during assessing organizations' PM Maturity Level constitute the center of many studies. Many of the studies on construction or building production process are concentrated only a very limited part of the architectural design process.

Except for those ones, if there are any studies focusing on architectural design offices, that means they lost their validities because of the rapid changes on PM discipline and especially the huge changes on the Project Management Knowledge Areas. Project Management Institute (PMI) presented the latest version of PMBOK including the major changes on Project Management Knowledge Areas in 2004.

Generally most of the studies on PM were focused on the qualitative changes and narrative evaluation of prior experiences on PM tools and practices. According to the researchers' discipline areas most of these studies were concentrated on other discipline areas like construction and engineering, computer software development, manufacturing industries, etc. rather than architectural design offices.

Another vital importance of this research is to integrate the approaches of PM discipline to architectural design offices. This integration provides a more realistic form for the new proposed model to assess the PM Maturity Levels of the architectural design offices.

The academic motivation of this research is to develop an analysis methodology that can be used reliably to measure costs and benefits of PM practices and processes quantitavely in architectural design offices. This quantitative research on PM practices and processes on architectural design offices ends with assessment reports. These reports will help architects and architectural design office managers to apply and integrate PM practices and processes to architectural design process.

This application and integration provides a number of data that serve architects to evaluate their architectural design processes by focusing and analyzing on the PM practices and processes.

The other primary benefit of the ARCH-PMM is that it provides the means for narrowing the scope of the improvement activities by targeting only on those PM processes and activities that provide the next foundation layer in an architectural design office's continued PM development in each of the nine (PMBOK 2004) knowledge areas.

1.5. Methodology

In order to reach above mentioned objectives following steps are planned:

1. Examining and analyzing the previous studies related to PM and PM Maturity Assessment to find potential areas for a deeper research.
2. Developing a modified 5 Level PM Maturity Model to assess architectural design offices' current PM Maturity level.
3. Selecting target architectural design offices to investigate and apply the model.
4. Measuring the selected architectural design offices' PM Maturity Levels with a semi-structured survey.
5. Evaluation of Arch-PMM

1.6. Research Limitations

The purpose of a semi-structured survey test is to determine whether Arch-PMM assessment methodology is working properly. A semi-structured survey with selected architectural design offices is conducted.

1.6.1. Selection Criteria for the Semi Structured Survey

The demographical structure of architects according to the Turkish Chamber of Architects is as follows (Table 1.3.), (Table 1.4.), (Table 1.5.):

Table 1.3. Demographic Structure of Architects in Turkey
(Source: Turkish Chamber of Architects)

City	Architects	(%)Ration over Turkey
Adana	680	2.10%
Ankara	7013	21.69%
Antalya	1299	4.02%
Balıkesir	263	0.81%
Bursa	998	3.09%
Çanakkale	138	0.43%
Denizli	244	0.75%
Diyarbakır	313	0.97%
Eskişehir	239	0.74%
Gaziantep	428	1.32%
Giresun	62	0.19%
Hatay	236	0.73%
İstanbul	13229	40.92%
İzmir	3342	10.34%
Kayseri	335	1.04%
Kocaeli	416	1.29%
Konya	862	2.67%
Mersin	405	1.25%
Muğla	661	2.04%
Ordu	115	0.36%
Samsun	388	1.20%
Trabzon	528	1.63%
Van	138	0.43%
Total	**32332**	**100.00%**

Table 1.4. Demographic Structure of Architects in Turkey – Members Change 01
(Source: Turkish Chamber of Architects)

Death Members	1471
Resigned Members	1139
Unknown	33
Active Members	32332
Total	34975

Table 1.5. Demographic Structure of Architects in Turkey – Members Change 02
(Source: Turkish Chamber of Architects)

Total members by 31.12.2005	31250
Increase between 01.12.2006 - 30.11.2006	1082
Active members by 01.12.2006	32332
Active members in Izmir by 01.12.2006	2243
Registered and re-registered Architectural Design Offices in Izmir City for 2006	525

The demographical structure of architects confirms us how large the architectural field in Turkey is, but the data from Turkish Chamber of Architects doesn't prove us that all these architectural design offices are actively on business.

Second important issue is the selection of the appropriate architectural design office among the members of Turkish Chamber of Architects.

These limitations channeled this research to find another selection criteria for the semi structured survey. The selected architects should actively be dealing with architectural design process. Thus, a random choice criteria from the members of Turkish Chamber of Architects is rejected.

Decision on Association of Turkish Independent Architects (ATIA) as a selection criteria compensates all the mentioned limitation handicaps as follows:

1. All the members of ATIA are also the member of Turkish Chamber of Architects.

2. An architect should actively be on architecture design business and her/his design should be constructed to be a member of ATIA.

In the next chapter current PM Maturity Models are presented.

CHAPTER 2

LITERATURE REVIEW ON PROJECT MANAGEMENT MATURITY MODELS AND TOOLS

There is growing awareness of the need for changes within the construction industry in its current practices and processes of project development which include design, procurement, construction, project delivery etc. This is mainly caused the dramatical decreasing of construction costs through standardization of construction process (CIRIA Report 1999); the increasing demand and sophistication of clients (Wognum et al. 1996); the rising requirements for project functionality through growing competition; the rapid developments in communication and information technologies; and the recommendations in UK Government-initiated reports such as the Latham report (1994) and the Egan Report (1998). Many construction companies are responding to the increasing importance of project development processes by incorporating Concurrent Engineering practices to improve their project development capability (De Graaf and Sol 1994).

2.1. An Overview of Tools and Models

There are several tools and models, which are being used for assessment of organizations for their project management maturity and other different practices. The brief descriptions of some models are below:

2.1.1. Readiness Assessment for Concurrent Engineering (RACE)

This tool was developed at West Virginia University (USA) in the early 90's and is widely used in the software engineering, automotive and electronic industries. It could be modified for use in construction and other industries. The RACE-model is conceptualized in terms of two major components: Process and Technology (CERC Report 1993; Wognum et al. 1996). The Process component is sub divided into ten elements and the Technology component into six (Karandikar et al. 1993).

2.1.2. The Process Model of Organization (PMO)

This model was developed to asses and analyze the processes and technology of an organization. The process model of organization (PMO) is a model, which can basically be used for analyzing and designing an organization, its processes and technology in the context of the market in which that organization operates. This model is used to detect bottlenecks that prevent the organization to achieve its objectives (Wognum et al. 1996).

2.1.3. A Combination of PMO&RACE (PMO-RACE)

PMO-RACE is the combination of two models (PMO and RACE) which was developed by the researchers at University of Twente and Eindhoven University of Technology (Netherlands) in the mid 90's. Since the Process Model of Organizations (PMO) can support the identification of key problem areas and identification of business drivers while the RACE-method is good at determining the performance level of the product development process, it was suggested that both methods could be combined to support improvement cycles. The combination would deliver the best of both worlds (De Graaf and Sol. 1994).

2.1.4. A Swedish Model Based on RACE (PRODEVO)

PRODEVO was developed at Swedish Institute for Systems Development (SISU) and this development was parallel to the development of PMO-RACE tool. Some of the dimensions and also a couple of the questions are assimilated in the present tool from RACE model, and to indicate a relation the working name "Extended RACE", was adopted earlier (Bergman and Ohlund 1995).

2.1.5. Capability Maturity Model (CMM)

CMM (Paulk et al. 1993) was basically developed for software development and evaluation and was developed by the Software Engineering Institute at Carnegie Mellon University in order to manage the development of software for the US government,

particularly that which was to be used by the Department of Defence in the late 80's (Aouad et al., 1998). Also the RACE model was developed based on ideas from CMM. Detailed information about CMM is on item 2.3.

2.1.6. Standardized Process Improvement for Construction Enterprises (SPICE)

This tool was developed at the University of Salford, United Kingdom and is in the form of a questionnaire, which was designed to evaluate the key construction processes within a construction organization (SPICE Questionnaire 1998). SPICE is basically intended for evaluating the maturity of the processes of construction organizations. It is based on CMM and is presently a research prototype (Finnemore and Sarshar 2000).

2.1.7. Project Management Process Maturity (PM)² Model

This 5-Level (PM)² Model was developed at University of California, Berkeley in late 90's. The primary purpose of the 5-Level (PM)² Model is to use as a reference point or a yardstick for an organization applying PM practices and processes. This 5-Level (PM)² Model further suggest an organization's application expertise and the organization's use of technology, or it might produce recommendations on how to hire, motivate and retain competent people. A total of 38 organizations, including 15 Engineering and Construction (EC), 10 Information Management and Movement (IMM, a.k.a. telecommunications), 10 Information Systems (IS, a.k.a. software development) and 3 Hi-Tech Manufacturing (HTM) companies, participated in the study (Kwak and Ibbs 1997).

2.1.8. SIMPLOFI Positioning Tool

This tool was designed and developed by the Department of Manufacturing Engineering at Loughborough University, United Kingdom. It formed part of the output of the SIMPLOFI (Simultaneous Engineering through People, Organization and Functional Integration) project in the mid 90's. the tool focuses on the introduction of

one specific product in an organization. This tool assists those people who are responsible for product introduction within an organization in answering the question: "I know what product I want to introduce-How do I organize the introduction of this product to achieve this most effectively?" (Brookes et al. 2000).

2.1.9. Benchmarking Organizational Project Management Capability Model (ProMMM)

The Project Management Maturity Model (ProMMM) was developed to meet the needs for understanding and determining an organization's project management processes are adequate. The basis for ProMMM is practical and pragmatic, based on the empirical experience of its developers in providing project management consultancy across a wide range of industries over many years. ProMMM used a perception based questionnaire to explore respondents' perception of the degree to which their organization manages projects effectively.

ProMMM acts as a benchmark for organizational project management capability, describing four increasing levels (naïve, novice, normalized and natural) with defined stages along the way against which organization can benchmark themselves. Many organizations used ProMMM since its original development to introduce effective project management (Hillson 2001).

2.1.10. Project Management in the Year 2020

"Project Management and Computers in the year 2010" describes the results of a survey that examines speculations about how information technology will be used to support project management 20 years from 2000 in the 2020. The paper reports and interprets the responses received from a group of experts in the field of architecture, engineering and construction. Various perspectives of information technology and project management are considered, such as the project management environment, computing systems, application areas and information integration.

In 1991, the paper "Project Management and Computers in the year 2010" presented the result of a survey that asked experts from architecture, engineering and construction (AEC) to speculate about the use of information technology (IT) to support

project management (PM) at a time 20 years in to the future. The survey asked about: the project management environment, computer hardware, integration and connectivity, programming languages and software development, user interfaces and computer applications for project management.

In 1996, the paper "Project Management, 2015 AD" reported results of a similar survey conducted five years later. Responses from the two surveys were compared and based on results and the authors' perspective of the future.

This paper is conducted five years later from 1996 with a similar survey to once again look for trends in the thinking about how IT will shape the future of PM for AEC (Froese et al. 2001).

2.1.11. The IACCM Business Risk Management Maturity Model (BRM3)

The IACCM (International Association for Contract and Commercial Management) Risk Management working group has attempted to address the questions of how an organization could evaluate, in a quantifiable fashion, its level of maturity in the area of business risk management.

This document was aimed at providing answers to questions like:

- How can I asses if my organization's approach to risk management is adequate?
- How can I compare my organization's approach with best practice against our competitors?
- Is there an accepted benchmarking for organizational risk management?

In the IACCM, Business Risk Management Working Group defined four levels of organizational business risk management maturity (Novice, Competent, Proficient, and Expert) against four key attributes (Culture, Process, Experience, and Application). Each attribute has further defined using several diagnostic characteristics, with each characteristic described for each of the four increasing levels of maturity.

The IACCM Detailed Level Questionnaire is provided as a set of tables with each row containing one characteristic within an attribute. The descriptions of each

characteristic in table should be considered in turn, and the appropriate maturity level selected, scoring 1, 2, 3, or 4 for that characteristic. The characteristic scores for each attribute are than totaled, and the average attribute score is calculated. The four attribute scores are then averaged to give an over all level score.

This allows a detailed diagnosis of the current maturity of business risk management, so that a tailored improvement plan can be produced, building on specific strengths and addressing particular weaknesses (IACCM 2003).

2.1.12. Cognizant Enterprise Maturity Model (CEMM)

This model provides tripartite usage of calibration, capability assessment, and maturity advancement. The entry point is an organizational and departmental profiler that provides relevance measures based on fuzzy multicriteria group decision making capabilities to key maturity areas identified for the five level maturity model. These relevance measures allow organizations to weigh and score key maturity areas and nurture the model based on their experience and industry experience. Each key maturity areas comes with a set of goals and abilities. Cognizant Enterprise Maturity Model relies on 4 criteria (Harigopal and Satyadas 2001):

1- Cognizant environments.

2- Knowledge utilization and leverage.

3- SEI CMM and People-CMM.

4- Adaptive enterprise and distinguishes between information and knowledge management.

2.2. The Software Engineering Institute Capability Maturity Model

In 1986 the Software Engineering Institute (SEI), which is affiliated with Carnegie Mellon University, began developing a process maturity framework for software development. With financial support from the Department of Defense the early effort resulted in the publication of the Capability Maturity Model (CMM) in 1991.

This is a lengthy foundation chapter in which the detailed description of the five-level maturity model is presented and applied to each of the 39 processes that define the project management body of knowledge (PMBOK 1996). These descriptions provide

the content for the survey that will be used to measure process and practice maturity. Maturity assessment will be the basis for a continuous improvement program for project management processes.

The purpose of CMM is to provide organizations with a guide for establishing process improvement programs for software development. The guide can be used both as a foundation for establishing tools and as input for creating a maturity questionnaire for process improvement.

According to CMM there are 5 levels of maturity which are named as follows: initial, defined, managed and optimizing. The brief descriptions of the levels are as below.

Initial: This process is ad-hoc. There may be a few defined processes. Some software engineers bring tools and templates that may have been learned elsewhere. On the other hand successful software development is largely dependent upon heroic efforts.

Repeatable: Processes are established and put in place for use across software development projects. Process use in recommended but not required. For some large or critical mission projects the use of these standard processes are often required.

Defined: Processes are standardized and documented. There is a standard software development process that all projects must use. Training and support are available through a Project Support Office (PSO).

Managed: Project process against plan is monitored, reported and controlled. Decisions regarding software development projects are made with reference to organizational considerations. Project management decisions are integrated into other business processes.

Optimizing: Projects performance is fed back into the process itself to enable a continuous quality improvement program. Best practices and lessons learned are input to the improvement program.

2.3. Project Management Body of Knowledge (PMBOK)

2.3.1. PMBOK 2000 Edition

The Project Management Institute (PMI) has published its standard for project management practice in document entitled "A Guide to the Project Management Body of Knowledge". Second version was published in 2000. PMBOK defines the project management life cycle in terms of five phases or process groups to use their terminology. These are initiating processes, planning processes, executing processes, controlling processes and closing. Spread across these 5 process groups are 39 process areas grouped into nine knowledge areas.

Project Integration Management – PMBOK 2000 Edition

Project Plan Development, Project Plan Execution, Overall change Control

Project Scope Management – PMBOK 2000 Edition

Initiation, Scope Planning, Scope Definition, Scope Verification, Scope Change Control,

Project Time Management – PMBOK 2000 Edition

Activity Definition, Activity Sequencing, Activity Duration Estimating, Schedule Development, Schedule Control

Project Cost Management – PMBOK 2000 Edition

Resource Planning, Cost Estimating, Cost Budgeting, Cost Control

Project Quality Management – PMBOK 2000 Edition

Quality Planning, Quality Assurance, Quality Control.

Project Human Resource Management – PMBOK 2000 Edition

Organizational Planning, Staff Acquisition, Team Development

Project Communications Management – PMBOK 2000 Edition

Communication Planning, Information Distribution, Performance Reporting, Administrative Closure.

Project Risk Management – PMBOK 2000 Edition

Risk Identification, Risk Quantification, Risk Response Development, Risk Response Control.

Project Procurement Management – PMBOK 2000 Edition

Procurement Planning, Solicitation Planning, Solicitation, Contract Administration, Contract Close-out.

2.3.2. PMBOK 2004 Edition

In 2004, PMI presented its new version of PMBOK with structural changes from the 2000 edition. In the new and current version, 39 processes areas which are grouped into nine knowledge areas are changed and increased to 44 processes areas. Seven new processes were added, two processes were deleted and 13 processes were renamed for a next gain of five new processes.

The changed and revised project management processes are shown with tables below (Table 2.1 – Table 2.9) according to the project management knowledge areas:

Table 2.1. Project Integration Management Processes
(Source: PMBOK 2004)

Project Integration Management Processes
Develop Project Charter
Develop Priliminary Project Scope Statement
Develop Project Management Plan
Develop and Manage Project Execution
Monitor and Control Project Work
Integrated Change Control
Close Project

Table 2.2. Project Scope Management Processes
(Source: PMBOK 2004)

Project Scope Management Processes
Scope Planning
Scope Definition
Create WBS
Scope Verification
Scope Control

Table 2.3. Project Time Management Processes
(Source: PMBOK 2004)

Project Time Management Processes
Activity Definition
Activity Sequencing
Activity Resource Estimating
Activity Duration Estimating
Schedule Development
Schedule Control

Table 2.4. Project Cost Management Processes
(Source: PMBOK 2004)

Project Cost Management Processes
Cost Estimating
Cost Budgeting
Cost Control

Table 2.5. Project Quality Management Processes
(Source: PMBOK 2004)

Project Quality Management Processes
Quality Planning
Perform Quality Assurance
Perform Quality Control

Table 2.6. Project Human Resource Management Processes
(Source: PMBOK 2004)

Project Human Resource Management Processes
Human Resource Planning
Acquire Project Team
Develop Project Team
Manage Project Team

Table 2.7. Project Communications Management Processes
(Source: PMBOK 2004)

Project Communications Management Processes
Communications Planning
Information Distribution
Performance Reporting
Manage Stakeholders

Table 2.8. Project Risk Management Processes
(Source: PMBOK 2004)

Project Risk Management Processes
Risk Management Planning
Risk Identification
Qualitative Risk Analysis
Quantitative Risk Analysis
Risk Response Planning
Risk Monitoring and Control

Table 2.9. Project Procurement Management Processes
(Source: PMBOK 2004)

Project Procurement Management Processes
Plan Purchase and Acquisitions
Plan Contracting
Request Seller Responses
Select Sellers
Contract Administration
Contract Closure

2.3.3. Project Management Process Groups

The Project Management Framework is divided into five standard phases, as defined in the Project Management Body of Knowledge, PMBOK Guide 2000. Each phase has associated activities.

Initiating Processes: Through the Initiation stage, an idea becomes a project. It is during this time that a project is proposed, the feasibility of doing the project is studied, and the overall project profile is developed. If approval to proceed with the project is obtained during the Initiation process, a project charter is developed and approved. The process then moves to the Planning process.

Planning Processes: This phase requires completion of a **Project Plan.** A Work Breakdown Structure and sub-plans are part of the Project Plan. The sub-plans may be incorporated into the main Project Plan or may be separate, depending on the scope and value of the project:

Executing Processes: Project plan execution involves implementing the plan by performing the activities in the plan. The project manager must integrate related areas of the project into a harmonious whole often by using a variety of techniques to engage with stakeholders. External factors may exert an influence and need to be taken into account. The project manager will again use a wide range of skills, including technical, financial, communications, human resource, etc. The aim is to focus on pulling all activities and aspects of the project together to achieve a successful end.

Controlling Processes: Controlling processes deals with ensuring that project objectives are met by monitoring and measuring progress regularly to identify variances from the plan so that corrective action can be taken.

Controls show that the project is producing the required results (that meet predefined quality criteria), is on schedule in meeting its targets using previously agreed resources and funding and remains viable against its business case. Controls balance benefits against costs and risks.

In conjunction with the execution phase, the project manager will be watching the progress of the project and ensuring that variances from the plan are identified and reported on and using a Project Change Request if required.

The project manager, the project team and the reference group will handle operational issues and minor variances.

Closing Processes: Closing processes deal with formalizing the acceptance of the project, bringing it to an orderly end and reviewing.

This phase provides the opportunity for the organization to learn from the work done via a review and analysis of metrics.

2.4. The Current Usage of Maturity Models

Morris says that in response to the perceived need to organize thinking about PM a number of frameworks have been produces over the last 30years. The first of the framework types are the process, life-cycle or maturity models. Common examples include the International Standard Organization (ISO) series, Project Excellence Model, Process Maturity Model (Kwak 2002), the Japanese designed P2M model and Projects in controlled Environments 2 (PRINCE 2)(Morris 2001).

Morris also states that the second type of framework are the the various 'Body of Knowledge'. For some their influence has been primary. They provide tha standards against which would be project managers may become certified. More fundemantally, they also provide a knowledge framework for understanding the many elements that comprise PM. Indeed, they have come to be used by eminent practitioners as best guides to subject (Moırris 2001). Turner recognizes a number of benefits that also seem pertinent, including:

- A consistent approach that can better promote familiarity within the project team and beyond
- A common vocabulary and understanding of key project terminology and activities.
- Demonstration of formally recognized procedures to clients and other stakeholders (Turner 1999).

In this respect they provide useful frameworks from which approach the generic PM literature.

All the PM Maturity Models which are mentioned above used questionnaire and interview survey method. Khalfan claims that RACE is basically designed for assessing the readiness of industries such as software, automotive, manufacturing and electronic industries, all of which have different characteristics to construction. Aspects covered focus on the processes in the above mentioned industries and require changes to assess the construction process. The structure of teams within the above mentioned industries are different from typical construction project teams (Khalfan 2000).

Khalfan also adds that the level of technology usage in the afore-mentioned industries is different from that in the construction industry. The products of the other industry sectors satisfy a large number of customers whereas a construction project is

one-off in nature, typically fulfilling the needs of a particular client or organization. The level of integration, communication, co-ordination, and information sharing are different between construction and above mentioned industries and managing a manufacturing product and a construction project require different levels of management skills (Khalfan 2000).

Kwak states that $(PM)^2$ assessment methodology was developed to assess the maturity of PM processes and practices among Engineering and Construction, Information Management and Movement also known as Telecommunications, Information Systems, also known as Software Development, and Hi-tech Manufacturing (Kwak 1997).

Kwak also acknowledges that it was difficult to recruit organizations to participate in that research. Kwak sent out invitation letters to potential participants and made announcements in PM-related magazines and organized meetings to promote the needs and importance of that study. Kwak conducted a pilot test with two selected organizations and states that the results were satisfactory to confirm the survey as appropriate to measure an organization's PM level (Kwak 1997).

SEI conducted a study to obtain information on the results of software process improvements (Herbsleb, J. et al. 1994). This study reported the cost and business value improvement efforts as well as the yearly improvement. SEI selected and measured for major factors: Productivity, Early Defect Detection, Time to Market, and Post Release Defect Reports. Data were analyzed to see hoe these for factors affected software development.

Paulk et al. states that SEI CMM can be used for Software Development Process Assessment, Software Development Process Improvement, Software Development Capability Evaluation. Developing five maturity levels, SEI CMM establishes a different component in the software process by achieving each level (Paulk et al. 1993).

Generally all the models discussed in this study target multiple industries (Karandikar et al. 1993; De Graaf and Sol. 1994; Bergman and Ohlund 1995; Kwak and Ibbs 1997; Finnemore and Sarshar 2000; Brookes et al. 2000; Hillson 2001; Harigopal and Satyadas 2001; Froese et al. 2001; IACCM 2003). Most of the models to assess the PM Maturity Levels use benchmarking organizations management capabilities.

Bamberger mentions that CMM was intended to provide one set of guidelines for managing software development projects and making improvements overtime. This

set of guidelines was based on best practices, software engineering discipline, real-world experience, and extrapolation from other industries. And, most importantly, this set of guidelines was just that-guidelines-not requirements or checklist of “must do” items; the guidelines were intended to be interpreted, and applied within the culture and content of each unique organization (Bamberger 1997).

Munns and Bjeirmi says that the growing popularity of PM theories seems to stem not only from their ability to bridge the gap between theory and practice on those “one of a kind” endeavours, but also from the fact that in such situations there is evidence that they are more efficient, effective and economic relative to normal organizational approaches (Munns and Bjeirmi 1996).

Most of the models discuss improvements in the product development process and the use of technology to facilitate the development process. Some of these models also cover the organizational environment to support the development process. Most of the models mentioned above are still under development but some of them are being used on a commercial basis. All the models are easy to use and user-friendly. All the Project management maturity models which are presented above generally constructed on 5-leveled maturity system. The Software Engineering Institute’s Capability Maturity Model is one of the pioneer reference points for the models. SEI by developing the CMM stated the 5-leveled maturity model for the first time.

CHAPTER 3

PROJECT MANAGEMENT MATURITY MODEL FOR ARCHITECTURAL DESIGN OFFICES

3.1. Project Management Maturity Levels for Architectural Design Offices

During developing the model for assessing the maturity level of the architectural design offices, five leveled system is used (Figure 3.1.). This study uses PMBOK as a primary reference for instructing and consulting in all areas of PM and closely aligned with it. ARCH-PMM and the following Maturity Levels of ARCH-PMM are developed for architectural design offices by analyzing and evaluating the previous maturity models such as (SEI 1993), (Kwak 1997), (Kwak and Ibbs 2002) and (Crawford 2006). All these previous maturity models were useful, however they all needed to be developed to be utilized for architectural design offices, because of their concerned areas, different practices and processes, different cultures and organizational structures, differences in their production processes and the product itself, etc.

This dissertation considers the importance of other maturity models and their maturity leveling systems, but because of the previously mentioned reasons, this study modifies and develops the previous maturity levels for architectural design offices by focusing on architectural design processes. Model uses 5-leveled maturity scale for architectural design offices as below:

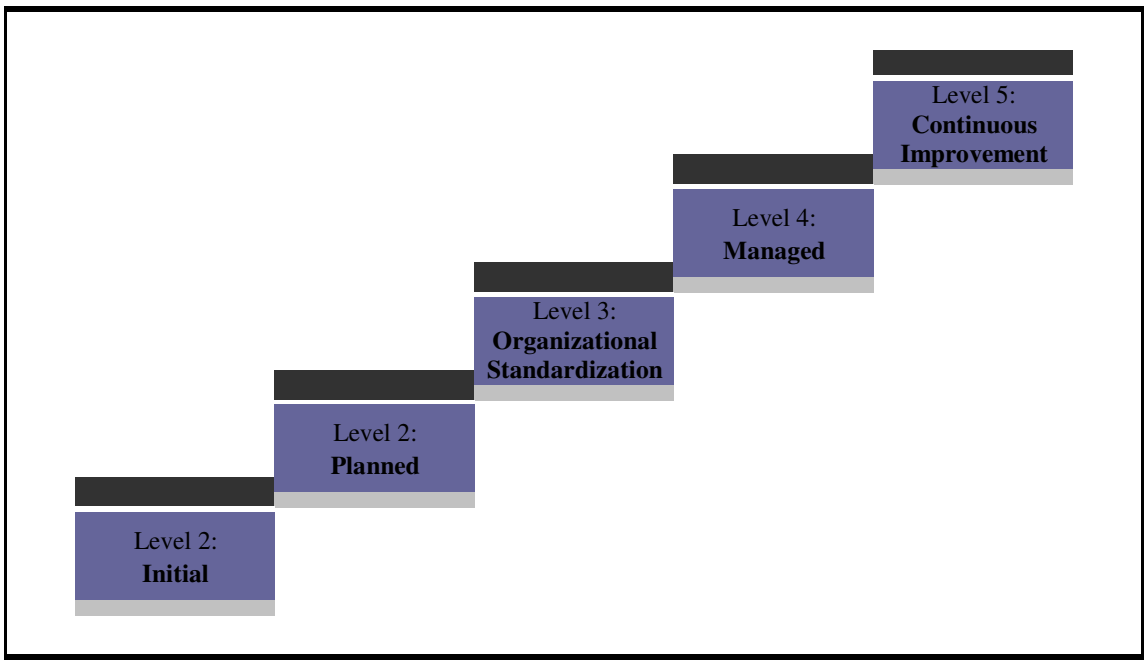


Figure 3.1. The Five Levels of ARCH-PMM

3.1.1. Level 1: Initial

Although there is awareness about project management, there are no formal practices or standards for it. Documentation is very weak. Architects are of a need for project management for the architectural design process. All the activities during the process are ad-hoc.

- Ad-hoc designs, solutions and processes
- Architects heard about project management.

3.1.2. Level 2: Planned

During design processes, many different project management processes are applied but there is no standardization. Documentation is basic but the links are not formed between the documentation activities. Office Management supports the project management but the architects are suffering to apply these to all design processes. There is no systematic application of the management activities.

Success is dependent to the architect's experience. Thus, an architectural design office having more design processes is like to be better in applying management activities.

Project management is project oriented. Every different design process is handled independently. When the scale of the project gets larger, the managers give higher importance to the project management activities.

- Project management is supported by the office managers.
- There is no systematic process.
- Success of the project management depends on the architects' experience.
- Project management is project oriented. Every process is independently handled.
- Managers pay more attention to higher scale projects

3.1.3. Level 3: Organizational Standardization

All the project management processes are in place and established as architectural design office's own organizational standards. All the other stakeholders of the process like client, other engineering design offices, contractor and the architects act as one project team. Architectural design office establishes its own processes and standards with formal documentations. Office managers are involved in the key decisions and they are also involved in the approval of key documents and other project issues. All the processes of the design in the architectural design office are automated. Each project is evaluated and managed in light of other projects.

At this level, architectural design office cannot blindly apply all processes equally to all projects. The processes should be modified according to the ongoing project. The modification of the standardized processes according to the ongoing project is another process. So, consideration must be given to differences between projects.

- Standardization of the processes for the architectural design office.
- All the stakeholders of the process act as one project team.
- Each project is evaluated and managed in light of other projects.
- The processes should be modified according to the project.

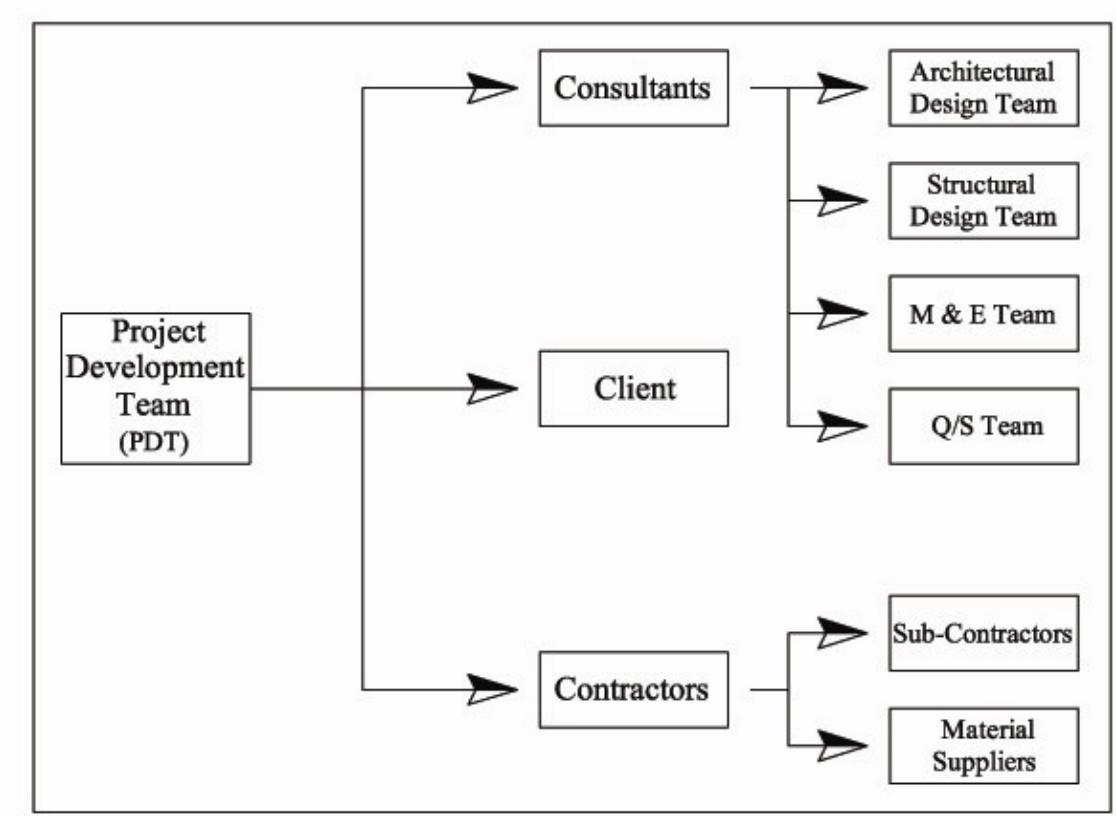


Figure 3.2. Project Development Team (PDT)
(Source: Khalfan 2000)

3.1.4. Level 4: Managed

Projects are managed in the light of future plans of the architectural design office. While doing this, the consideration of the previous processes are not neglected. Office managers use efficiency and effectiveness metrics to make decisions regarding the current project and realize the impacts on other projects. All projects, changes and other issues are evaluated based upon metrics from cost estimates, baseline estimates and earned value estimations.

Project Development Team (Figure 3.2.) continues in this level more efficiently. All project information is distributed and integrated to all members of the project development team. All the processes and standards are documented for the decision of the project processes. These documents support the usage of metrics. Office managers purely and brilliantly understand their roles in the process and execute it very clearly and effectively.

- Projects are managed in the light of future plans
- Office managers use the metrics for the project decisions.
- PDT work very efficiently. Standardization integrates to all PDT members.
- Office managers brilliantly understand their roles.

3.1.5. Level 5: Continuous Improvement

Processes are actively used by the office managers for the improvement of the project management activities. Lessons learned are used for improving the project management processes, standards and documentations. All the staff of the architectural design office not only focuses on the current project activities but also focuses on the continuous improvement. All the collected metrics during the execution of the project processes are also used for the future decisions.

- Processes used for the improvement of the project management activities.
- All the staff of the architectural design office focuses on the improvement.
- All collected metrics used for future decisions.

3.2. Project Management Knowledge Areas

3.2.1. Project Integration Management

The purpose of project integration management is as follows:

- To initiate the project
- To coordinate the project activities and integrate all efforts into a project management plan.
- To integrate, analyze and report the project results in carrying out the project management plan.
- To control the changes to the baseline.
- To collect, integrate and organize project information system.
- To close the project in an orderly and disciplined system.

3.2.1.1. Initiation and Scope Definition

Initiation and scope definition deals with the formal authorization of a project and definition of project scope, assumptions and constraints.

Level 1: Initiation of a project starts without a contract, usually only verbally. Scope of the project is defined not in details. Initiation and scope definition and its processes are not standardized and even changeable during the execution of the architectural design processes. In every project, these processes differ.

Level 2: Initiation mainly starts with a contract. Senior architects encourage the staff to prepare scope statements especially for larger detail projects.

Level 3: Initiation never starts without a contract. Project team prepares a report before the initiation according to the project. Scope is defined in details by the integration of project development team. Assumptions and constraints are defined in details as a must.

Level 4: There is an organizational standard for the preparation of the contract and initiation of the project. All the detailed scope statements, assumptions and constrains are managed by checking, monitoring and documenting throughout the architectural design process.

Level 5: All the processes done for the initiation such as; contract preparing and scope determining are all for the process improvement. All data gained during the process are used for the improvement of scope determination and development of requirements. Scope is regularly monitored and results are carefully documented. All these actions are evaluated during the process.

3.2.1.2. Deliverables Identification

Deliverables Identification deals with all the documents and jobs delivered at the end of the project.

Level 1: Deliverables are identified only verbally and not in written or written under some main titles. Sometimes it cannot even be mentioned to the client. Deliverables are identified at the end of the project. The process is ad-hoc.

Level 2: Key deliverables are identified and listed. Documentation is very weak and not standardized. It is depended to the scale of the project. If the scale of the project is larger the architects pay more attention to the deliverables.

Level 3: Deliverables are clearly identified and documented in details. Scope, technical requirements and adequacy of these documents are determined and approved and added to the contract.

Level 4: All the architectural designs' layouts and other documents are clearly identified and documented in details. These works are listed and delivered to the clients and other parties for checking, monitoring and documentation.

Level 5: There is a full change control on deliverables. Any change is only initiated if it is fully understood and documented. All these actions and their documentations are used for the continuous improvement.

3.2.1.3. Project Management and Plan Development

Project Management and Plan Development identify the route during the whole architectural designing process of the architectural design office.

Level 1: Every architect in the office defines its own way. Determined targets are independent and usually focus on the result. No interval milestones are planned. When examined in details all the works done are independent and ad-hoc.

Level 2: Architectural design process is planned during initiation. This planning process is dependent to the scale of the project. Sometimes the architects can neglect this stage if the scale of the project is small or if office had repeated similar projects on high numbers.

Level 3: All the phases and the processes of the designing process is planned in details and documented. This documentation is done not only for the current project but also to be used for the next projects.

Level 4: All the phases and processes of the design process is planned and documented in details and these documents are always used during the process. All the activities during the project management plan development are planned considering the organizational identity of the architectural design office.

Level 5: An improvement process is always in place to improve architectural design process. Works done and conclusions during the process are used to improve the architectural design process. The act of planning a project is clearly understood and its consumption of resources is planned as well.

3.2.1.4. Project Management Plan Execution

Project Management Plan Execution deals with the carrying out of the Plan Management Plan processes.

Level 1: During architectural design process, all the design decisions and criteria are given verbally and not documented. Results of the interval designs are only noted to solve the current momentary problems.

Level 2: Only summary information on work results is developed. Main aim is to achieve the schedule milestones. To describe project status, technical status information is integrated with the cost and schedule information. While documenting the project performance reports only basic metrics are collected.

Level 3: Results during architectural design process are analyzed in summary and in details and reported. On every phase of the design process, information like time spent, drawn/designed by, version number, etc. are documented by reflecting the identity of architectural design office.

Level 4: Every phase of the design process is reported one by one. While documenting these reports, distribution to all departments of the architectural design office, project development team and other stakeholders is also taken into consideration.

Level 5: An improvement process is always in place to improve project management plan execution of the architectural design process. Lessons learned are captured and used to improve the execution efforts.

3.2.1.5. Change Control

Change Control deals with all the changes during the architectural design process. Assessing and identifying the changes and their distribution to all related parties, controlling, monitoring and managing them are all integrated to Change Control.

Level 1: Changes during architectural design process are only mentioned verbally, not documented and not monitored. There is no change control information's distribution to other stakeholders or sometimes very few if these changes are vital. Every change is carried out independently from the stakeholders sometimes even from the managers of architectural design office.

Level 2: There is a defined and documented change control for scope changes. If the scale of the project is larger than change, control is managed more carefully. Cost and schedule changes are not still controlled.

Level 3: While managing the changes during the architectural design process a clear and detailed system is carried out. All the activities are documented. Reports are distributed to all related parties.

Level 4: Every change and every revision is reported one by one. While these reports are documented, distribution to all departments of the architectural design office, project development team and other stakeholders are also taken into consideration.

Level 5: Project changes and revisions are included in the determination of project efficiency and effectiveness. Lessons learned are being captured in a repository. Lessons learned are captured and used to improve the monitoring and control efforts.

3.2.1.6. Project Closure

Project Closure deals with controlling and checking the decisions, assumptions, scopes, deliverables, etc. defined and documented or mentioned in the contract and approvals during initiation phase. After checking and controlling if all works are completed or cancelled, project closure deals with the acceptance of the deliverables by the client. Furthermore, organizational knowledge and project artifacts are collected and preserved for learning purposes and potential re-use in other projects.

Actions of project closure are: vendor management during architectural design process, acceptance by the client, contractual and administrative closure procedures, payment for services and close out activities.

Level 1: Delivery of final layouts and other architectural design works are done informally. Contract close outs are carried out weakly. No acceptance of the client. Weak or non documentation of the contract close out reports. No standardization and no written procedures.

Level 2: There is a formal acceptance and contract close out but a standard process is not established or documented. There is no procedure or planned process for close outs of cancelled and uncompleted architectural design works. But even if the architectural design work is cancelled or uncompleted a file of documentation and reports are kept in the office.

Level 3: During close out phase, there is always a formal procedure for acceptance of the deliverables and project report and documentation.
The client and users are involved in reviewing of documentation and deliverables completion. Close out phase action and reporting starts after signing off the acceptance approvals by the client or his/her representatives.
After signing off, a final report is sent to the client. There is a standard procedure for close out phase.

Level 4: All stakeholders of the projects integrate fully to the close out activities of the architectural design works. All the staff working for the architectural design office participate in the briefings to discuss and evaluate about the works done and lessons learned. Project teams are recognized for their efforts. All projects are terminated prematurely and also are closed using a standard process for capturing all relevant artifacts and data.

Level 5: Project closure processes are evaluated on a periodic basis and enhancement are continuously incorporated. A performance database exists to capture performance information on the project to include contractors. All cancelled projects undergo a review process order to determine root causes as lessons learned.

3.2.1.7. Project Information System

Project Information System deals with documenting all the works and activities done starting from the acceptance of the project by the architectural design office till to the close out and conclusion processes. The main product of this component is the all information about the architectural design process which is accessible to all stakeholders.

Level 1: There is no system for collecting, integrating or organizing the project related information tools, processes and procedures. Architects decide on the system whatever they desire.

Level 2: System is very basic like a central file system. There can be a kind of information system but not standardized.

Level 3: There is a central information system in the architectural design office for collecting, integrating or organizing the project related information tools, processes and procedures. The systems are becoming standardized across projects.

Level 4: There is a file center (department) in the architectural design office. All reports, revisions, corrections and other related documents about the architectural design process are collected in this center, ready to be distributed to other stakeholders or to be used for the next design process. There is an organizational standardization so architects don't have to spend extra manual effort for this process.

Level 5: An improvement process is in place to continuously improve the project information system. Lessons learned are captured and used to improve the project system.

3.2.2. Project Scope Management

The purpose of project scope management is as follows:

- To ensure that the project includes all the work required and only the work required completing the project successfully.

3.2.2.1. Scope Planning and Management

Scope planning and management deals with how to define the project scope. Also developing a work down structure, verifying the scope and controlling the scope are all integrated with scope planning and management.

Level 1: There is no project with scope management plan. A very basic contract or verbal request of the client and its notes are the initiating documents of scope planning and management.

Level 2: Development of a scope plan is accepted as part of the project management process without a systematic approach. Scope planning activities are more effective if the architectural design office repeats projects with similar scopes. Larger scale projects have prior importance over the attention of the senior architects.

Level 3: An architectural design project scope management plan template exists and is consistently used for all projects. This document defines how a scope of a project is to be determined and controlled.

Level 4: Scope planning and management is actively used on all types of projects and it is accepted by the Project Development Team. Scope planning and management is adapted to the size and type of the project involved, as well as the organizational approach.

Level 5: Scope Planning and Management is actively focusing on improvement. Measuring value of scope changes, consideration of cost of rigor applied to each project and process for recording and disseminating lessons learned are integrated to Scope Planning and Management.

3.2.2.2. Business Requirements Definition

This is the assessment and development of processes, procedures and standards relating to the collection of the business related requirements of projects.

Level 1: Business requirements are not managed.

Level 2: There is a documented process. Office managers collect the data and define the business requirements. The result of this process is the list/document of business requirements. Mostly the architects submit the requirements to the managers and then the managers sign off to approve them.

Level 3: In this level, business requirements are managed by a checklist which is prepared to be checked. All the other stakeholders and Project Development Team members are integrated to the process. To prepare the list, all the other stakeholders and the PDT members come together and all of these are responsible for the business requirements. In addition to the previous level also the stakeholders sign off the approval of the requirements before the senior architects.

Level 4: Project Development Team completely defines for the documentation of the business requirements. Current project's business requirements are integrated with other ongoing projects requirements.

Level 5: There is a fully change control on business requirements. Without a complete understanding, changes are not initiated and documented. Senior architects integrates to the process only at appropriate levels. Final requirements and its documentation are kept to be used for upcoming or future projects.

3.2.2.3. Technical Requirements Definition

Technical Requirements Definition is the assessment and development of processes, procedures and standards relating to the collection of technical requirements of the project. The aim is translating the business requirements into technical requirements.

Level 1: Technical requirements are documented for projects, which have some general definition of what will be produced if these are met.

Level 2: There is a basic process for establishing a base set of deliverables for a project. The project manager always verifies project scope (what is to be included/excluded in project) with a client area. Managers signs off the documents to approve. There is agreement on how those deliverables will operate when produced.

Level 3: There is in place standard format both for technical specifications and process which these specifications are produced. This process is used on a continuing and ongoing basis. Project Development Team is integrated to the process. This team approves the technical requirements and the specifications.

Level 4: Project Development Team fully documentates the technical requirements and specifications based on organizational standards. These are created only after analyzes of results of the proposed system on the current technical environment and other ongoing projects.

Level 5: There is a full change control on requirements and specifications. Without a complete understanding, changes are not initiated and documented. Management integrates to the process only at appropriate levels. Final requirements and its documentation kept to be used for upcoming or future projects.

3.2.2.4. Work Breakdown Structure (Project Charter)

Work Breakdown Structure (WBS) is a fundamental project management technique for defining and organizing the total scope of an architectural design process, using a hierarchical tree structure. The first two levels of WBS define a set of planned outcomes that collectively and exclusively represent 100% of the project plan (project scope). A WBS (figure 3.2.) helps an architectural design office to assign any project activity easily.

Level 1: There is very basic work identification for an architectural design process. The architectural design office establishes a simple project plan which usually doesn't have guidelines to follow, develop and plan.

Level 2: A WBS is defined in a basic process including probably the first 2 levels which are showing the architectural design office's primary project plan. The items on level 2 are mainly identifying the deliverables to the client. Most of the architectural design offices reach to the 3rd level during the design process is progressing. These WBS structures are used to developed the architectural design schedule and as a communication vehicle for the status of the project.

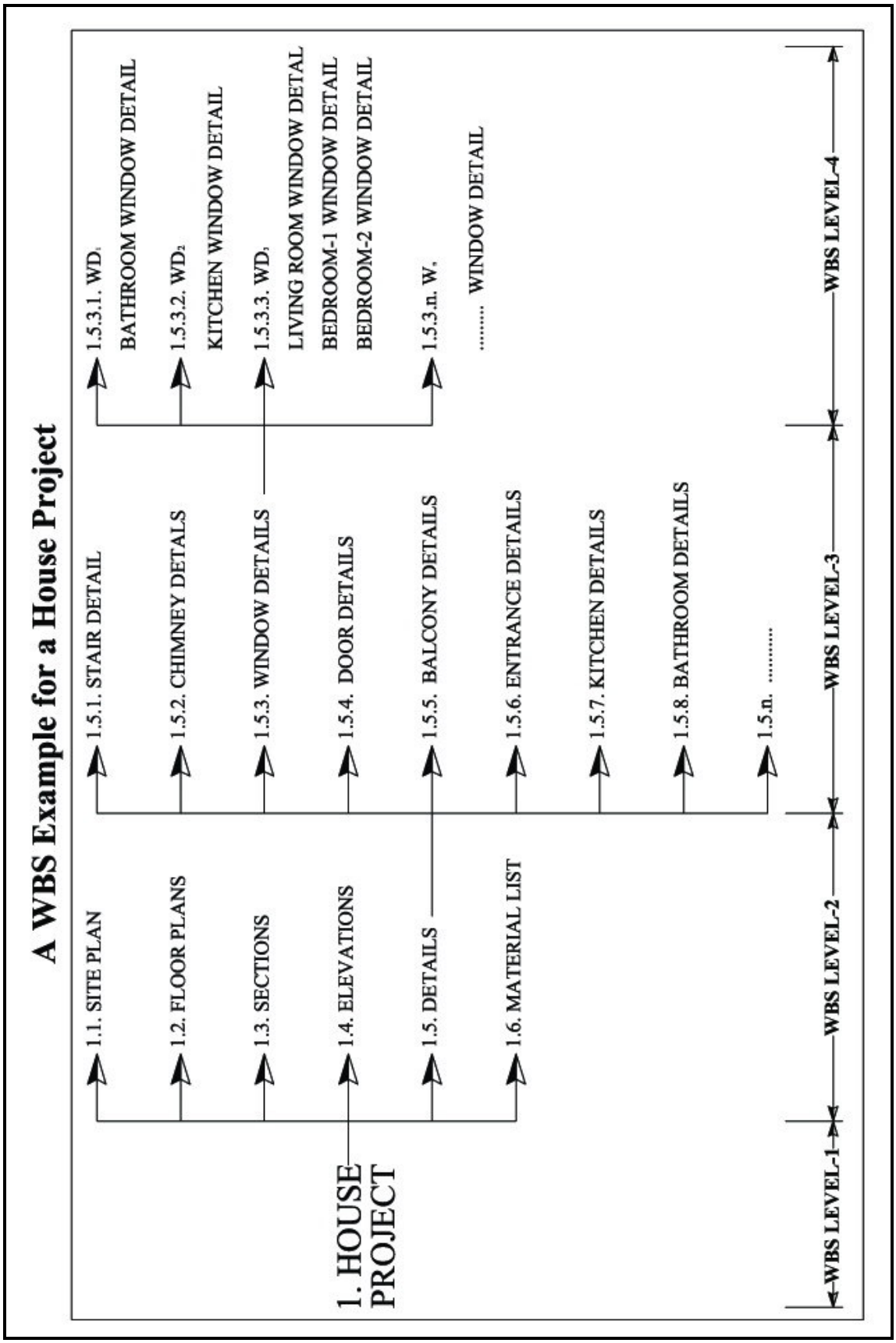


Figure 3.3. A WBS Example for a House Project

Level 3: PDT and other stakeholders are integrated to WBS process. The WBS is used for the determination of the project tasks. PDT is responsible for developing and approving the WBS.

Level 4: WBS is integrated to the change control process. Creating and developing of WBS co-operates with the documentation of the deliverables. PDT can make acceptable changes on WBS without approving, but PDT also understands that these changes might impacts on the other management areas like scope, time, cost, etc. that must be approved by the architectural design office.

Level 5: Determination of WBS process is regularly examined (usually at project close-down) to assess lessons learned regarding project improvements. WBS is checked and monitored regularly and project changes are foreseen and documented carefully.

3.2.2.5. Scope Change Control

Scope change control deals with the project scope changes and it covers the regularity of the use and overall evaluation of proposed changes.

Level 1: Scope changes are not managed. If there is a need for a scope change, this is down after some communications. There is no documentation process of the scope changes.

Level 2: There is a defined and documented scope change control, generally for larger scale projects. Senior architects also monitor these changes if the scale of the project is larger.

Level 3: PDT manages the scope change control. All the other stakeholders are informed for the changes and the status of the project. This process is documented and repeatable

Level 4: All processes are documented and ready to be used. Scope, cost and schedule reports are integrated with technical status reports.

Level 5: There is a continuous improvement process in place to improve the scope change control. Lessons learned are captured and utilized to improve the process. There is a scope variance utilizing and cost assessment processes during the execution of the project.

3.2.3. Project Time Management

The purpose of project time management is as follows:

- To develop and manage the project schedule.
- To ensure the project completes within the approved time frame.
- To define the project activities,
- To execute the schedule.
- To control the plans during project execution.

3.2.3.1. Activity and Resource Definition

Activity definition deals with identifying and documenting the project activities which are identified in the WBS. Resource definition deals with defining what resources are needed in which quantities for the ongoing architectural design process. The main resources are labour, material and equipment. The outcome of activity and resource definition component is an activity list including activity definitions, a list of the project resource requirements, constraints and assumptions.

Level 1: WBS generally identifies the milestones and the deliverables. The project schedule is at the milestone level. There is no activity definition to reach the milestones. Project managers develop their own way to identify the resources and quantities needed. There is no documentation process and milestones are not standard.

Level 2: There is an existing scope process and a scope statement is prepared, but the managers still do not integrate to the process. For defining the activities there is a basic documentation process. When the scale of the project larger the activity and resource definition processes become standard and the project schedule comes out in details. At least up to 3rd level of WBS, activities are detailed to achieve the scope. The activity definition process is expanded to collect historical information and it is documented and repeatable. The top level WBS template and identified set of key stones and activity definition process is standardized for larger scale projects. A planning process is developed and documented to include the resource listing and methodologies for determining the quantities. Office managers support the planning process and it is accepted by the architectural design office.

Level 3: There is an organizational standardization for the scope statements for all projects. WBS is the main basis for determining the project activities and resource requirements. A detailed schedule and activity list is an organizational standard. PDT defines the external and independent activities. The activity definition process is documented and repeatable. All the metrics of the projects like the number of activities per period are being collected and analyzed on the types of the resources required by the projects.

Level 4: All the activity and resource definition process activities are monitored regularly. PDT uses this information to make decisions regarding the project and related efforts. Lessons learned are being captured.

Level 5: There is a continuous improvement process is in place to identify the activities completely and effectively. Architectural design office' PDT uses the templates, experience and standards to achieve this. There is a continuous improvement process is in place also for the resource planning to identify the resource requirements in the shortest period and in the right quantities. An advanced process is developed and documented.

3.2.3.2. Activity Sequencing

Activity sequencing deals with sequencing the project activities considering the relations and relativity between them. The outcome of activity sequencing is a project network diagram.

Level 1: Projects are sequenced on an adhoc basis. This sequencing is set according to the architects own decisions. Architects deal with the activities independently and there are no project network diagrams.

Level 2: There is a basic and documented process for activity sequencing and establishing the dependencies. The activity sequence process includes the identification of assumptions and constraints that affect the architectural design processes' activity sequence. The process becomes standard on larger scale projects. Network diagrams are basic and not detailed.

Level 3: Activity sequencing process is dependent to other stakeholders' processes and activity network diagrams. The process is standard and repeatable. PDT documents the network diagrams.

Level 4: PDT regularly monitors the project dependencies use them to support the decisions. Lessons learned are being captured.

Level 5: There is a continuous improvement process in place to improve activity sequencing. Lessons learned are captured and used to improve activity sequencing efforts.

3.2.3.3. Schedule Development

The objective of schedule development is to identify dependencies between project activities, assign resources and identify start and end dates for each project activity. The main outcome of this component is the project schedule.

Level 1: There is no schedule development process. Architects only estimate the start and end dates and some very common milestones very roughly. Architects are not sure about these estimations so they avoid mentioning them on the contracts or with written approvals.

Level 2: There is a basic schedule development process. The process is documented and developed generally on higher scale projects. Development of the process is dependent to the number of similar concepts designed by the architectural design office. Project schedule covers the starting day and information for each deliverables to the stakeholders. Resources are included into the schedule. Main milestones are mentioned and baselines are established in the schedule, but these may change frequently.

Level 3: PDT builds the links to the project scope and WBS while establishing the project schedule. PDT studies and analyzes the history data over the previous similar concepts. While preparing the schedule development PDT never hesitates to consult to the experts if needed and rely on their reports. Scheduling process is fully integrated with PDT. Baselines are established and managed. All metrics are collected and analyzed. All processes are documented and being utilized.

Level 4: Baselines are managed and used for planning and managing the project execution. Schedule development is used for supporting the all given decisions. Lessons learned are captured. The baseline process is fully integrated with the architectural design office's organizational planning systems and risk management processes.

Level 5: A continuous improvement process is in place to improve schedule development processes. Lessons learned are captured and used for the continuous improvement.

3.2.3.4. Schedule Control

Schedule control aims to realize and manage the project activities within the planned time frame. Schedule control manages its processes by establishing a schedule control system, publishing schedule status reports, analyzing schedule performance metrics, determining changes to the schedule baseline and informing the stakeholders. The main products of schedule control are schedule control reports, performance analyzes and revised schedule baselines.

Level 1: There is no proper schedule control process. Every milestone of the design process is individually managed without monitoring. There is no standardization for schedule control processes.

Level 2: Schedule control system is very basic. Schedule controls done if the stakeholders have demand and these are generally on key milestones. Architects pay attention to schedule control on larger scale projects and documentation is weak and still there is no standardization, but on small scale projects architects are more capable on managing with simple variances.

Level 3: PDT manages the schedule control. Every progress is informed to the stakeholders. Schedule baselines are established and managed. Cost and schedule reports are integrated. There is a full documentation for the schedule control related processes.

Level 4: Schedule assessments are incorporated and included in the determination of project efficiency and effectiveness. Earned value techniques are used to update project schedules and to support the determination of project efficiency and effectiveness. Lessons learned are being captured.

Level 5: A continuous improvement process is in place to improve schedule control processes. Lessons learned are captured and used for the continuous improvement of the schedule definition.

3.2.3.5. Schedule Integration

Schedule integration deals with the integration of major components of the architectural design schedules. Schedules are integrated throughout the organization to accurately understand the impact of change. The main outputs of schedule integration are integrated design process, program and organizational schedules.

Level 1: There is no schedule integration formally. The ad-hoc level schedule integration is done when there is an individual request is on. These are generally mentioning the milestone status.

Level 2: Schedule integration is done manually. There is no attempt to integrate the dependencies and relations within program schedules and external relations schedule.

Level 3: A process is developed and documented to integrate program and external schedules with the other stakeholders. The program integration is centrally conducted and the process is repeatable. Key external dependencies are identified, monitored and managed. There is an organizational view over this component.

Level 4: PDT makes decisions understanding the full impact across programs and the organization. Schedules are managed, documented and developed during the execution of the architectural design process. Independent audits have been introduced to identify and recommend areas for improvement with an expertise report.

Level 5: A continuous improvement process is in place to improve schedule integration processes for programs across the architectural design office. Lessons learned are captured and used for the continuous improvement of the schedule integration.

3.2.4. Project Cost Management

The purpose of project cost management is as follows:

- To determine the total cost of the projects
- To ensure the project completes with in the approved budget.
- To estimate the cost of identified resources.
- To involve in developing a project baseline, comparing progress against baseline and controlling costs.

3.2.4.1. Cost Estimating

Cost estimating is an analytical process using factors, relationships, and expert knowledge to develop the cost of an architectural design process. The main outcome is an architectural design process cost estimate and a cost management plan.

Level 1: Cost estimating is on ad-hoc basis. Generally milestones and deliverables are tried to be identified to determine what the estimate is. Estimation documentation is limited, incomplete and not required for the architecture.

Level 2: There is a very basic cost estimation generally cover the first two levels of the WBS with a brief schedule. Cost estimating is matured where larger scale projects are concerned. It is norm to have a project schedule at least to level three in the WBS.

Level 3: Alternative cost analyzes are integrated to the cost estimations. The entire process is fully documented and repeatable. The major specific architectural design process standards and factors are developed. Metrics are collected, analyzed and reported. The historical database is established.

Level 4: All the processes are documented and being utilized. Architectural design office's cost standards and factors are used for the WBS.

Level 5: A continuous improvement process is in place to improve cost estimating processes for better forecast projects costs and improve the cost management plan. Lessons learned are being captured and used to improve cost management efforts. The final reports are compared with the original estimates. PDT uses these comparisons and other data for continuous improvement and for future projects. Lessons learned are being captured.

3.2.4.2. Cost Budgeting

Cost budgeting deals with developing a project cost baseline by allocating the cost estimates to individual elements in the WBS. The main output is a project cost baseline.

Level 1: There is no established practice and documentation of the processes. The process is incomplete.

Level 2: Cost budgeting process is still not standardized and well documented except for larger scale projects. Baselines are established in line with the project schedule, but may change frequently. Documentation varies at different levels of detail for every each architectural design process.

Level 3: Projects are developing and documenting project baselines at the lowest reasonable level. The baselines are established in line with the project schedule. Baselines are established and managed.

Level 4: All the processes are documented and being utilized. The baseline process is fully integrated with the scheduling and the architectural design office's finance and risk management process.

Level 5: A continuous improvement process is in place to improve cost budgeting processes and baseline processes. Lessons learned are being captured and used to improve the baseline effort.

3.2.4.3. Performance Measurement

Performance measurement deals with measuring the project performance to determine whether architectural design process has been accomplished in accordance with the plans. The main products are comparison of actuals to the baseline and earned value metrics.

Level 1: There is no performance measurement. There is no established practice or procedure, every architect follows her/his own method.

Level 2: Architectural design office is capable of tracking summary level hours and budget and tracking progress toward achieving milestones. Metrics such as planned budget, planned hours, hours spent are established in a very simple system.

Level 3: The capability exists to calculate the budgeted cost of work scheduled and performed, the actual cost of work performed, budget at completion and estimate et completion. The full process is documented and repeatable.

Level 4: All earned value techniques are used as appropriate on key projects where logical application provides measurable benefit, including performance indicates to compare project performance to the project baseline and make forecasts as appropriate. Earned value is used to update project cost and revise the baseline cost if applicable.

Level 5: A continuous improvement process is in place to improve earned value processes. Lessons learned are being captured and used to improve the measuring effort. Earned value techniques are used to update project costs and to support the determination of project efficiency and effectiveness.

3.2.4.4. Cost Control

Cost control deals with managing the cost baseline to ensure the architectural design process completes within the approved budget. Managing the cost baseline involves implementing a cost control system, publishing cost status reports, analyzing cost performance metrics, determining changes to the cost baseline, managing the authorized changes, informing stakeholders and taking corrective action. The main outputs of this component are cost reports, cost performance analyzes, revised project cost baseline and lessons learned.

Level 1: Architects do cost control with their own approach generally uniquely managed and in many cases not monitored. Cost reports are prepared and documented if there is a demand from the other stakeholders.

Level 2: A process is developed and documented to publish and distribute cost reports. Periodic cost reports are developed at the summary level and provided to key stakeholders. Summary cost reports are produced from an integrated system. Basic cost metrics are collected and reported. Baselines are established in line with the project schedule, but may change frequently

Level 3: PDT uses the cost change control process, cost reporting process and performance reports. All these documentations are evaluated, managed, documented and distributed to other stakeholders. Cost and schedule reports are integrated. Architectural design office works with a corporate financial/ accounting system.

Level 4: All processes are in place, documented and being utilized. The cost control system is integrated with the architectural design office's control systems and monitoring programs. Cost and schedule reports are integrated with technical status reports. Actuals are provided by the corporate financial/accounting systems and analyzed by the PDT.

Level 5: There is a continuous improvement process is in place to improve cost control processes. Lessons learned are being captured and used to improve the

monitoring and controlling efforts. Cost assessments are incorporated and included in the determination of project efficiency and effectiveness.

3.2.5. Project Quality Management

The purpose of project quality management is as follows:

- To satisfy the client.
- To conform to requirements.
- To ensure fitness to requirements
- To ensure if the design is fit for use.

3.2.5.1. Quality Planning

Quality Planning deals with identifying the quality standards, practices and associated quality activities. Planning should be done in parallel with other ongoing architectural design processes and other design process activities. The main output of quality planning is the quality management plan. Quality management plan identifies the specific quality practices, resources and activities relevant to the project and its deliverables.

Level 1: There is no quality planning. Architects try to use the governmental standards when the project is needed.

Level 2: Quality control planning is dependent to the official documents, but architectural standards are not neglected. Especially on large scale projects architects consider quality planning more effectively. Architects are aware of the quality need difference on every type of architectural design. Architects signs off on the quality plans on the larger scale projects.

Level 3: The quality planning process has been enhanced to include guidelines for design experiments and has standardized checklists for the use of the PDT in creating

their quality plans. Architectural design office has identified one or two architects whose focus is organizational project quality standards and assurance.

Level 4: The quality planning process now includes the perspective of the entire environment into which the building is being constructed. The architectural design office benchmarks its project results against other related projects.

Level 5: Architectural designs are consistently reviewed, inspected and tested against the standards. The quality process includes templates and guidelines for review and testing that design with other designs done by the office.

3.2.5.2. Quality Assurance

Quality assurance deals with developing and assessing processes, procedures and standards to assure the architectural design work will meet relevant quality standards.

Level 1: There are no established practices or standards for quality assurance, but some architects establish project procedures for their project teams on an ad hoc basis check to make sure everyone is following the procedures.

Level 2: A basic approach to quality assurance is established. For larger scale projects, architects establish project procedures or peer reviews to assure the team is following the procedures. Quality assurance processes, including tools and techniques such as flowcharting and architectural definitions are considered standard approaches on larger scale projects. Architects have devised checklists for use in checking.

Level 3: Tools and techniques, such as design of experiments and quality assurance checklists are now considered standard approaches on larger scale projects. PTD integrates with other stakeholders quality standards.

Level 4: PDT teams integrate with other stakeholders quality teams and identify the appropriate standards for the ongoing design process. Documentation procedures are in place and each component is fully documented. Nearly all the projects use quality assurance processes as specified by the standards.

Level 5: Feedback is gained from the quality assurance processes and is actively used to improve project management processes for future projects. Effectiveness and efficiency of both the final design and the project processes are regularly measured using metrics collected throughout the project.

3.2.5.3. Quality Control

Quality control deals with monitoring the actual project results to see if they comply with relevant quality standards and identifying ways to eliminate causing unsatisfactory results. Quality control activities are the procedures necessary to ensure the project deliverables meet the quality objectives and attributes defines in the team's quality management plan.

Level 1: There are no established practices or standards for quality control. Architects only consider the architectural standards and regulations of the related municipalities and other local authorities where the build is going to be constructed. There is no standard documentation. All the processes are ad hoc. Standardization and identifying the standards and regulations starts when the project comes to consideration for the architectural design office.

Level 2: Besides laws, regulations and legal standards, architectural office starts to deal with project checks and reviews of individual deliverables. Quality control processes become prior when the scale of the project is larger. It is easier to apply quality control process to repeated projects. Generally the office collects and documents the necessary legal standards and documents.

Level 3: Project performance standards are identified and begin to be established and measured against. The quality process includes templates and guidelines for review of

documents and drawings. The client is actively involved in project review and controls with the PDT. The client and the PDT approves the quality controls by sign offs.

Level 4: PDT reviews and checks the drawings consistently. Not only the design quality any principles but also the other processes and activities of the architectural design office are also manages, reviewed and checked. The quality process includes templates and guidelines for review and checking (testing if needed) with other ongoing design processes and other systems.

Level 5: PDT uses quality control results to make decisions on the appropriateness of the design. Quality control results also directly affect actual checking, reviewing and testing processes used to validate and verify deliverables.

3.2.5.4. Management Oversight

The purpose of management oversight is to understand, support and be involved in project management activities. This includes the following items.

Awareness and support: Awareness and support involves management understanding and being cognizant of project management activities and advocating organization-wide implementing of project management process and standards.

Involvement: Involvement covers management participation and inclusion in project management activities, processes and standards.

Level 1: Architects recognize that there are project management processes occurring within the organization on an ad hoc basis by individually. Architects understand the definition of a project and are aware of the need for project management.

Awareness and Support: Architects are aware of project management processes and recognize that there is a difference between the requirements for project management. Architects support individual interests in applying project management standards or processes on an adhoc basis at the discretion of the project managers, but do not require and conformity of use.

Involvement: Architects' involvement in daily project activities is none. The only activity is the project status.

Level 2: Basic project management processes exist in the organization, but they are not considered an organizational standard. When the scale of the project is larger then the clients and other stakeholders need to use the project management processes. Most project management processes are in place and are considered standard practice for larger scale projects. Architects understand the use of project management processes and support its use throughout the architectural design office.

Awareness and support: On larger scale projects, architects encourage the establishment of project cost, schedule and technical performance planning and tracking. Architects prepare the actual status reports and formal acceptance notification of project completion.

Involvement: For larger scale projects, architects encourage summary progress reporting of project performance at the milestone level for schedule and cost. Architects approve the project charter and assign the team. Architects sign off on project completion.

Level 3: All project management processes are in place and repeatable. The clients are integrated to the PDT. Architects fully support and have institutionalized the processes and standards. PDT is regularly involved in input and approval of key decisions and documents and in key project issues.

Awareness and support: Architects are required to attend project management awareness trainings. Architects support the projects within the organization by ensuring they have visibility and prioritization.

Involvement: On most projects, PDT informally prepares project baseline and project actuals comparison analysis. This information is used for evaluating the relative progress of the project compared to other projects. PDT actively involves key critical decisions within the projects, including change control, risk response, quality assurance and customer interaction.

Level 4: Project management processes are integrated with corporate processes. Architects clearly understand their role in the project management processes as key to organizational success.

Awareness and support: Architects actively support the project management processes as key to organizational success. Architects also support the evolution of the project management profession within the organization and actively support the need for both project management expertise and technical expertise on all projects.

Involvement: On all projects, PDT formally prepares project baseline and project actuals comparison analysis. PDT takes an active role in performance measurement metrics of efficiency and effectiveness on corporate systems and project management processes.

Level 5: Improvement processes are in place and utilized. Lessons learned are regularly examined and used to improve documented processes. All projects, changes and issues are evaluated based upon efficiency and effectiveness metrics and PDT takes an active role in management oversight. Projects are directly tied to the success of the organization.

Awareness and support: A continuous improvement process is in place to improve the management's awareness and support of corporate projects and their needs. Lessons learned are captured and used to improve the monitoring and control efforts. Projects are managed with consideration as how the similar project performed in the past and what is expected for the future.

Involvement: A continuous improvement process is in place to improve the management's involvement in the process of managing projects. Lessons learned are captured and used to improve the monitoring and control efforts..

3.2.6. Project Human Resource Management

The purpose of project human resource management is as follows:

- To identify the requisite skills required for specific architectural design and management activities.
- To identify individuals who have those skills.
- To assign roles and responsibilities.
- To manage and ensure high productivity of resources
- To forecast future resource needs.

3.2.6.1. Human Resource Planning

Human Resource Planning refers to the activities of identifying, documenting and assigning project roles, responsibilities and reporting relationships for the project.

Level 1: Human resource planning is on ad hoc basis. Architects try to plan human resource according to the ongoing projects' needs.

Level 2: Architects create a basic overview of the types of skill sets that are required for the ongoing projects or upcoming larger scale projects. Basic responsibility definitions exit so that the individuals on the architectural design process know who reports to whom on project. An informal analysis is conducted to define the organizational, technical and interpersonal interfaces that exist with in the organization. In addition to a project organization chart, there is a narrative description of the responsibilities for the key project personnel and a staffing plan that defines when resources will be needed.

Level 3: A formal analysis is conducted to define the organizational, technical and interpersonal interfaces that exist within the organization. Constraints those may be prevalent in attaining requires resources are analyzed and a response is developed.

Level 4: Project organizational management is integrated into the overall resource pool management. An action plan is developed to deal with the organizational, technical and interpersonal interfaces that exist within the organization. Constraints to resource planning are managed. Integrated decision making begins to occur.

Level 5: Organizational planning is evaluated on a periodic basis and enhancements to the process are continuously incorporated. Performance metrics for human resources are utilized to define the efficiency and effectiveness of resource utilization throughout the project. Stakeholder analysis effectiveness and efficiency is evaluated to ensure continuous involvement and sign off throughout the project. Lessons learned are captured for effective organizational planning.

3.2.6.2. Staff Acquisition

Staff acquisition covers identifying, soliciting and acquiring the necessary resources for the project.

Level 1: There is an ad hoc process of finding who is available to work on project activities.

Level 2: Staff acquisition consists of identifying the individuals who have the requisite skill sets and time availability to work on the project. The staff management plan includes defining the parameters for the desired team, including minimum experience, personal interests and characteristics and availability to determine a good fit among project team members.

Level 3: PDT deals with the planning of the staff acquisition. Architects give the last decision but ask for the opinion of the PDT. If needed PDT may ask for specific independent expertise

Level 4: Architectural design office establishes its own human resource department and assigns the staff for it. An action plan is developed. Constraints to resource planning are managed. There is commitment by all stakeholders to the definition of the roles and responsibilities in the staff planning. Integrated decision making begins to occur.

Level 5: Architectural design office evaluates its resource forecasting for continuous improvement and enhancements. Resource variance reports measure performance metrics of efficiency and effectiveness. Lessons learned are captured.

3.2.6.3. Develop and Manage Project Team

Team development is the act of creating synergy between project team members to enhance productivity, efficiency, and overall project success. Project team also tracks team member performance, provides feedback and resolves issues.

Level 1: There is an ad hoc process of trying to ensure that project team members work together in a professional manner. Generally the architect does not understand the team members meetings. Architects only organize meetings for explanations, revisions, for defining the deliverables to the all relative designers.

Level 2: Teams are not assigned automatically. Architects assign the teams by her/his opinion. There is a specific process for incorporating the team into scope development and the development of the work plans. There are some guidelines for project initiation team meetings, scheduled status reviews, technical reviews. The involvement of the team to the meetings is to keep the team members appraised how the project is progressing. Team is integrated into scope planning and management of the project.

Level 3: Project teams are assigned automatically, but the architects approve and propose it to the clients. All stakeholder input is fully solicited. Project teams are managing the architectural design processes. Project teams are integrated to PDT. Project team process is being utilized on most projects.

Level 4: A team development process is developed and established by which teams on medium and large projects are expected to evolve. Team member training needs are identified and communicated to the PDT, who works with the team member to meet those training needs. PDT significantly contributes to the performance evaluation of the individual.

Level 5: Architectural design office invests in its people and actively ensures that project teams have all the required to succeed on a regular basis. Team members' needs are forecasted and acknowledged as value added investment for the organization. Team satisfaction is measured. Lessons learned are captured.

3.2.6.4. Professional Development

The purpose of professional development is to develop the level of professionalism that exists within the architectural design office's PDT and project team member resource pool, as well as to develop how the organization supports and views the professional requirements for project management. This is supported by the subcomponents mentioned below:

Individual Project Management Knowledge: This refers to the knowledge acquired by the individual project management as a degree, a certificate, an awareness of the need for project management education.

Individual Project Management Experience/Competence: This refers to the individual's actual experience in working on or leading projects. Examples of project experience include working as a project controller, scheduler, construction manager, experting on construction cost, 3D and CAD design, etc. competency is measured by determining the effectiveness of an individual's work efforts or an individual's ability to successfully lead the delivery of projects of varying size and complexity.

Corporate Initiative for Project Management Development: If the acknowledges project management as a cornerstone for building corporate success, then they will incorporate environmental success factors, such as formalized professional developmental programs or project management career path (training, compensation, motivation, etc.) for their PDT and project team members.

Level 1: There are no corporate standards or processes in place from which one can build justification for a project management career path.

Individual Project Management Knowledge: Some individuals may understand the need for it.

Individual Project Management Experience/Competence: Some individuals may understand the need for it.

Corporate Initiative for Project Management Development: Some individuals may understand the need for it.

Level 2: There is a general recognition within the organization that an individual's knowledge base, experience and competence factors to successful outcome of projects.

As such, for larger scale projects an expectation for this occurs. Architectural design office begins to define the project related roles.

Individual Project Management Knowledge: For larger scale projects, architects follow these processes: scope, schedule and cost. Most individuals working on projects are expected to understand how to define these triple processes.

Individual Project Management Experience/Competence: It is expected that individual project team members have also had successful experience working on different projects and have demonstrated strong individual and teaming attributes. Some individuals are beginning to demonstrate project related specialties where they have strengths, such as a project controller, scheduler, construction manager, experting on construction cost, 3D and CAD design, etc.

Corporate Initiative for Project Management Development: There is a recognition process in place whereby those who are successful on larger scale projects will be acknowledged and compensated for their performance. The corporation makes available to anyone who will be involved on a project management essentials course, and all are encouraged to take this course to ensure a basic understanding of project management concepts and applicability.

Level 3: The architectural design office has a defined project management process in place and PDT members are expected to follow the process in planning and managing. The office has established different project related roles and expects that every individual will develop his/her career, and help them to succeed.

Individual Project Management Knowledge: All PDT members are expected to have a solid knowledge base about how to plan and track projects. PDT members are encouraged to take certificates and degrees related to project management.

Individual Project Management Experience/Competence: Every individual is evaluated on his/her performance, customer satisfaction, team member satisfaction and triple constraints parameters.

Corporate Initiative for Project Management Development: The architectural design office insists that all individuals and stakeholders attend a project management essential course that covers the basic elements of project management. The organization recognizes that effective project management is a cornerstone to organizational success.

Level 4: PDT supports the integration of the professional project related tracks into the corporate human resource structure of the organization.

Individual Project Management Knowledge: All PDT members who have chosen to focus on a project related specialty area are actively pursuing a related certificate or degree in that area.

Individual Project Management Experience/Competence: A project related role competency measurement has been defined and individuals are given a continuum that can be utilized for performance measurement and career growth.

Corporate Initiative for Project Management Development: The organization is actively staffing and providing a complete training curriculum for each of the different project related roles from project manager, to CAD designer, etc.

Level 5: Improvement procedures are in place and utilized. Lessons learned are regularly examined and used to improve documented processes. Projects are given high value within the organization.

Individual Project Management Knowledge: An improvement process in place to continuously improve the individual's knowledge base in project management. Lessons learned are captured and used to improve the monitoring and control efforts.

Individual Project Management Experience/Competence: An improvement process is in place to continuously improve the individual's ability to attain experience and improve competency in project management. Lessons learned are captured and used to improve the monitoring and control efforts.

Corporate Initiative for Project Management Development: An improvement process in place to continuously improve the organization's ability to enhance the project management. Lessons learned are captured and used to improve the monitoring and control efforts.

3.2.7. Project Communications Management

The purpose of project communications management is as follows:

- To manage the project data process from collection to categorization, to dissemination, to utilization and decision making.

3.2.7.1. Communications Planning

The purpose of communications planning is to determine the information and communications need of all the project stakeholders.

Level 1: There are no established standards for communication planning. The clients or the stakeholders may ask for the status of the project, then the architects provide it.

Level 2: There is an informal stakeholder analysis where the stakeholders are identified and provide project summary reports for status, progress or phase completion. Project constraints and assumptions are developed. If there is an ongoing larger scale architectural design process a communication management plan is developed.

Level 3: There is an accepted communication plan for all projects.

Level 4: There is a method for updating and refining the communications management plan as the project progresses and develops and is incorporated into the corporate system.

Level 5: Communication planning documentation and lessons learned are analyzed for value added impact. Lessons learned are captured.

3.2.7.2. Information Distribution.

The purpose of information distribution is to make the information available for all stakeholders of the architectural design process.

Level 1: Information is distributed to the stakeholders in an ad hoc basis response to a specific question or subject.

Level 2: There is a basic information distribution process is in place. Project stakeholders are directed to a specific sharing file on a computer network or central physical location, where they can retrieve needed project information.

Level 3: There is a formal information retrieval system by which project stakeholder can retrieve information through an electronic text base or central repository. There is a formal information distribution system including project meetings, hard copy documentation, fax, electronic mail. PDT confirms stakeholder satisfaction with information dissemination on a regular basis.

Level 4: There is an automated retrieval system in place that is based upon a database structure and inquiry process. The information distribution system includes meetings of varying formats and also multimedia distribution, such as video conferencing and internet.

Level 5: All the documentation of the ongoing architectural design process is available for all stakeholders during administrative closure. Lessons learned are evaluated to determine continuous quality improvement measurements of the process.

3.2.7.3. Performance Reporting

Performance reporting deals with the information needed during project execution, control and includes status reporting, progress measurement and forecasting data and reports received from project integration.

Level 1: When any stakeholder asks for the current status of the ongoing project, he/she can only get in touch with the architect.

Level 2: During the architectural design process there are 3 types of information which are available status, progress and phase completion. At the conclusion of the design process there is a formal customer sign off.

Level 3: PDT is involved in the identification, analysis, approval of changes to the project plan. All the reports are documented and archived for future reference.

Level 4: All projects are expected to capture performance measurements for understanding and analysis of project performance.

Level 5: Lessons learned are analyzed and the results are reconstructed into the process for continuous enhancements. Performance metrics are utilized to define efficiency and effectiveness metrics for projects.

3.2.7.4. Issues Tracking and Management

Issues tracking and Management deals with the supplementary information about the ongoing architectural design process. Managing, using and evaluating are the main activities of issues tracking and management.

Level 1: Issues are handled on an ad hoc basis and may be discussed in meeting.

Level 2: There is a documented process in place where issues are collected, documented, managed and brought to a conclusion. This process is followed at times and encouraged on larger scale projects.

Level 3: Issues are consistently addressed during regular, team meetings. The client area is part of determining issues and coming up with proposed resolutions and actions.

Level 4: The impact of project issues to other areas of the organization are understood and project issues are prioritized for resolutions and to minimize impact to the organization.

Level 5: This process is periodically evaluated to determine potential enhancements in the process. Lessons learned about the effectiveness of the issues tracking and management processes are collected.

3.2.8. Project Risk Management

The purpose of project risk management is as follows:

- To identify analyze, respond and control risk factors during the architectural design process.
- To understand the risk events
- To determine the best way to deal with the risks.
- To develop and execute a plan and monitoring progress.

3.2.8.1. Risk Identification

Risk identification involves with determining which risks are likely to be faced during the execution of the architectural design process activities. The main products of this component are risk events and risk triggers.

Level 1: There is no risk management and risks are not identified as a normal practice. Some stakeholders or the client can mention some risks to be taken under consideration by the architect.

Level 2: There is a documented process for risk identification. Architects encourage risk identification activities if the scale of the ongoing architectural design process is large. Some risks are listed and identified. Generally time, scope, deliverables and cost are the main problems that can occur during the execution of the design process. A WBS template goes to at least level three.

Level 3: The architectural design office has a documented, repeatable process for identifying project risks, which is fully implemented. Documentation exists on all processes. The process is expanded to include efficient avenues for teams to identify risks (checklists, automated forms, etc.). Risk discussions from past projects are done by meetings when similar projects are going to be undertaken.

Level 4: All processes are in place, documented and being utilized by nearly all projects. Management takes an organizational view. Risk management integrates with the cost management, time management, finance and accounting and strategic planning processes.

Level 5: A continuous improvement process is in place to improve risk identification. Lessons learned are captured and used to improve risk identification activity.

3.2.8.2. Risk Quantification

Risk quantification covers evaluating risks and assessing the potential outcomes. The main product is prioritized list of quantified risk events.

Level 1: There is no risk quantification and risks are not identified as a normal practice. Some stakeholders or the client can mention some risks to be taken under consideration by the architect or if there is already a risk is a problem.

Level 2: There is a documented process for risk quantification. Risks are still evaluated on a project by project basis. Risks are listed according to their importance for the architectural design office. Architects use their previous design experience to approach the risks.

Level 3: The risk quantification process is further expended to identify more advanced procedures for quantifying risks and multiple criteria to prioritize risk items. The entire process is fully documented and repeatable. Risks are evaluated on an organizational basis.

Level 4: All processes are in place, documented and being utilized. Risk quantification is integrated with cost management, time management, finance and accounting and strategic planning processes.

Level 5: There is a continuous improvement process is in place to improve risk quantification. Lessons learned are captured and used to improve risk quantification activity.

3.2.8.3. Risk Response Development

Risk response development involves defining the steps to manage the risks. It includes determining how best to respond and establish contingency plans, reserves and agreements necessary to contain risks.

Level 1: Risk response takes place when there is a risk is occurring. Architects response on an ad hoc basis.

Level 2: Architects may informally think about their strategy for dealing with future risk events and discuss the strategies among themselves. The plan will cover things such as who is responsible, how the information will be maintained, how plans will be implemented and how reserves will be distributed.

Level 3: The risk response development process is expended to include templates for the risk management plan. The organization is capable of allocating project reserves to cover risk items.

Level 4: All processes are in place, documented and being utilized. Risk response development is integrated with cost management, time management, finance and accounting and strategic planning processes.

Level 5: A continuous improvement process is in place to improve risk response development. Lessons learned are captured and used to improve risk response development activities.

3.2.8.4. Risk Control

Risk control involves controlling risks, making decisions on how to handle each situation, and taking corrective action.

Level 1: Risks are solved by day to day actions. Architects deal with the risks when they occur.

Level 2: Architects apply their own approach during the execution of the design process and activities. Architects assign responsibilities for each risk item as it occurs. Some risks are discussed with meetings in the office. If the scale of the project is larger, risks are considered more carefully. Architects organize periodic meetings especially for daily activities. The risk status is distributed to key stakeholders and incorporated into the project schedule.

Level 3: The process is fully developed and utilized for managing and controlling risks. Project risks are actively tracked and corrective actions are taken. Metrics are collected, and analyzed.

Level 4: All processes are in place, documented and being utilized. Risk response control is integrated with cost management, time management, finance and accounting and strategic planning processes.

Level 5: A continuous improvement process is in place to improve risk control. Lessons learned are captured and used to improve risk control activities.

3.2.8.5. Risk Documentation

Risk control involves establishing a project database to collect historical information on the risks encountered and related experiences. The main products are the historical database and post project assessment.

Level 1: There is no historical database documentation. Some past activities may needed to be discussed.

Level 2: Architects may collect some historical information about some general risks that the architectural design office might have to face in the future.

Level 3: Architectural design office is collecting historical information such as common risk items and risk triggers and keeps them in a database.

Level 4: The historical database is expanded to include common interdependency risks between projects.

Level 5: A continuous improvement process is in place to improve risk documentation. Lessons learned are captured and used to improve risk documentation activities.

3.2.9. Project Procurement Management

The purpose of project procurement management is as follows:

- To plan all purchases.
- To plan acquisitions.
- To plan the contracts.

3.2.9.1. Procurement Planning

Procurement planning involves determining whether to procure or produce by the company. After determining this, the next steps are deciding how to procure, identifying what and how much to procure and determining when to procure comes. The building materials are also counted in this process. The outcome of this component is the procurement management plan.

Level 1: There is no recognized practice for procurement planning, but architects define the basic requirements which are essential for the ongoing architectural design process.

Level 2: After the project request is received from the client, architects identify the main services and decide to plan the processes. This ends with a scope planning and the identification of the deliverables.

Level 3: PDT presents a formal recommendation report to the architectural design office and to the client. The essentials are supplied jointly by the design office and also by the client.

Level 4: Client works with a consultancy company and this company integrates to the PDT. All decisions are made under this PDT structure but again architects play a very important role on the decisions.

Level 5: Procurement planning is evaluated on a periodic basis and enhancements to the processes are continuously incorporated. The decisions are made based upon efficiency and effectiveness metrics. Historical data is used for the decisions.

3.2.9.2. Requisition

Requisition bridges the gap between identifying requirements and contracting. The process includes identifying potential vendors, determining solicitation type, determining type of contract, developing procurement documents. The outcome is the solicitation package.

Level 1: There is no recognized practice for requisition, but architects usually do these activities with the same methods.

Level 2: A process is identified for identifying contract requirements, identifying potential vendors, selecting the appropriate contract type, determining the best procurement approach. Architectural design office, groups the vendors according to their fields for later material decisions needed for the building.

Level 3: PDT deals with the vendors' recommendations, prepare the specifications for the vendors. The process for developing procurement documentation is expended to include procurement templates such as status reporting and other attachments.

Architects understand the importance of the material information so ask vendors to make presentations for the office.

Level 4: The project's requisition is fully integrated with the organization's requisition process. Architects are encouraged to attend to courses periodically for the construction methods of the materials.

Level 5: Requisition process is evaluated on a periodic basis and enhancements to the process are continuously incorporated. The process is automated and triggered.

3.2.9.3. Solicitation/Source Selection

This process involves finding the right vendor and negotiating the contract. It includes soliciting information, receiving bids and proposals, evaluating the information, negotiating the contract and finalizing the contract. The outcome is the order with a contract.

Level 1: There is no standard practice for source selection. Architects do it on their own way. Architectural design office's needs are decided by the architect. Generally, the architect asks the materials for the building to the client. The architect can't make a decision by him/herself.

Level 2: Usually, architects contact the vendors and conduct the price comparison. The vendor is asked to commit the final delivery date for the services with key milestones. No specific quality standards are detailed for the vendor.

Level 3: Vendors are asked to supply a detailed plan, including WBS and detailed, sequenced activity list, in line with the project's structure. PDT carry out the process integrated with the client and the other stakeholders.

Level 4: The project's solicitation and source selection is fully integrated with the organization's solicitation and source selection process.

Level 5: Solicitation and source selection process is evaluated on a periodic basis and enhancements to the process are continuously incorporated. The process is automated and triggered.

3.2.9.4. Contract Management/Closure

This includes actions involved with vendor management during contract performance, acceptance by the client, payment for services and close out activities. The purpose is to assure that the seller performance in accordance with the terms of the contract and receives proper reimbursement.

Level 1: Architects manage the contracts ineffectively. The only aim to achieve the end dates.

Level 2: The vendor is expected to supply to the project manager periodic status reports that reflect to reach the milestones. Formal acceptance and contract closure occurs. Information is sent to the architectural design office if needed especially for larger scale projects.

Level 3: Vendors report in a timely manner to the PDT and to the client if needed (if the vendor is supplying the material for the building or other engineering or related services). The client is integrated to the PDT for the checkouts. PDT signs off the contracts.

Level 4: The vendor is required to report progress against plan using the organization's standard project management tools and techniques. Vendors are integrated to the project management and architectural design processes and activities.

Level 5: Contract management and closure are evaluated on a periodic basis and enhancements to the process are continuously incorporated. Architectural design office considers strategic alliances with the preferred vendors. A performance database exists to capture the performance of the vendors and the contractors and other related parties.

3.3. Evaluation of ARCH-PMM

ARCH-PMM Model is developed by adapting SEI's Capability Maturity Model (Paulk et al. 1993), Kwak and Ibbs's Project Management Process Maturity $(PM)^2$ Model (Kwak 1997)(Kwak and Ibbs 2002), Crawford's Project Management Maturity Model (Crawford 2006) and adapting Project Management Insititute's PM processes (PMBOK 2004) to architectural design processes.

SEI's Capability Maturity Model is the primary work based on 5 leveled maturity and used for the structure of ARCH-PMM Model Levelings. SEI's Capability Maturity Model is utilized and implemented successfully on various studies such as; (Kwak 1997), (Finnemore and Sarshar 2000), (Harigopal and Satayadas 2001), (Voivedich and Jones 2001), (Froese et al. 2001), (Jacobs and Trienekens 2002), and (Crawford 2006).

ARCH-PMM constructed its assessment structure related to the PM processes and PM Knowledge areas of PMBOK like most of the previous PM Maturity Models such as; (Kwak 1997), (Finnemore and Sarshar 2000), (Harigopal and Satayadas 2001), (Hillson 2001), (IACMM 2003), and (Crawford 2006).

Most of the PM Maturity Models (Paulk et al. 1993), (Karandikar et al. 1993), (De Graaf and Sol, 1994), (Bergman and Ohland 1995), (Wognum et al. 1996), (Finnemore and Sarshar 2000), (Froese et al. 2001), (Harigopal and Satayadas 2001), (Brookes et al. 2002), (Jacobs and Trienekens 2002), and (Crawford 2006) including ARCH-PMM developed an assessment questionnaire supported by an interview.

3.4. Architectural Design Offices' Project Management Maturity Level Assessment Questionnaire

ARCH-PMM Assessment Survey is based on the five leveled ARCH-PMM Model (Table 3.1.). ARCH-PMM Assessment Survey is developed to provide an efficient tool for measuring an architectural design office's PM Matutity level. Final data of this assessment is used to evaluate the current PM level of an architectural design office according to the developed ARCH-PMM Model.

Primary aim of this assessment is to help architects for the improvement of the project management capabilities of their Architectural Design Offices.

Table 3.1. The Five Levels of ARCH-PMM

Level 1	**Initial**
Level 2	**Planned**
Level 3	**Organizational Standardization**
Level 4	**Managed**
Level 5	**Continuous Improvement**

Each process is assigned with a score based on Likert Scale (1 to 5) (Table 3.2.). The scores are added and avareged to determine the each PM Knowledge Area's Level of the architectural design office. Then these PM Knowledge Area scores are added and avareged to determine the overall ARCH-PMM level of an architectural design office.

Table 3.2. The Scoring System of ARCH-PMM Survey

L1	1 point
L2	2 points
L3	3 points
L4	4 points
L5	5 points

Finally, each score of an architectural design office benchmarked with other architectural design offices' scores. This comparison shows every office's current PM capabilities related to ARCH-PMM Model.

There are 2 sections in the ARCH-PMM Assessment survey as detailed below:

1- First section is to collect organizational information about the architectural design office (Figure 3.4.).

2- Second section is the 42 itemed semi-structured assessment survey (Figure 3.5.).

Their combination form the final structure of the ARCH-PMM Assesment Survey.

PART I

ARCH-PMM Assessment Survey
Organizational Information

Company Name							
Founder/Partners							
Year of Establishment							
City of establishment							
Adress							
Telephone **Fax** **website** **e-mail**							
experience (by years)	trainee	still educating	1-3 yr	4-5 yr	6-10 yr	over 10 yr	degree of education
Number of total staff							
Number of architects							
Number of engineers							
no. of technical person							
structure	constitutionalized	external	Note				
financing and accounting							
chartered accounted							
experience (by years)	trainee	still educating	1-3 yr	4-5 yr	6-10 yr	over 10 yr	degree of education
Related Person 1							
Related Person 2							
Related Person 3							
Related Person 4							

Figure 3.4. ARCH-PMM Survey – Organizational Information

PART II

Semi Structured ARCH-PMM Assessment Survey

Assessment Questionnaire

	Semi Structured ARCH-PMM SURVEY	L1	L2	L3	L4	L5
	Project Integration Management					
1	Scope Definition	☐	☐	☐	☐	☐
2	Deliverables Identification	☐	☐	☐	☐	☐
3	Project Management Plan Development	☐	☐	☐	☐	☐
4	Project Management Plan Execution	☐	☐	☐	☐	☐
5	Change Control	☐	☐	☐	☐	☐
6	Project Closure	☐	☐	☐	☐	☐
7	Project Information System	☐	☐	☐	☐	☐
	Project Scope Management					
8	Scope Planning and Management	☐	☐	☐	☐	☐
9	Busines Requirements Definition	☐	☐	☐	☐	☐
10	Technical Requirements Definition	☐	☐	☐	☐	☐
11	Work Breakdown Structure	☐	☐	☐	☐	☐
12	Scope Change Control	☐	☐	☐	☐	☐
	Project Time Management					
13	Activity and Resource Definition	☐	☐	☐	☐	☐
14	Activity Sequencing	☐	☐	☐	☐	☐
15	Schedule Development	☐	☐	☐	☐	☐
16	Schedule Control	☐	☐	☐	☐	☐
17	Schedule Integration	☐	☐	☐	☐	☐
	Project Cost Management					
18	Cost Estimating	☐	☐	☐	☐	☐
19	Cost Budgeting	☐	☐	☐	☐	☐

Figure 3.5. Semi Structured ARCH-PMM Survey – Assessment Questionnaire

20	Performance Measurement	☐	☐	☐	☐	☐
21	Cost Control	☐	☐	☐	☐	☐
	Project Quality Management					
22	Quality Planning	☐	☐	☐	☐	☐
23	Quality Assurance	☐	☐	☐	☐	☐
24	Quality Control	☐	☐	☐	☐	☐
25	Management Oversight	☐	☐	☐	☐	☐
	Project Human Resource Management					
26	Human Resource Planning	☐	☐	☐	☐	☐
27	Staff Acquistion	☐	☐	☐	☐	☐
28	Develope and Manage Proect Team	☐	☐	☐	☐	☐
29	Proffesional Development	☐	☐	☐	☐	☐
	Project Communication Management					
30	Communications Planning	☐	☐	☐	☐	☐
31	Information Distribution	☐	☐	☐	☐	☐
32	Performance Reporting	☐	☐	☐	☐	☐
33	Issues Tracking and Management	☐	☐	☐	☐	☐
	Project Risk Management					
34	Risk Identification	☐	☐	☐	☐	☐
35	Risk Quantification	☐	☐	☐	☐	☐
36	Risk Response Development	☐	☐	☐	☐	☐
37	Risk Control	☐	☐	☐	☐	☐
38	Risk Documentation	☐	☐	☐	☐	☐

Figure 3.5. (Cont.)

Project Procurement Management

39	Procurement Planning	☐	☐	☐	☐	☐	
40	Requistion	☐	☐	☐	☐	☐	
41	Solicitation/Source Control	☐	☐	☐	☐	☐	
42	Contract Management/Closure	☐	☐	☐	☐	☐	

KNOWLEDGE AREA MATURITY LEVEL

Project Integration Managment	☐	☐	☐	☐	☐	
Project Scope Management	☐	☐	☐	☐	☐	
Project Time Management	☐	☐	☐	☐	☐	
Project Cost Management	☐	☐	☐	☐	☐	
Project Quality Management	☐	☐	☐	☐	☐	
Project Human Resource Management	☐	☐	☐	☐	☐	
Project Communications Management	☐	☐	☐	☐	☐	
Project Risk Management	☐	☐	☐	☐	☐	
Project Procurement Management	☐	☐	☐	☐	☐	

ARCHITECTURAL DESIGN OFFICE'S MATURITY LEVEL	☐	☐	☐	☐	☐	

Figure 3.5. (Cont.)

PART III

Semi Structured ARCH-PMM Assessment Survey
Demographical Questions

1. Mark your yearly turnover? (YTL - New Turkish Lira)

- ☐ 0 YTL - <120.000 YTL
- ☐ 120.000 YTL - <250.000 YTL
- ☐ 250.000 YTL - <500.000 YTL
- ☐ 500.000 YTL - <2.000.000 YTL
- ☐ over 2.000.000 YTL

2. Order the following construction systems by their frequency in your designs

- ☐ Reinforced Concrete
- ☐ Steel
- ☐ Wood
- ☐ Other (……..)

3. Mark the types of buildings below you designed during the last 24 months.

- ☐ Buildings for Transportation
- ☐ Residential
- ☐ Buildings for Tourism
- ☐ Sports and Recreation
- ☐ Health Complex
- ☐ Educational Buildings
- ☐ Cultural Buildings
- ☐ Urban Design, City Planning
- ☐ Industrial and Agricultural Buildings
- ☐ Financial and Commercial Buildings
- ☐ Environmental Development

Figure 3.6. Semi Structured ARCH-PMM Survey – Demographical Questionnaire

4. Mark the total area of the buildings you design yearly.

- ☐ 0 m2 - <20.000 m2
- ☐ 20.000 m2 - <50.000 m2
- ☐ 50.000 m2 - <100.000 m2
- ☐ 100.000 m2 - <250.000 m2
- ☐ over 250.000 m2

5. Mark the percentage of the buildings you design include inspection and control services.

- ☐ None
- ☐ 0% - <33%
- ☐ 33% - <66%
- ☐ 66% - <100%
- ☐ Always

6. Mark the presentation techniques you use.

- ☐ Models
- ☐ Sketches and hand drawings
- ☐ 3D Models (CAD)
- ☐ 2D Models (CAD)
- ☐ 2D Drawings (Hand drawings)

7. Which one is your main client?

	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
☐ Private	0%	0 - <25%	25-<50%	50%	50-<75%	75-<100%	<100%
☐ Government	100%	75-<100%	50-<75%	50%	25-<50%	0 - <25%	0%

Figure 3.6. (Cont.)

8. Mark the software packages you use.

- ☐ CAD Software (e.g. AutoCAD, ArchiCAD, IdeMimar, IdeCAD,…)
- ☐ 3D Modelling Softwares (3DMAX, ArtLAntis, AutoCAD 3D, etc.)
- ☐ Project Management Softwares (MSProject, Primevera,…)
- ☐ Payroll software
- ☐ Accounting software
- ☐ Enterprise Resource Planning Software (e.g. Poly, ConstuctWare,…)

9. Mark your area of activity.

	Percentage
☐ Domestic (300km radius)	(……%)
☐ National	(……%)
☐ International	(……%)

10. Mark the services you are providing.

- ☐ Architectural Design
- ☐ Engineering Design
- ☐ Consultancy
- ☐ Contructing
- ☐ TUS

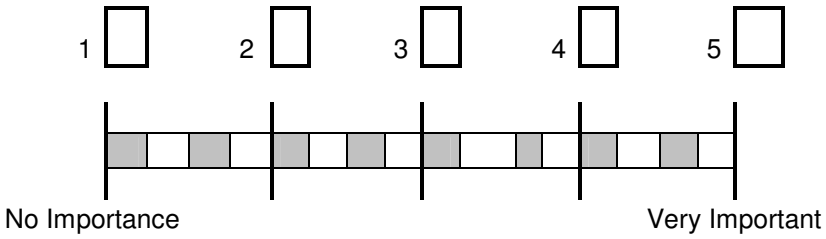
11. Mark the repeated clients.

- ☐ 0% - <20%
- ☐ 20% - <40%
- ☐ 40% - <60%
- ☐ 60% - <80%
- ☐ 80% - <100%

Figure 3.6. (Cont.)

☐ 100%

Mark the importance of the above criteria for you.



12. Mark the number of awards you won.

☐ None

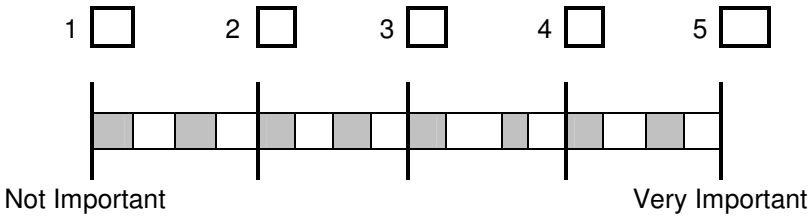
☐ 0 - <5

☐ 5 – <10

☐ 10 - <20.

☐ More than 20

Mark the importance of the above criteria for you.



13. Write the number of published articles about your designs.

☐ .....

Mark the importance of the above criteria for you.

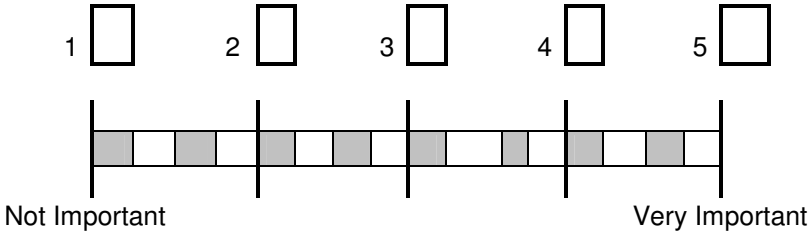
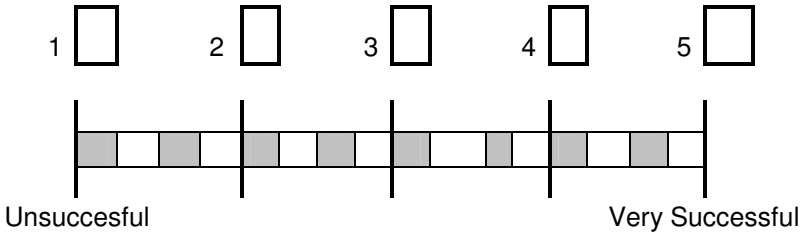
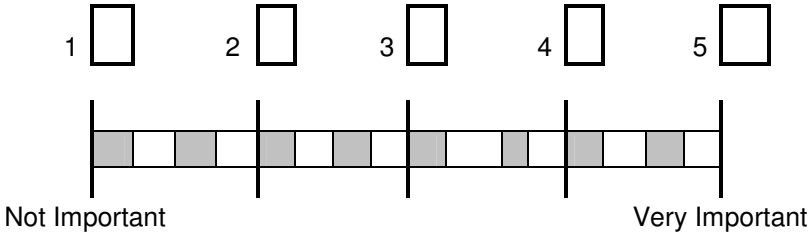


Figure 3.6. (Cont.)

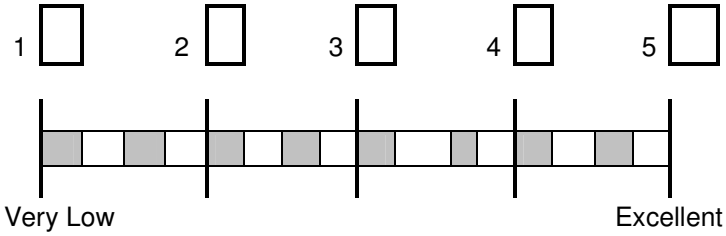
14. How successful do you rate yourself according to your competatives?



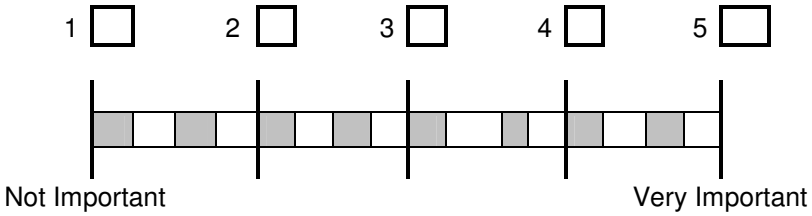
Mark the importance of the above criteria for you.



15. Mark your profitability against the other architectural design offices.



Mark the importance of the above criteria for you.



16. Mark the ratio of the biddings you enter results with architectural design contract.

- ☐ 0% - <20%
- ☐ 20% - <40%
- ☐ 40% - <60%
- ☐ 60% - <80%
- ☐ 80% - <100%

Figure 3.6. (Cont.)

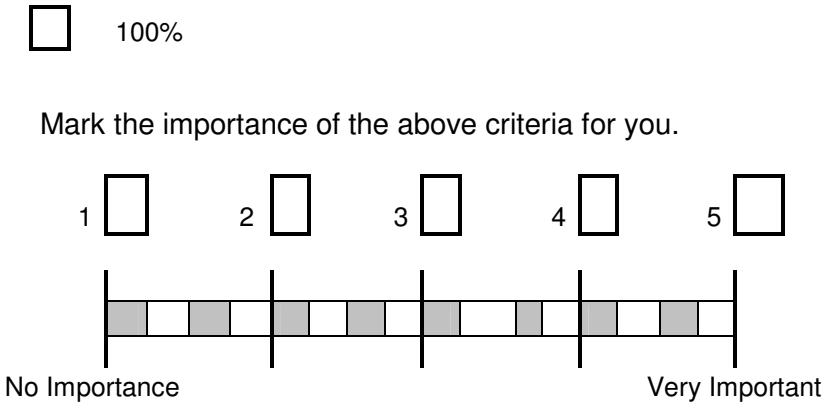


Figure 3.6. (Cont.)

CHAPTER 4

FINDINGS and ANALYSIS

The findings of this research are presented in two sections namely, Maturity Test and Demographical Information analysis. In the Maturity Test results, the data that are derived from the architectural design offices are analyzed. In the second phase, the demographical data is utilized in order to assess the impacts of PM function areas on the PM maturity of the architectural design offices.

4.1. Maturity Test

The Arch-PMM Model is developed in this research by modifying and developing the previous maturity models of the Arch-PMM Model specifically aims for maturity levels' of architectural design firms' PM functions. Arch-PMM Model demands data from the architects who are providing architectural design service currently. Therefore the selection of these architects is very important. This dissertation selected the members of the Association of Turkish Independent Architects (ATIA) to participate in this assessment. During the interviews the total number of members of ATIA was 151 and this research is able to reach 71 of them for the assessment. The interviews took more time than originally planned. The main reason was all the interviews done face to face with the managers in their offices. Secondly, most of the managers of the architectural design offices didn't pay attention to their date of appointments and this made a very important loss of time while traveling between three different cities.

Totally 71 ATIA member architectural design offices participated in this study:

25 Architectural design offices from Izmir,
21 Architectural design offices from Istanbul,
25 Architectural design offices from Ankara,

The Arch-PMM Survey conducted in two phases. In the first phase, all the architects were asked to fill the form concerning about the demographical structure of their architectural design office. In the second phase, Arch-PMM questionnaires were conducted by the writer by the mutual interviews with the architects. These two data gathering stages totally took 12 weeks to be completed.

Overall Arch-PMM of each architectural design office was calculated by averaging 9 functional management maturity areas of each architectural design office. Every function is compared with each other according to their total scores. Data from these architectural design offices are presented in Figures 4.01 – 4.52.

ARCH-PMM Model guides architectural design offices to identify their strengths and weaknesses of their current PM practices and process. These are total of 42 questions to determine maturity level of 9 PM functions.

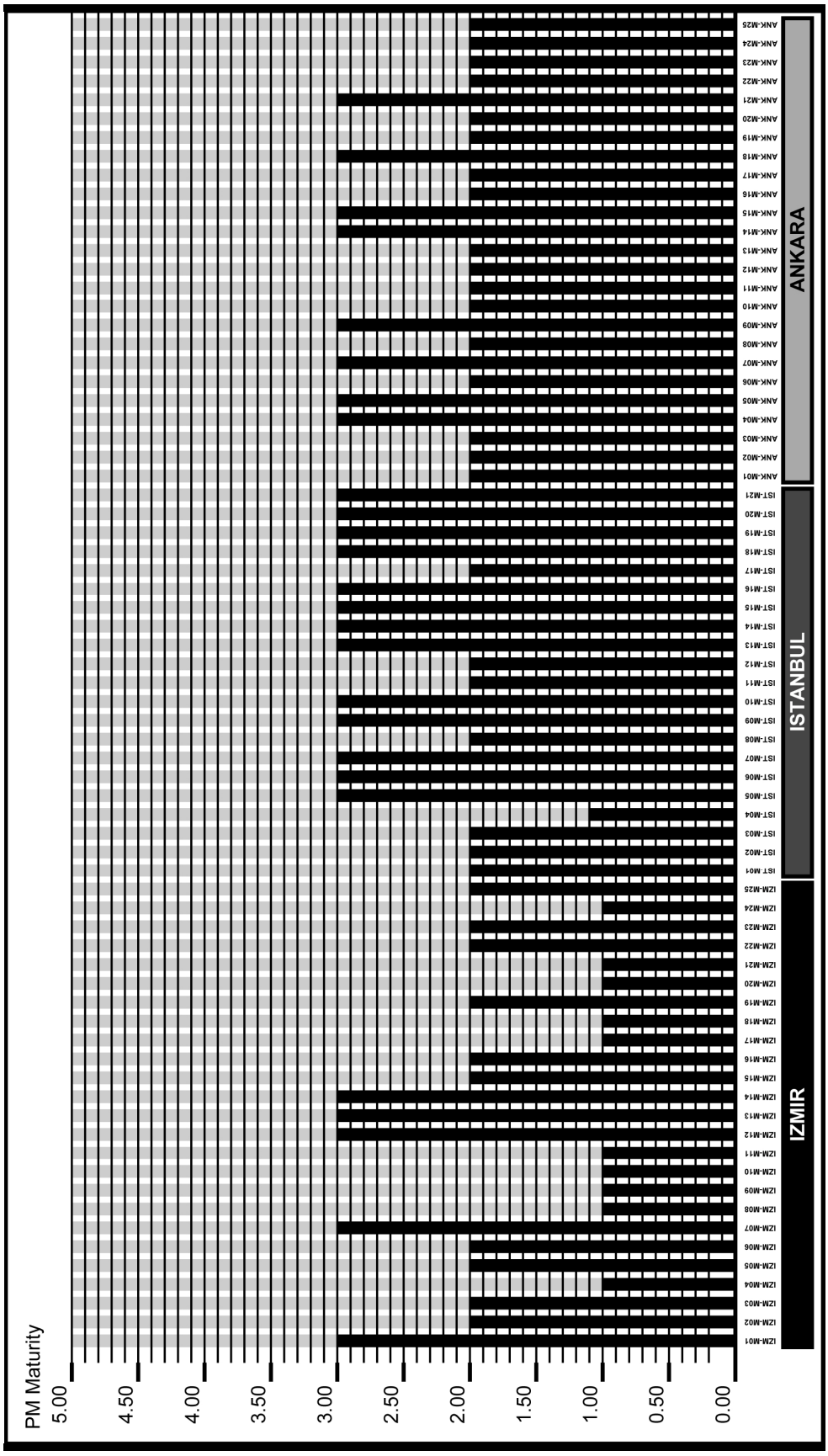


Figure 4.1 Q01 – Project Integration Management – Scope Definition

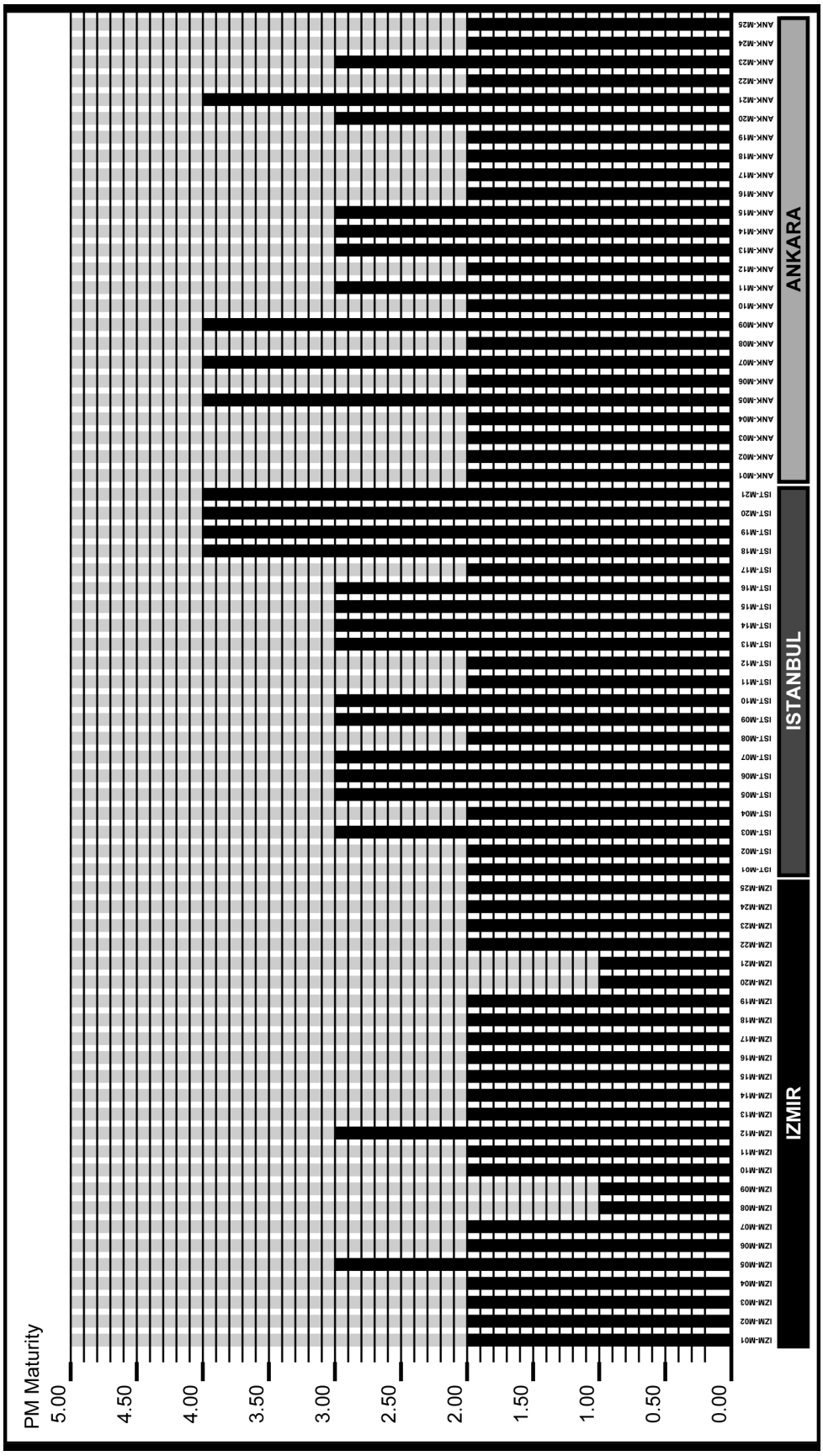


Figure 4.2 Q02 – Project Integration Management – Deliverables Identification

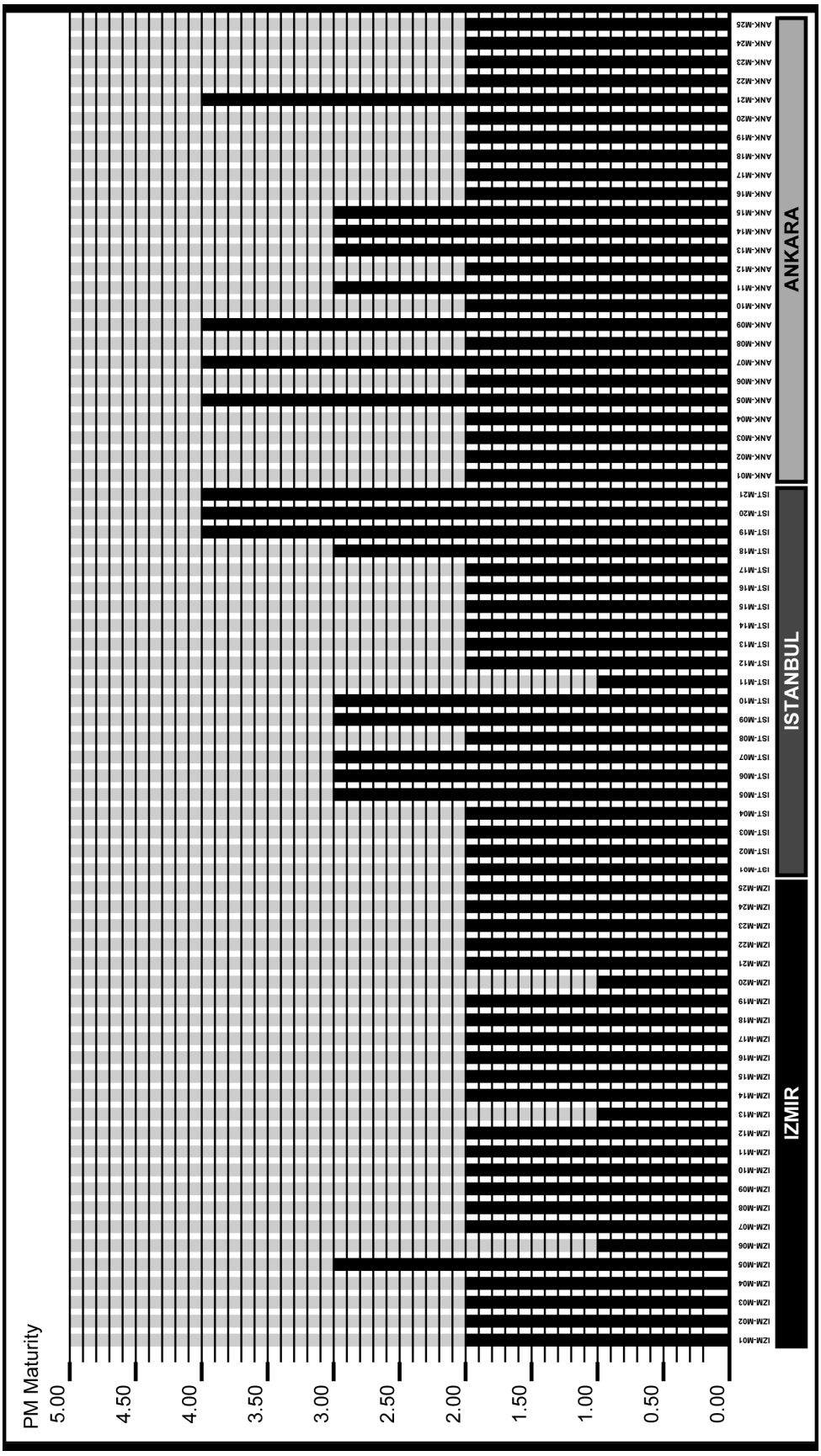


Figure 4.3 Q03 – Project Integration Management – Project Management Plan Development

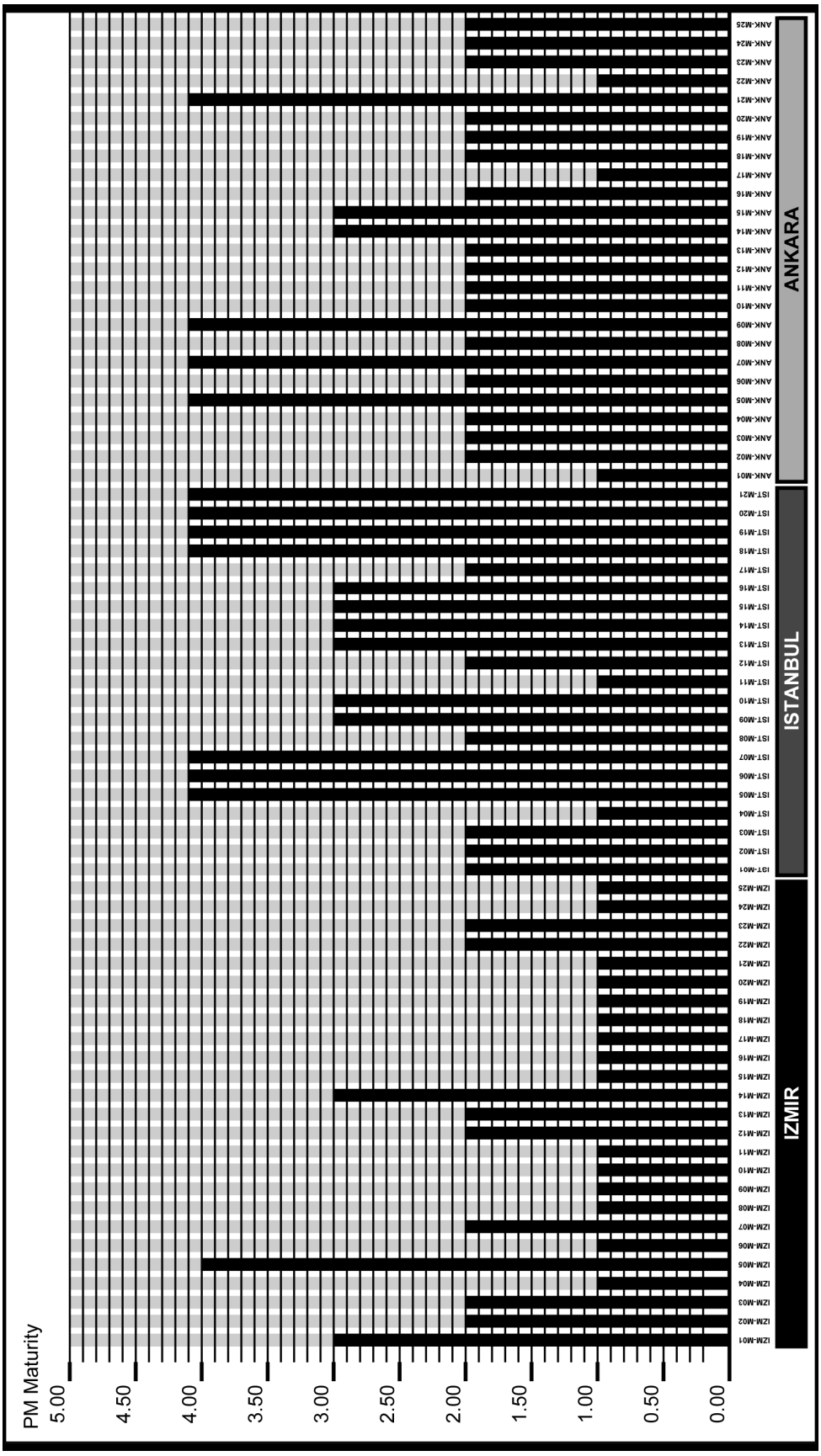


Figure 4.4 Q04 – Project Integration Management – Project Management Plan Execution

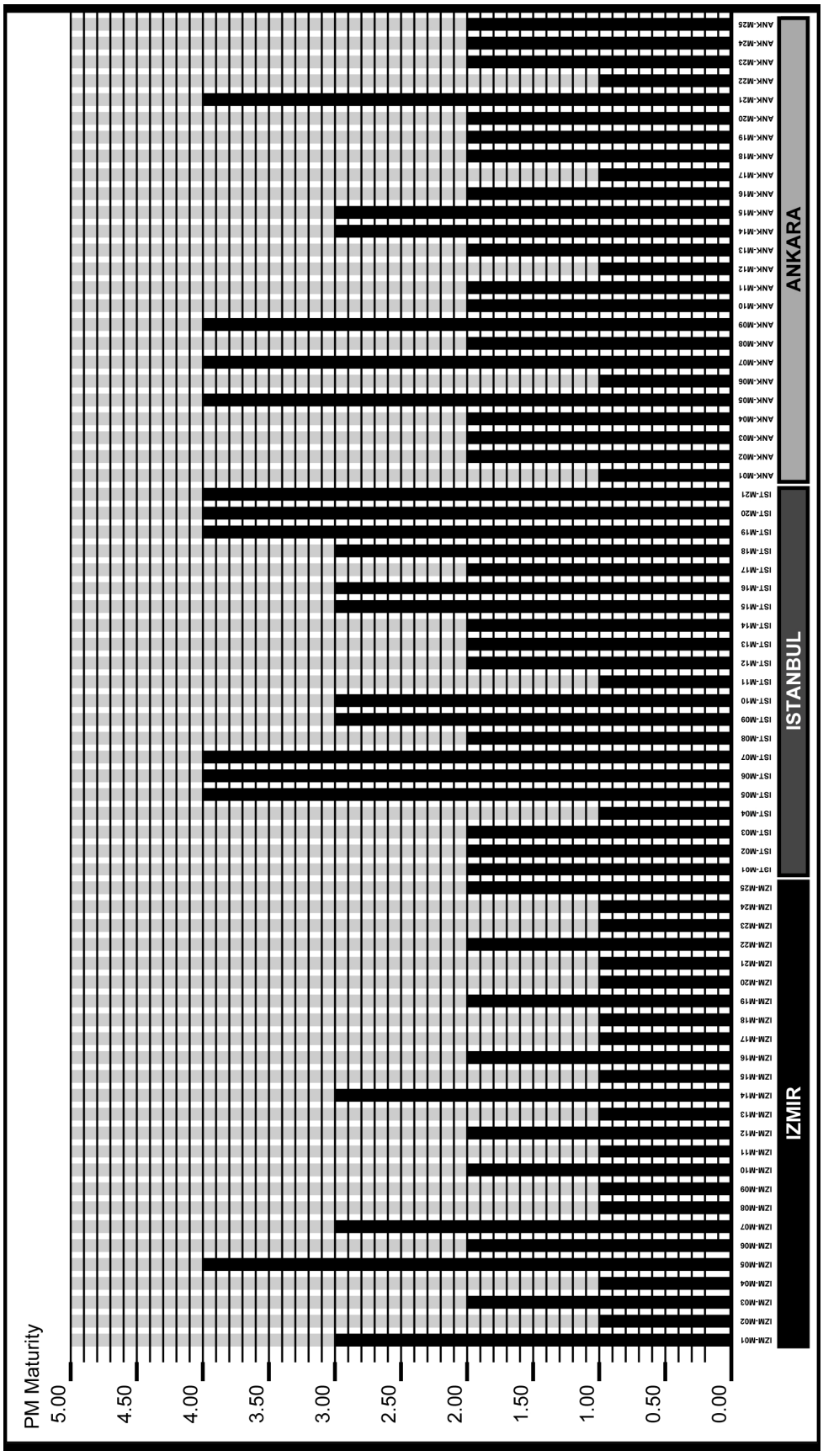


Figure 4.5 Q05 – Project Integration Management – Change Control

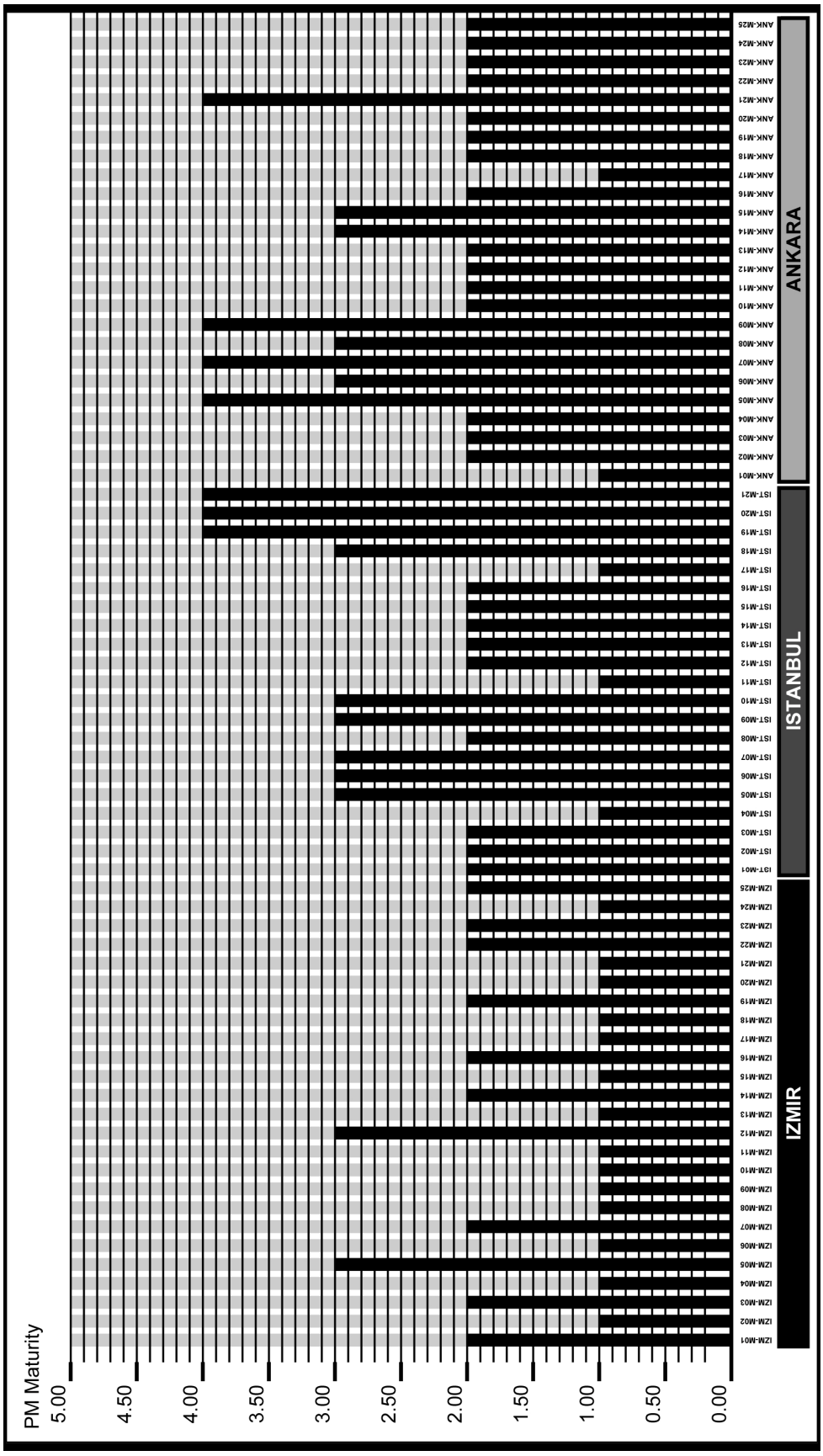


Figure 4.6 Q06 – Project Integration Management – Project Closure

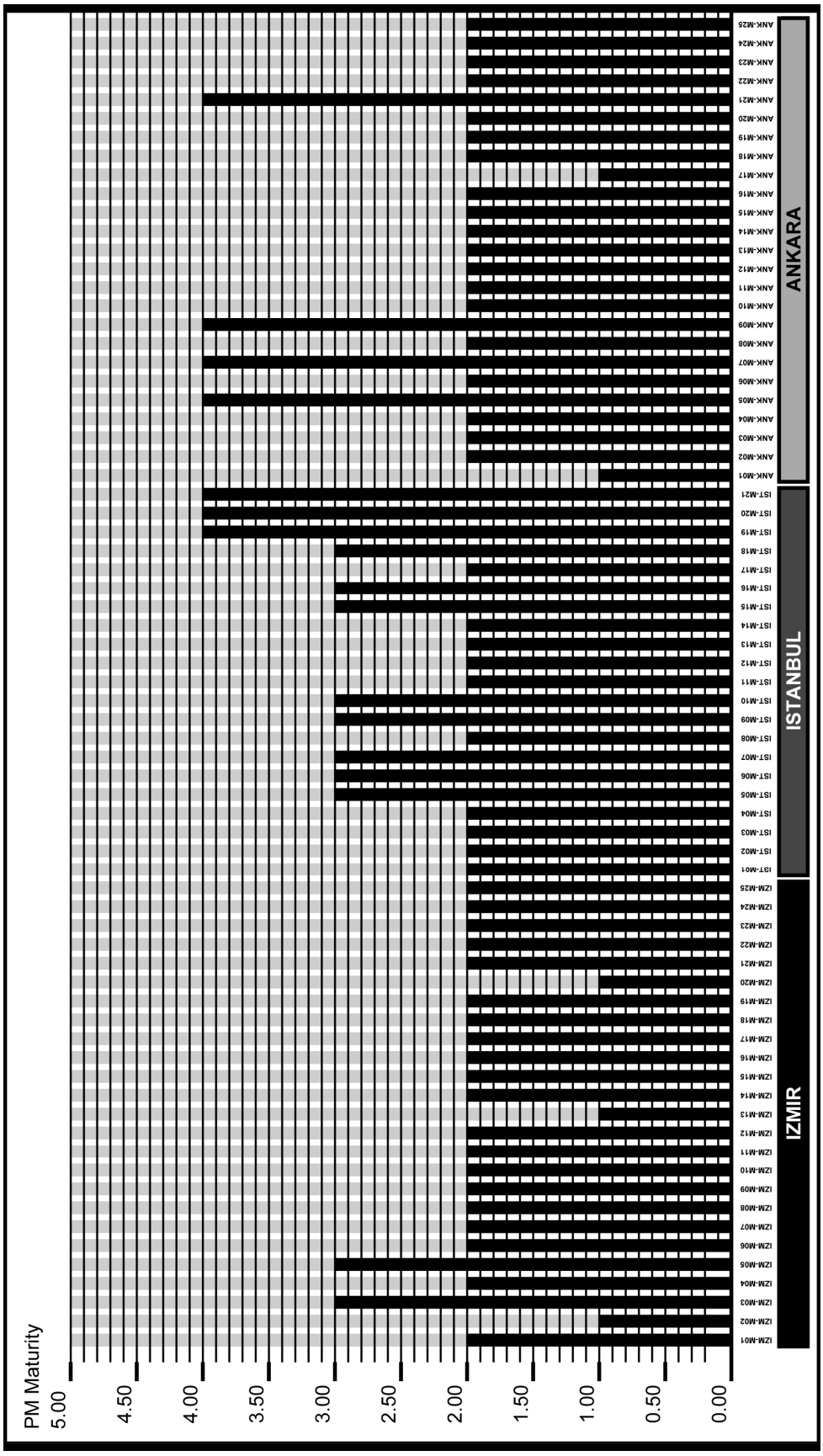


Figure 4.7 Q07 – Project Integration Management – Project Information System

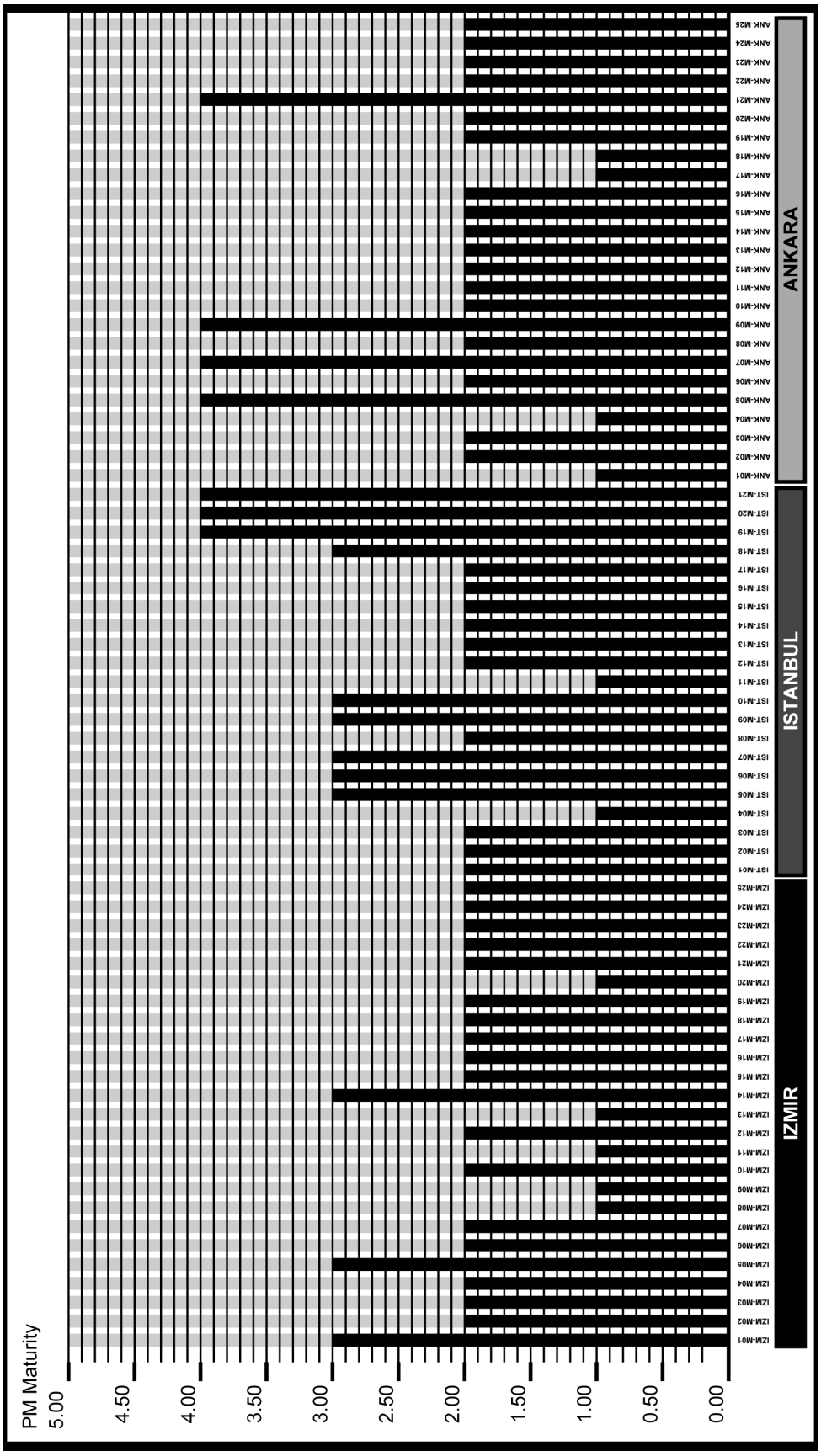


Figure 4.8 Q08 – Project Scope Management – Scope Planning and Management

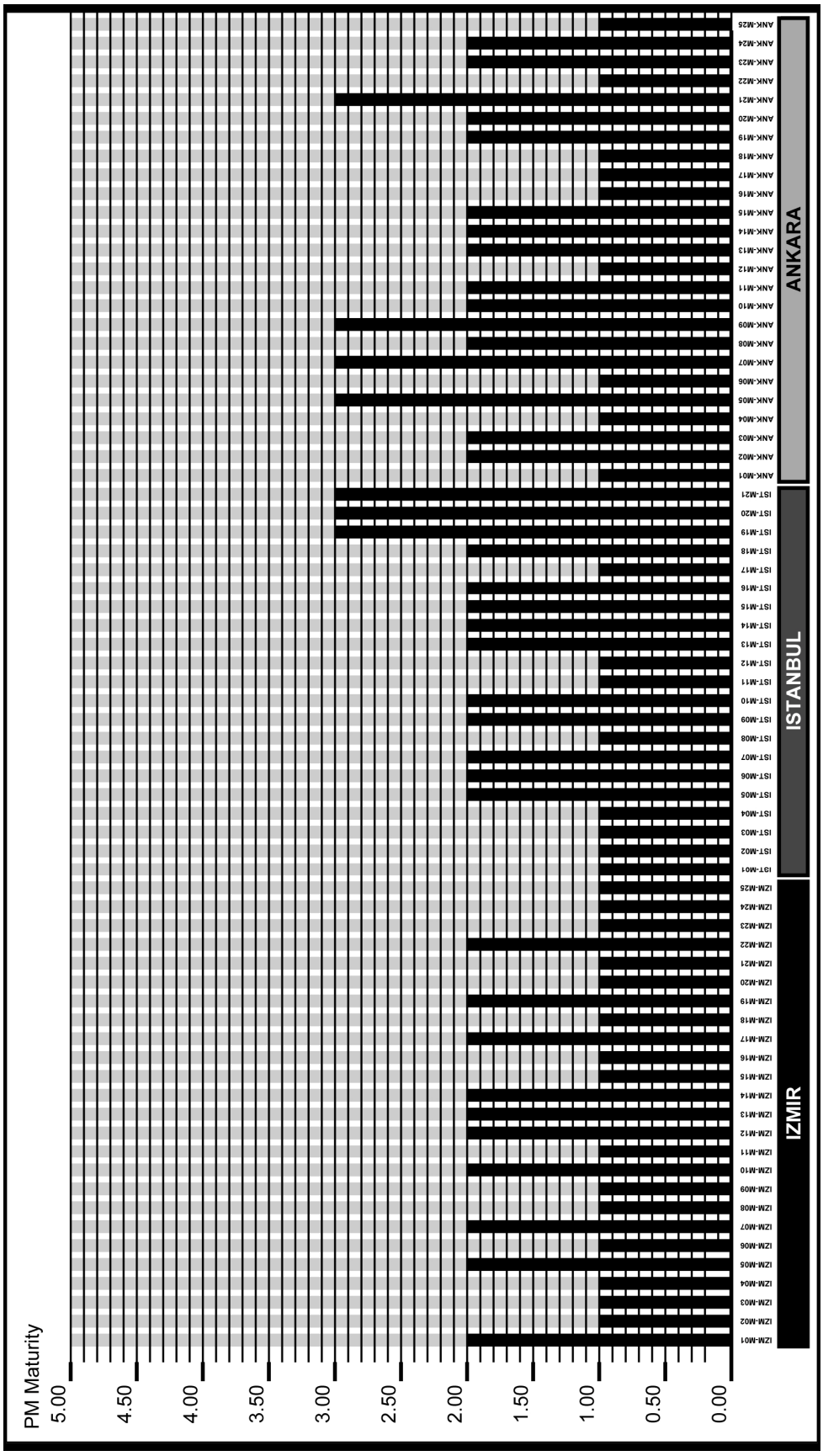


Figure 4.9 Q09 – Project Scope Management – Business Requirements Definition

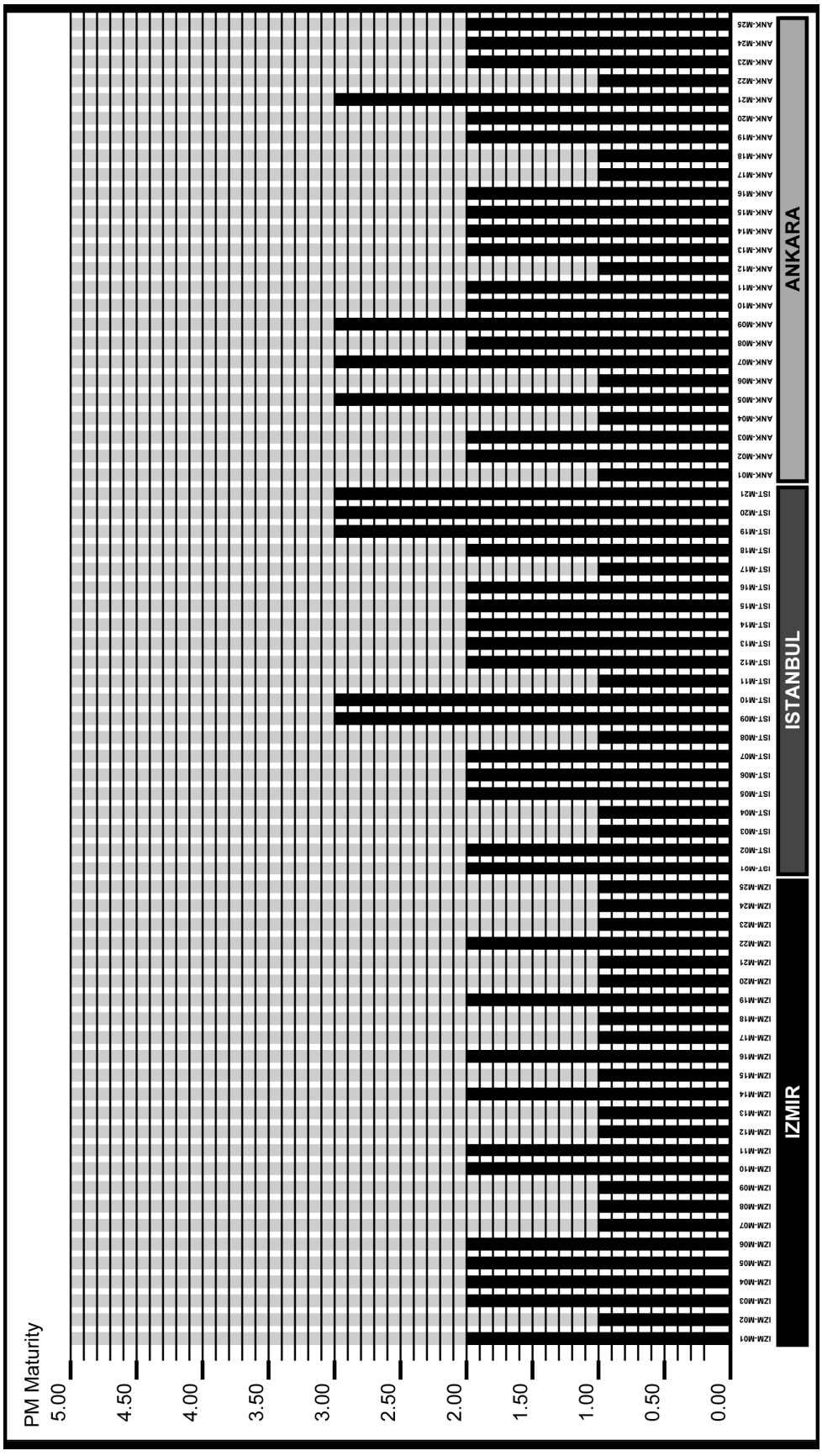


Figure 4.10 Q10 – Project Scope Management – Technical Requirements Definition

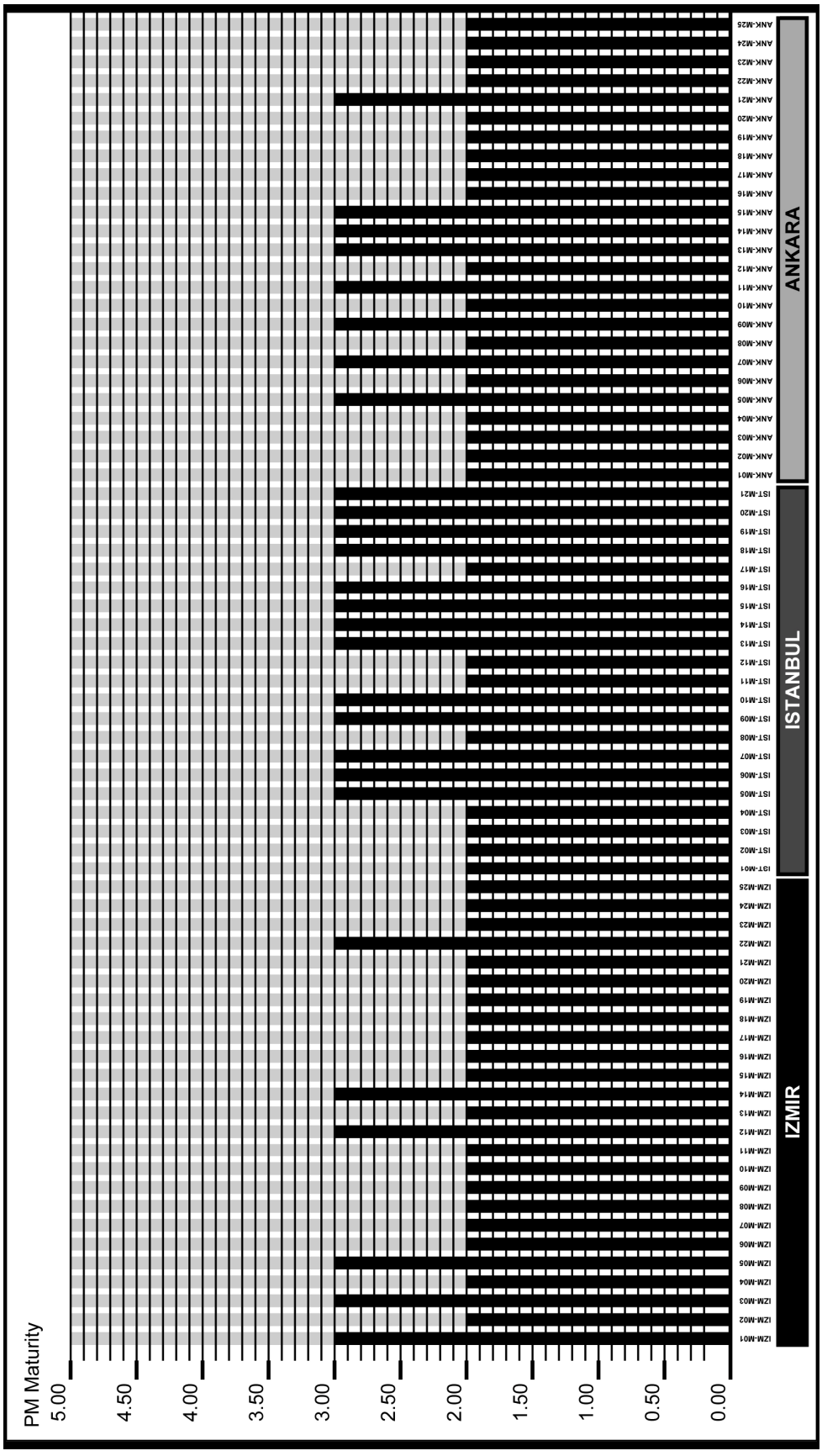


Figure 4.11 Q11 – Project Scope Management – Work Breakdown Structure (WBS)

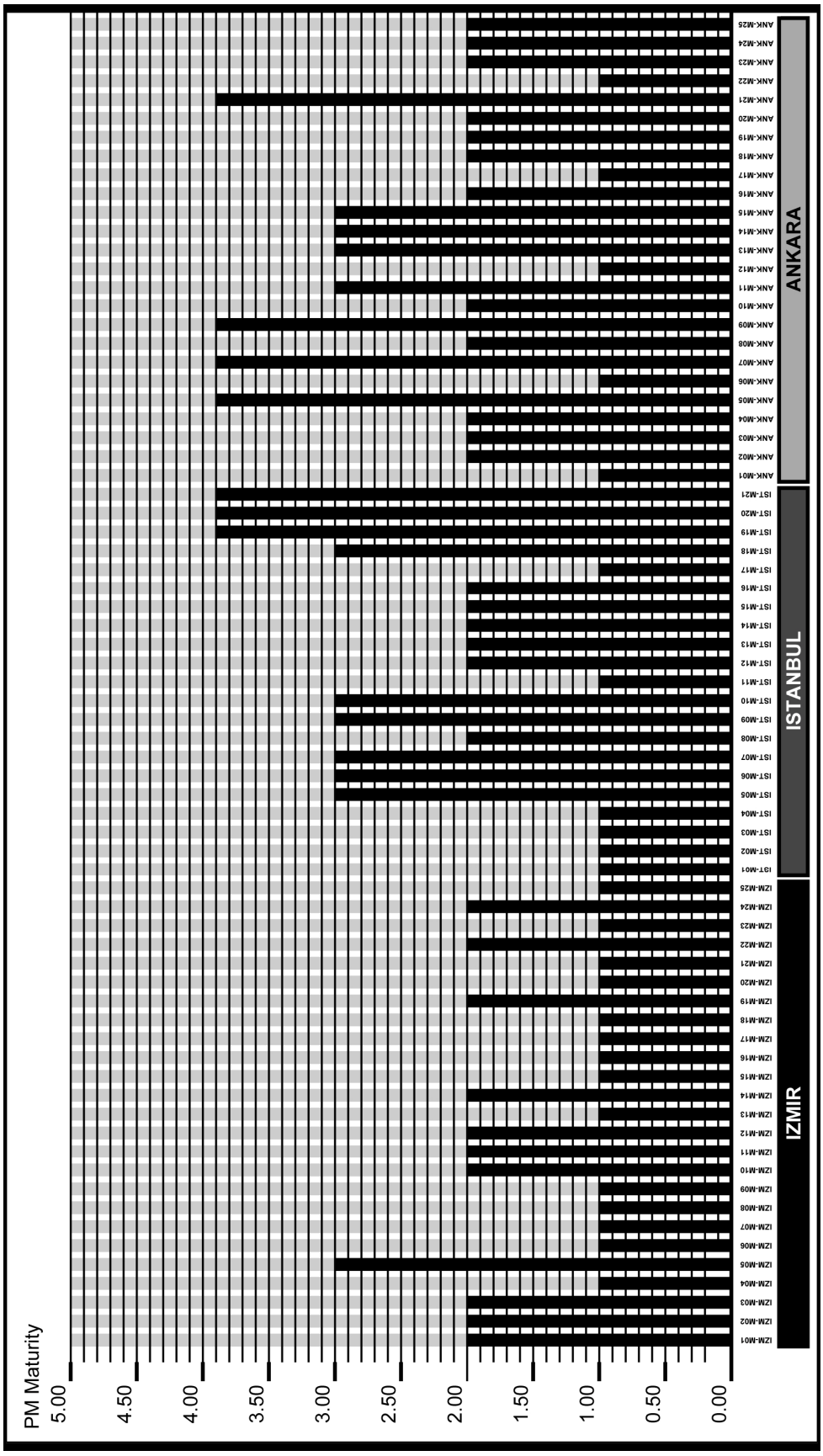


Figure 4.12 Q12 – Project Scope Management – Scope Change Control

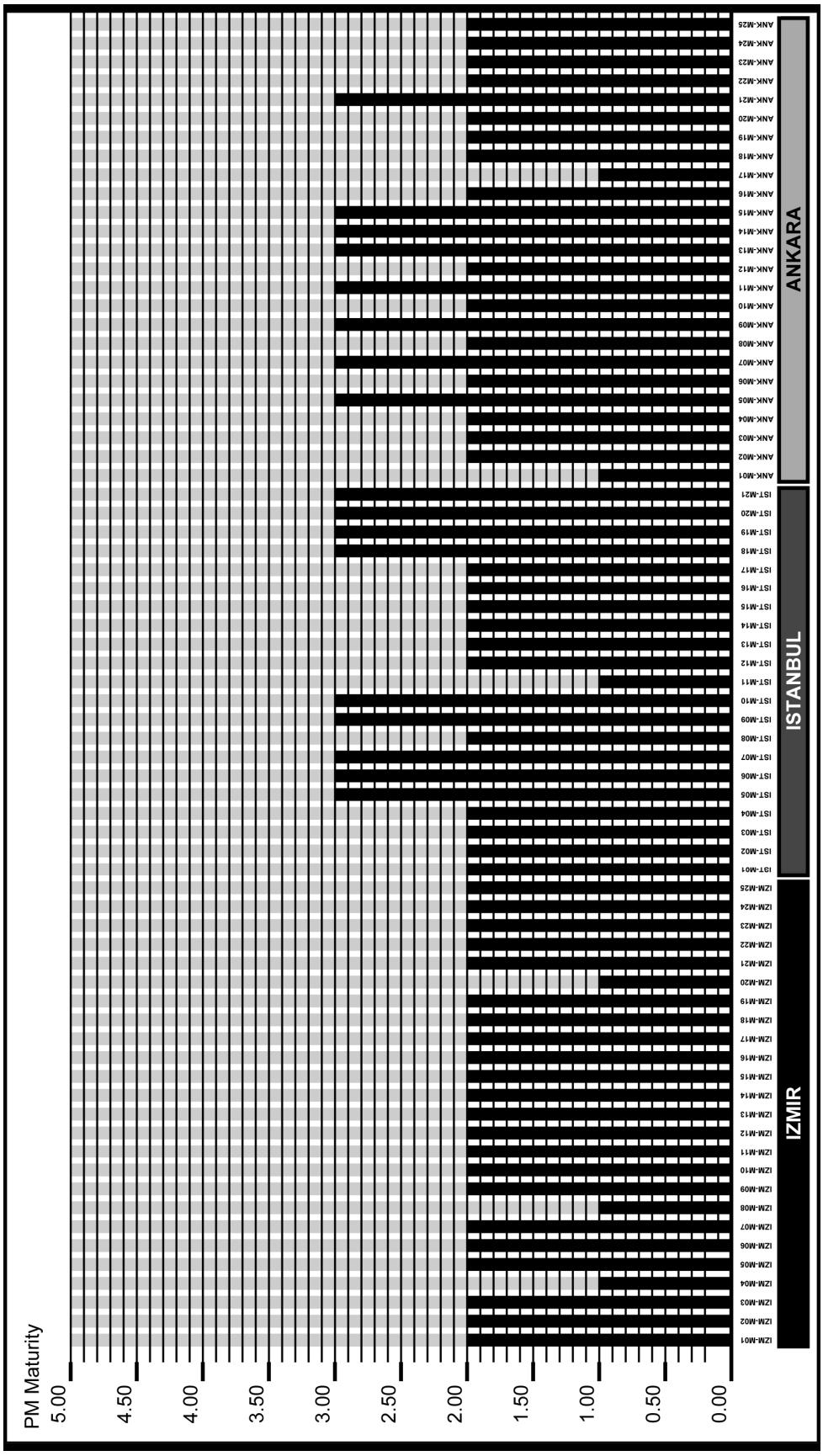


Figure 4.13 Q13 – Project Time Management – Activity and Resource Definition

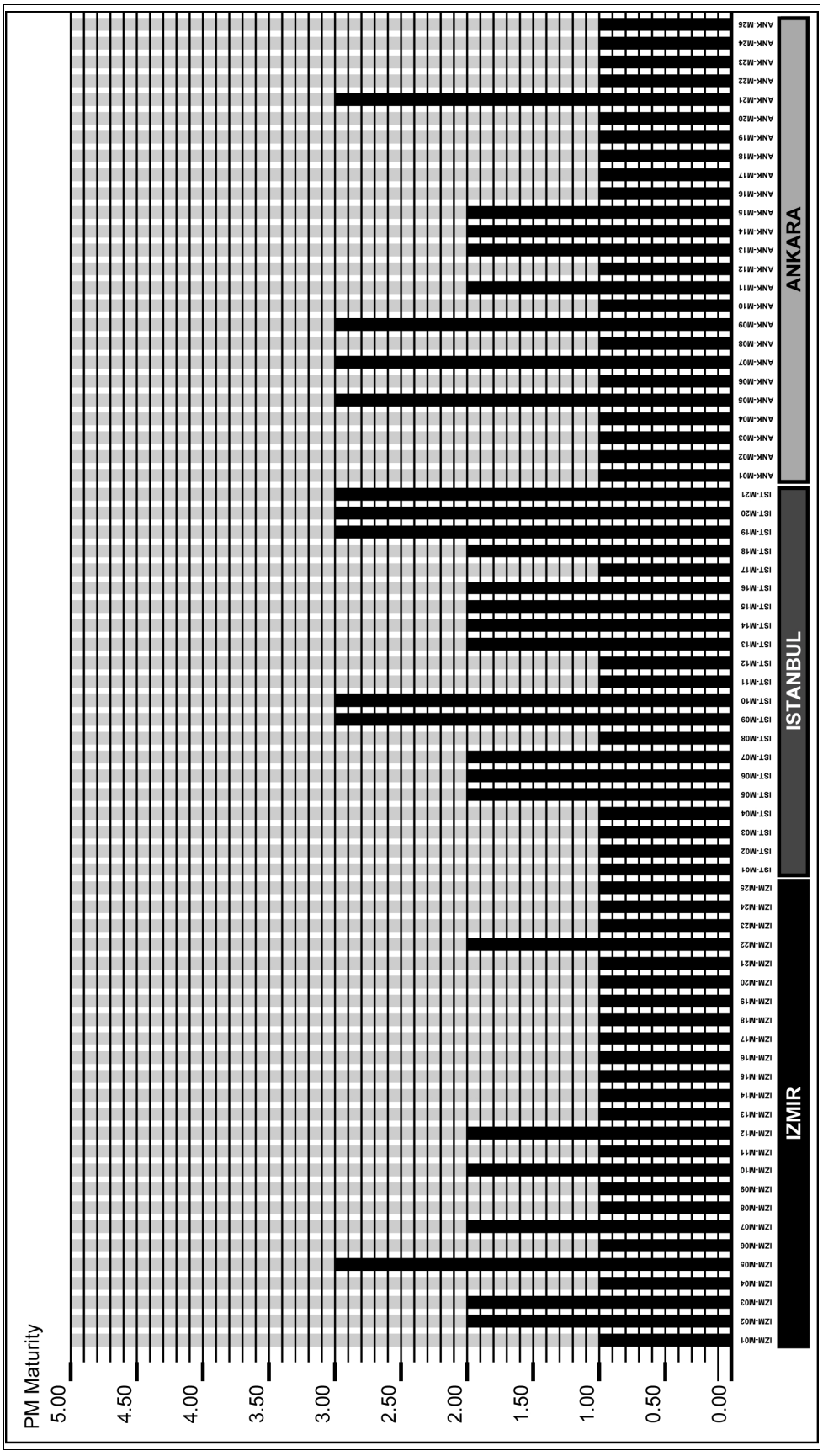


Figure 4.14 Q14 – Project Time Management – Activity Sequencing

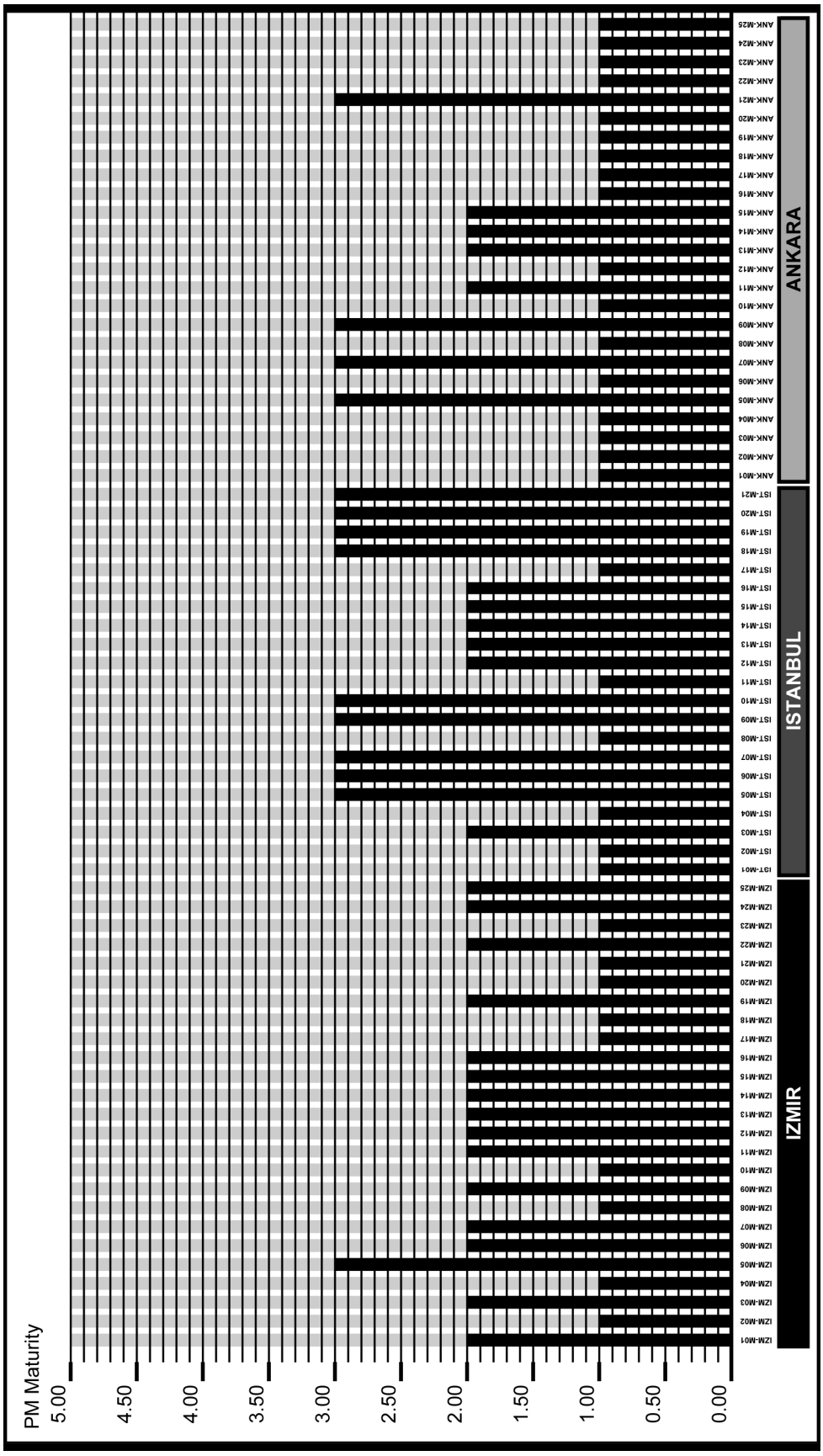


Figure 4.15 Q15 – Project Time Management – Schedule Development

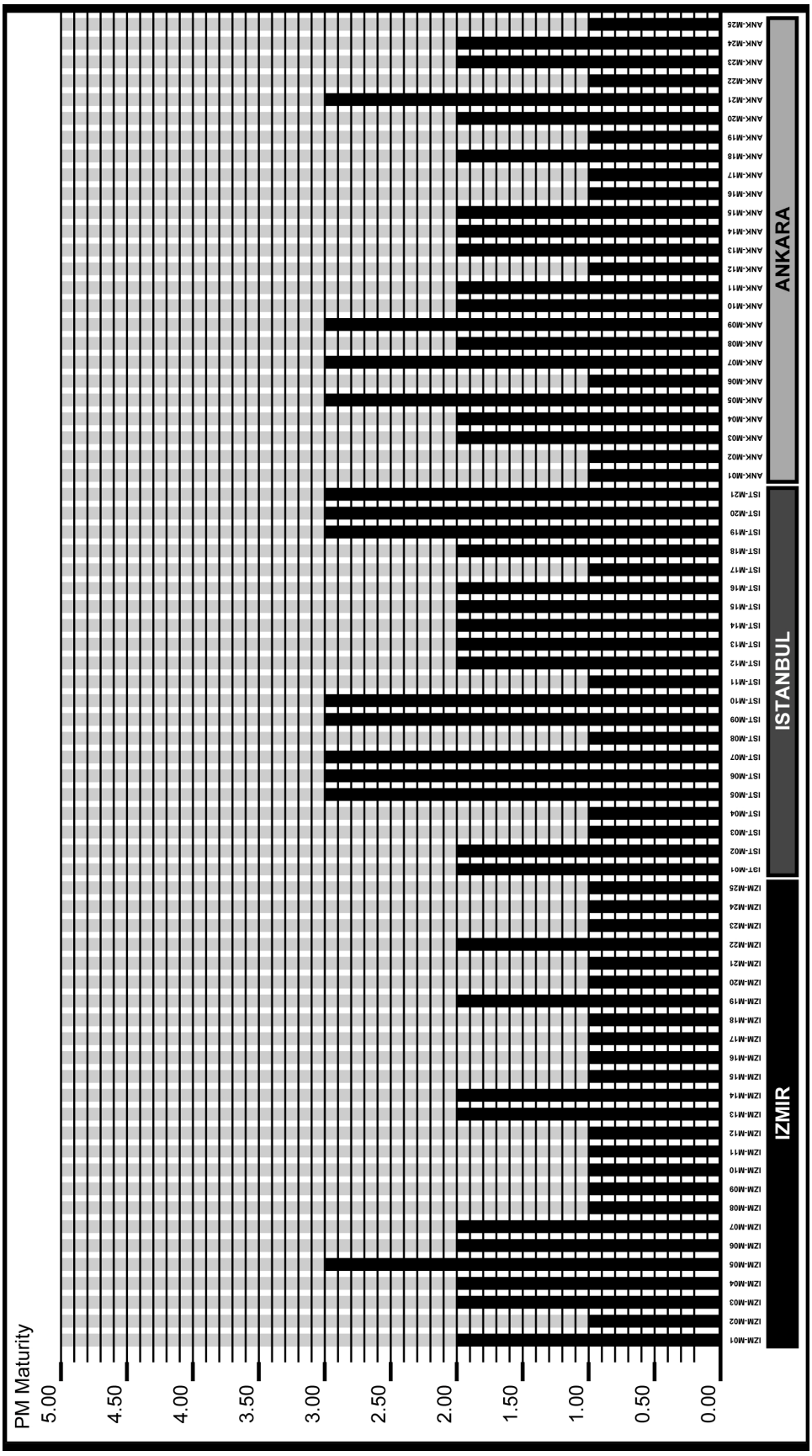


Figure 4.16 Q16 – Project Time Management – Schedule Control

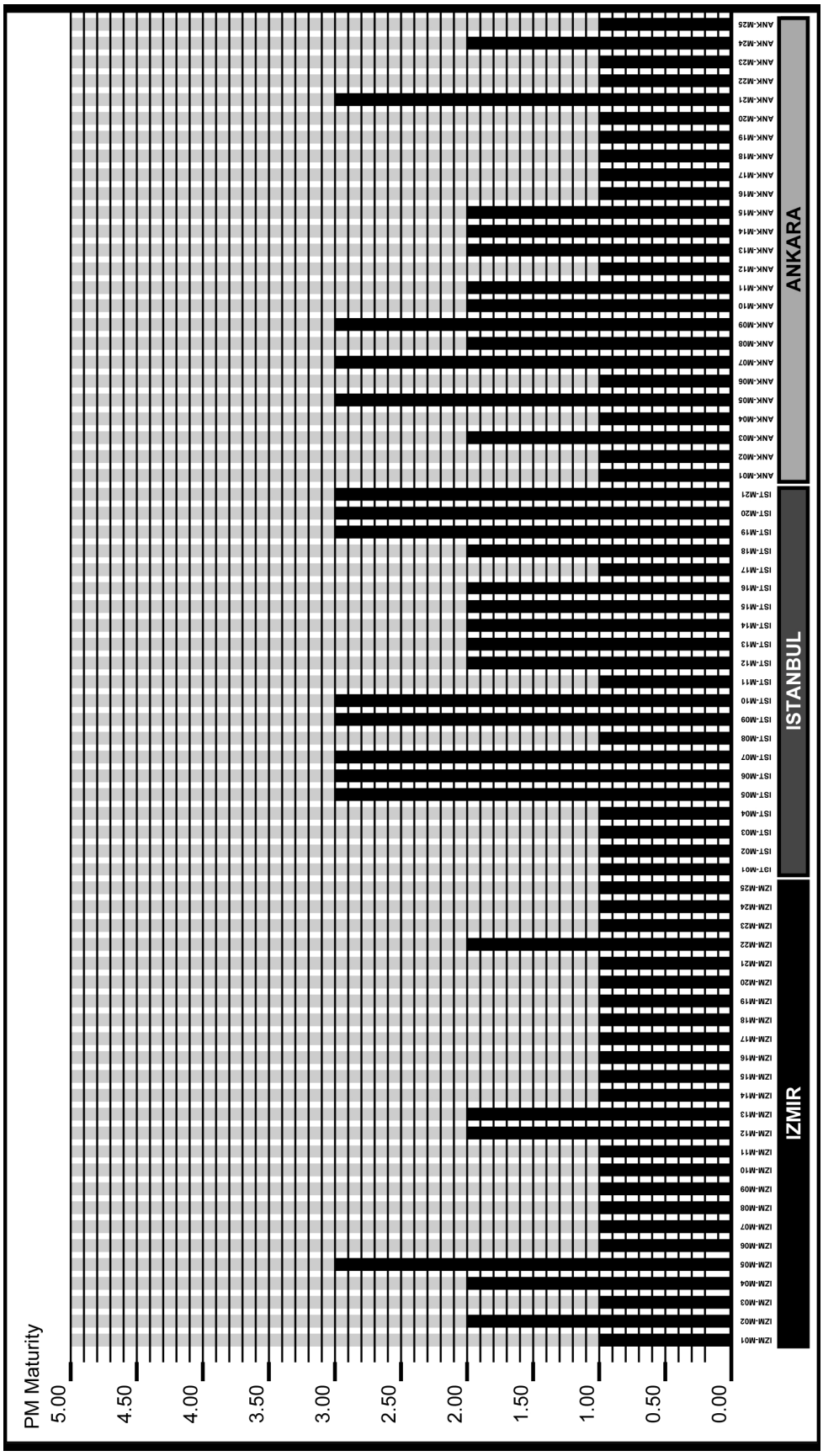


Figure 4.17 Q17 – Project Time Management – Schedule Integration

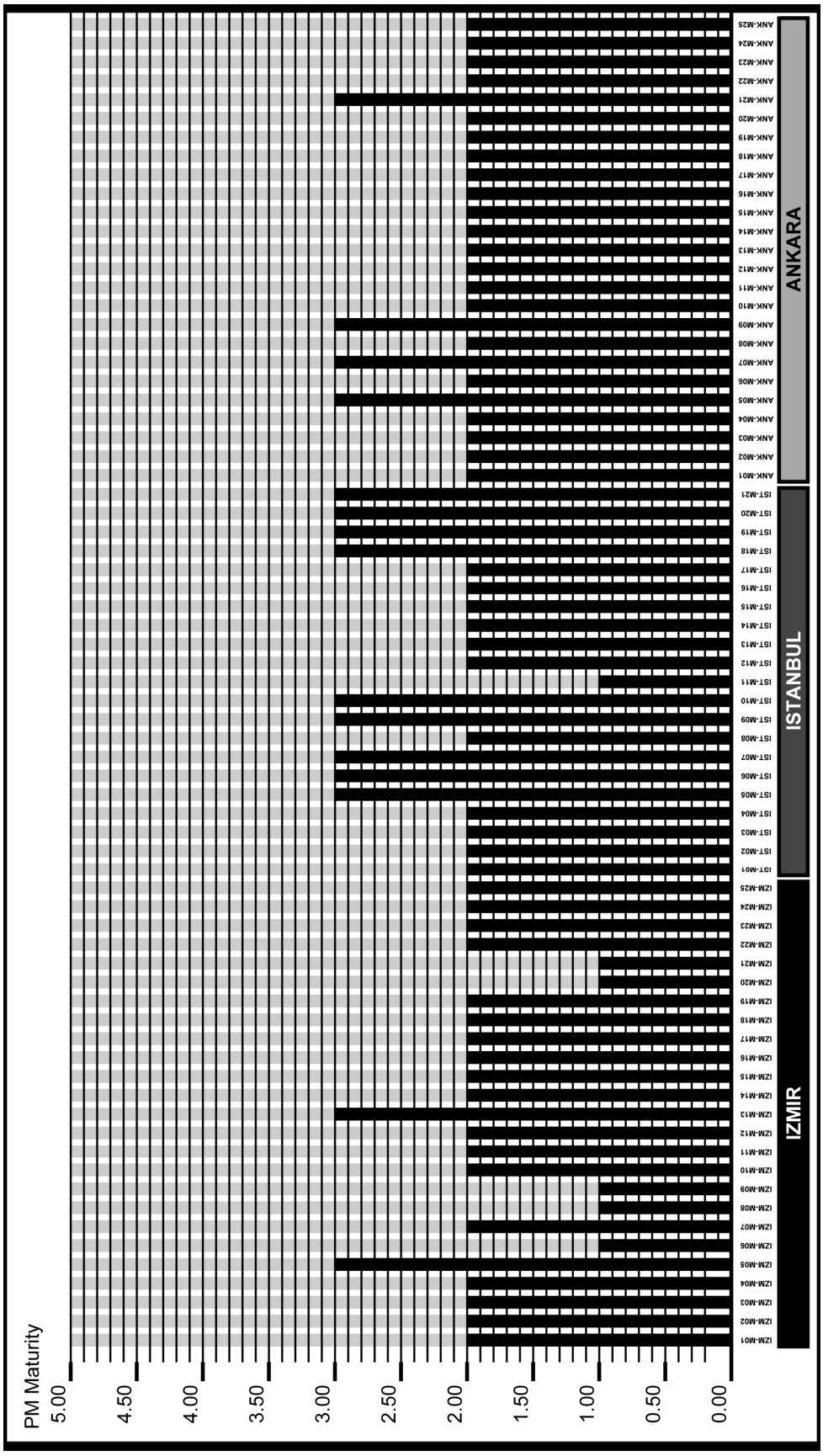


Figure 4.18 Q18 – Project Cost Management – Cost Estimating

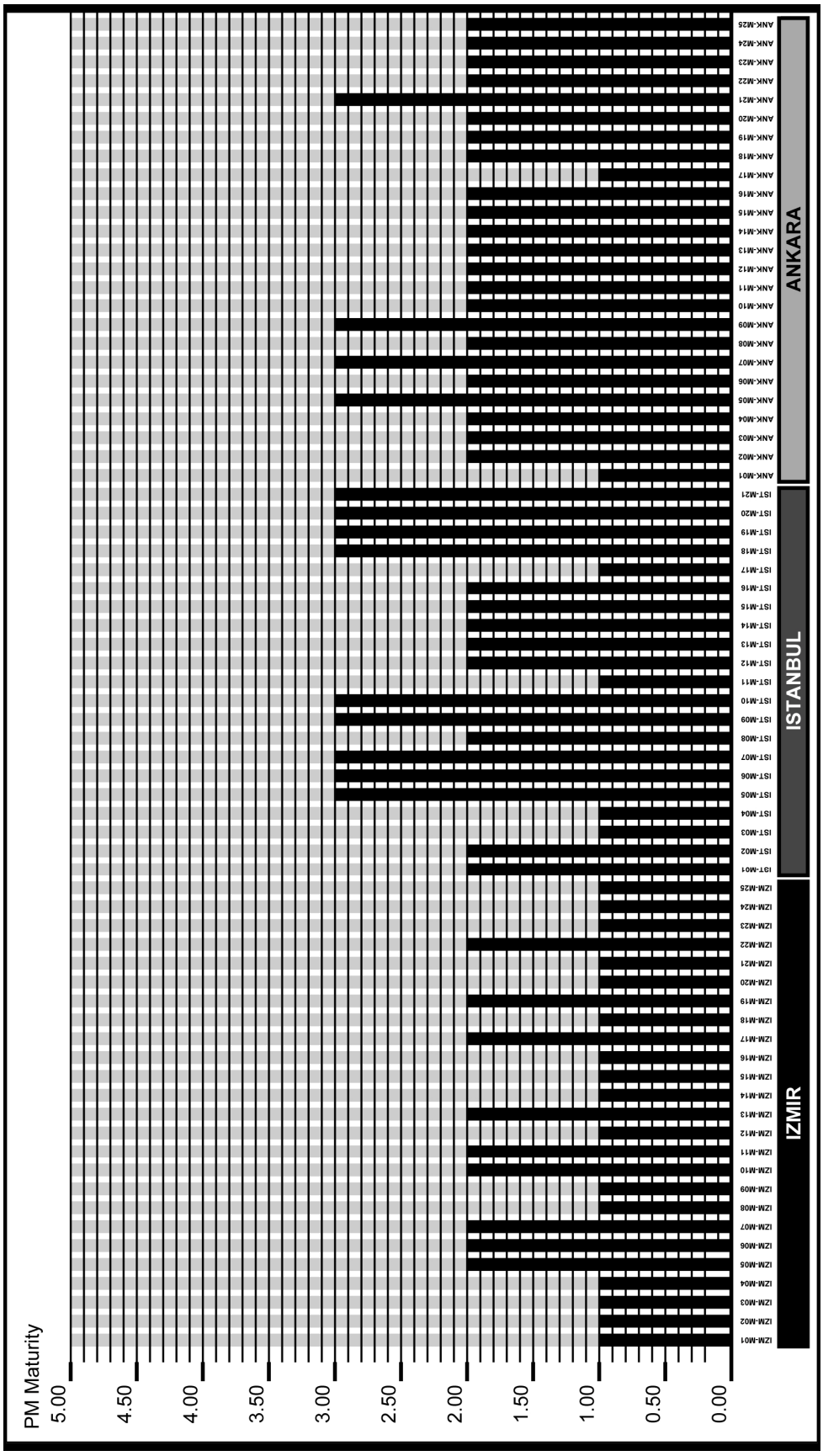


Figure 4.19 Q19 – Project Cost Management – Cost Budgeting

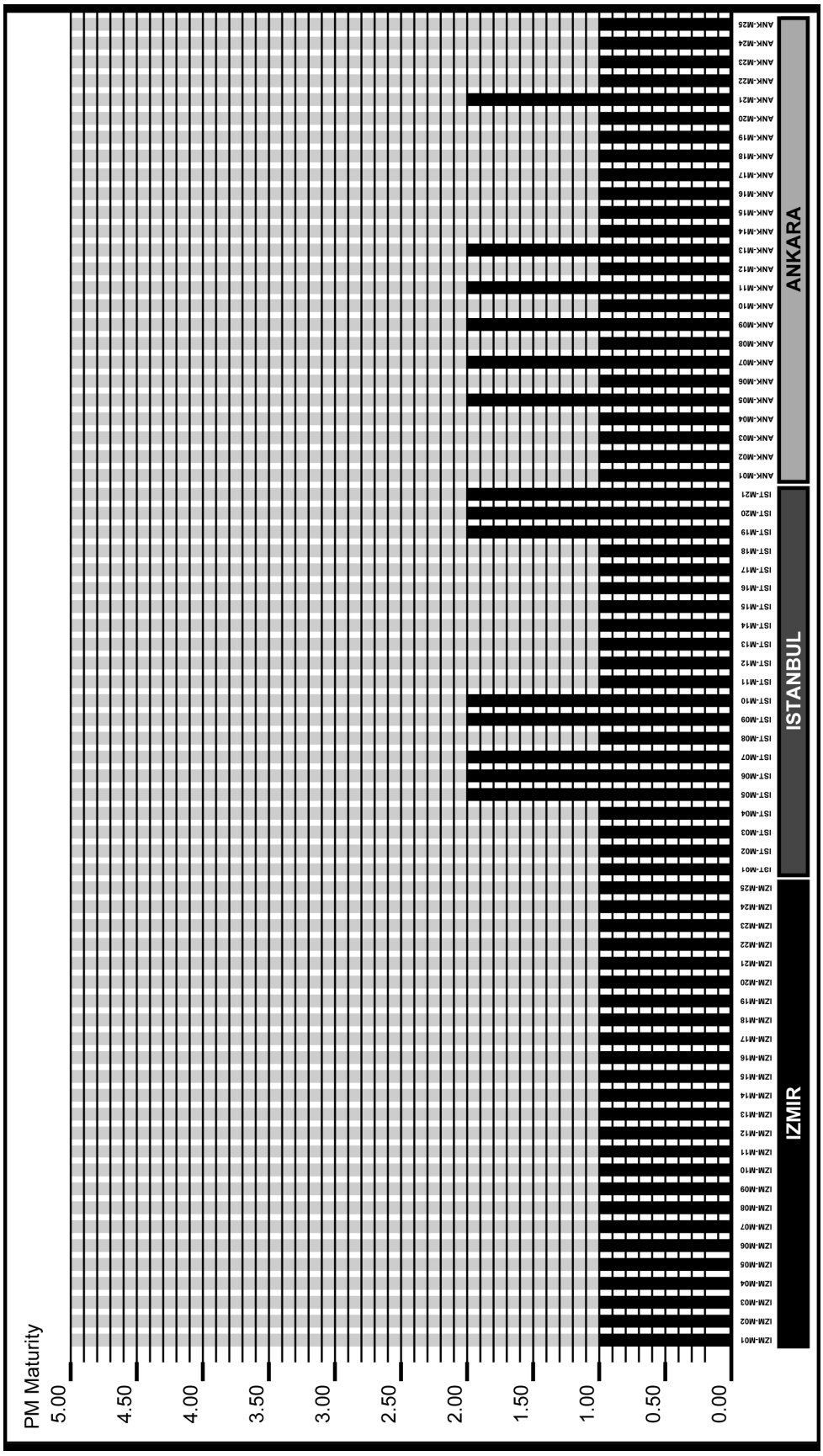


Figure 4.20 Q20 – Project Cost Management – Performance Measurement

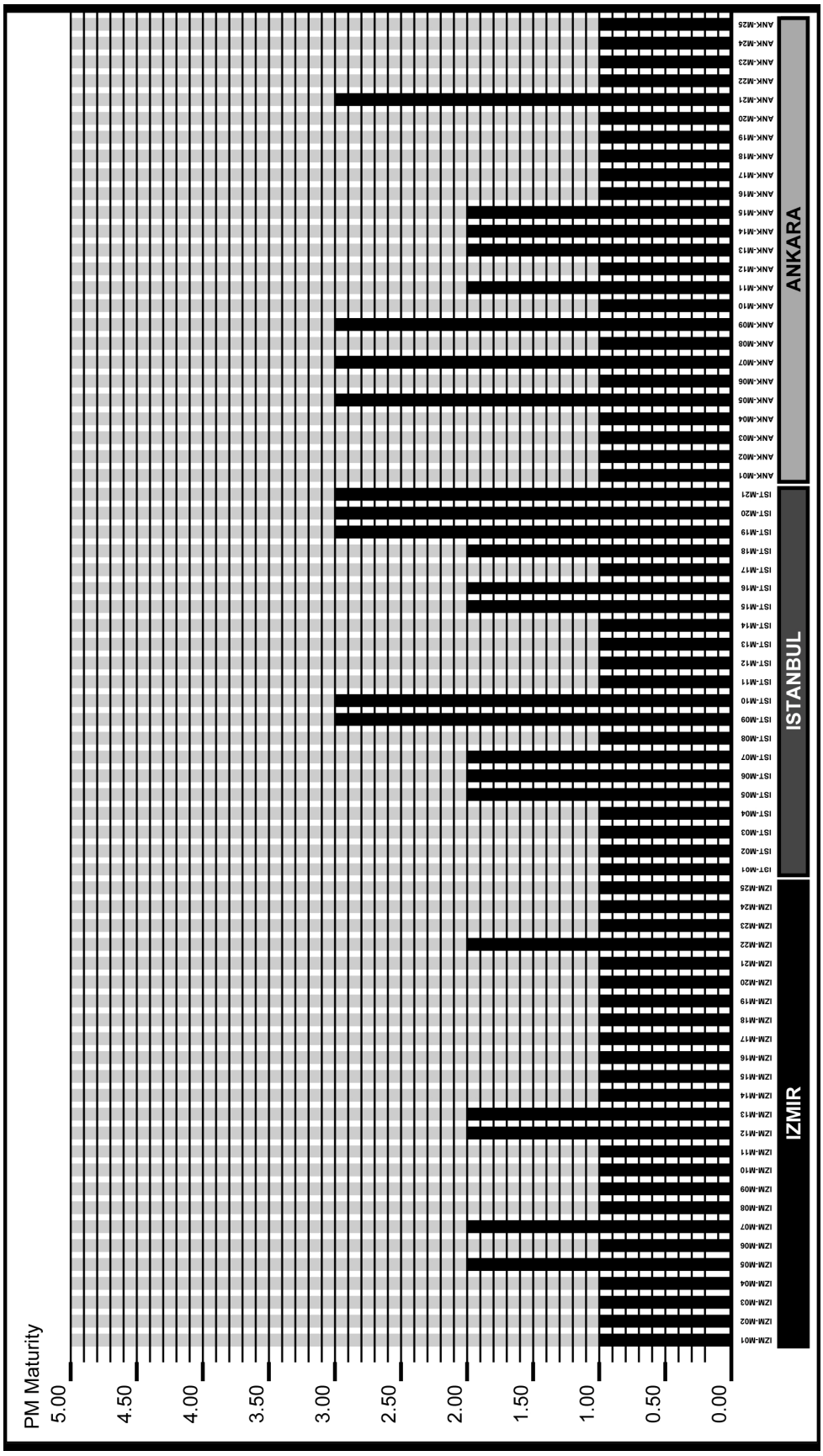


Figure 4.21 Q21 – Project Cost Management – Cost Control

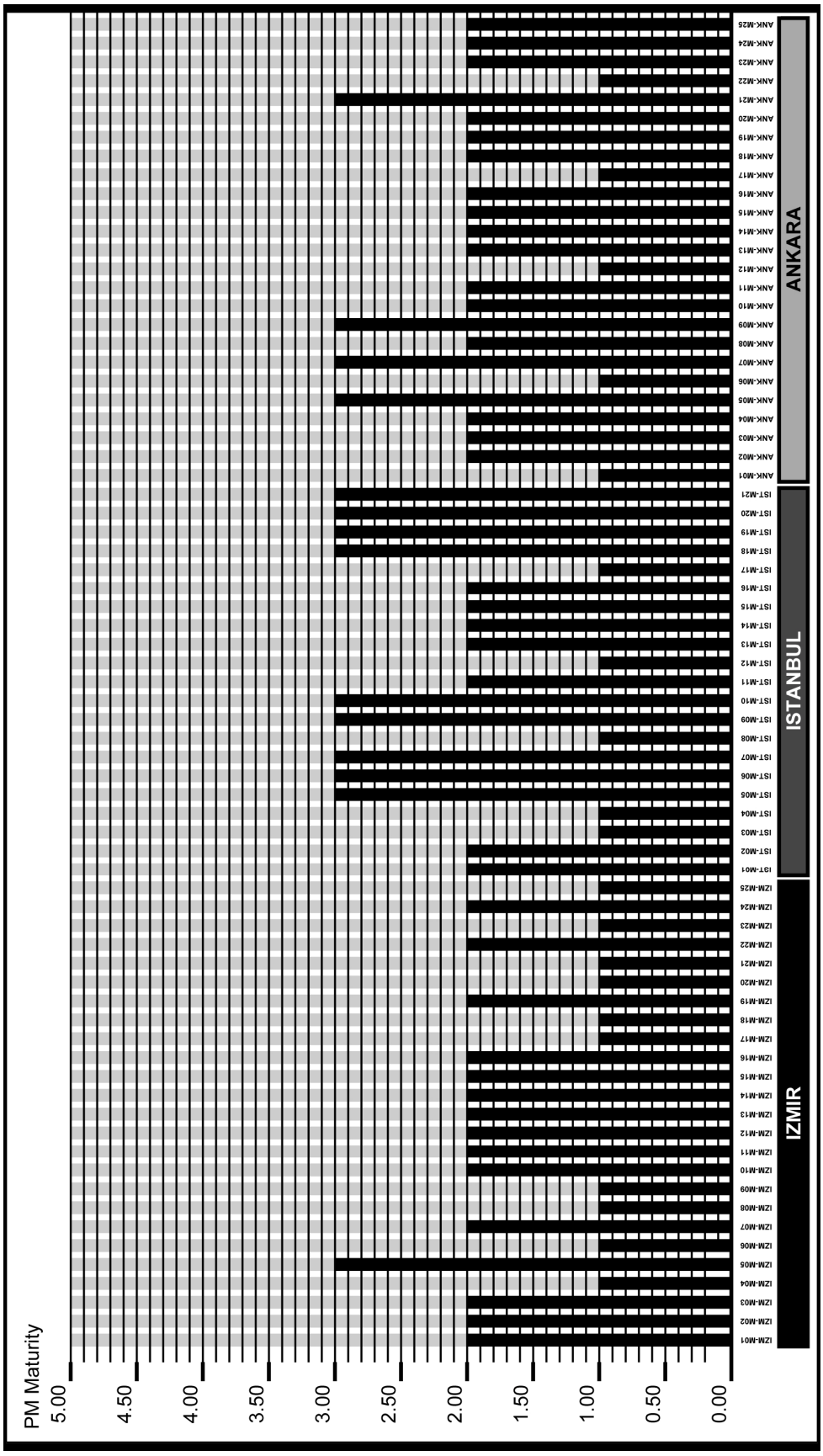


Figure 4.22 Q22 – Project Quality Management – Quality Planning

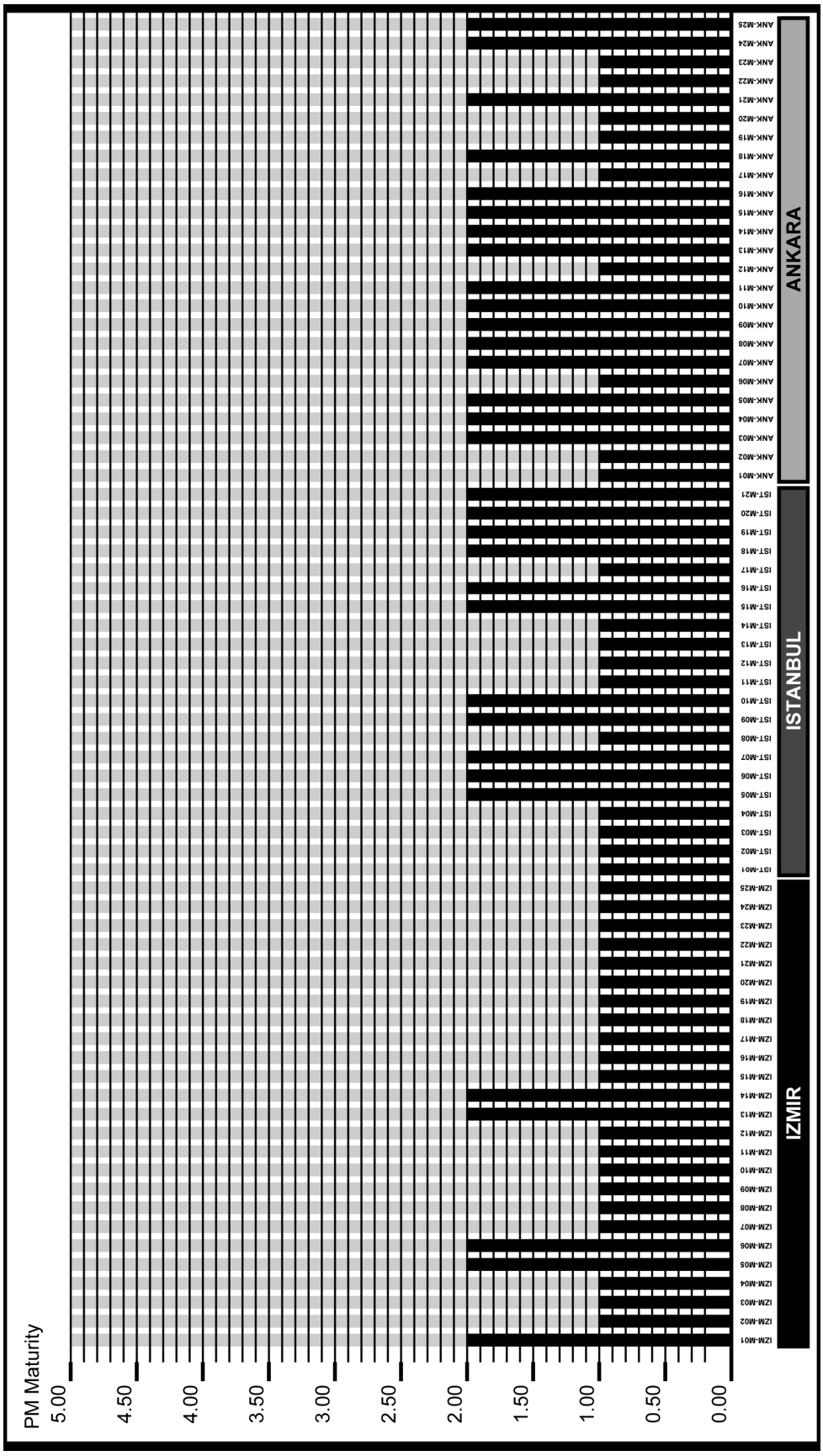


Figure 4.23 Q23 – Project Quality Management – Quality Assurance

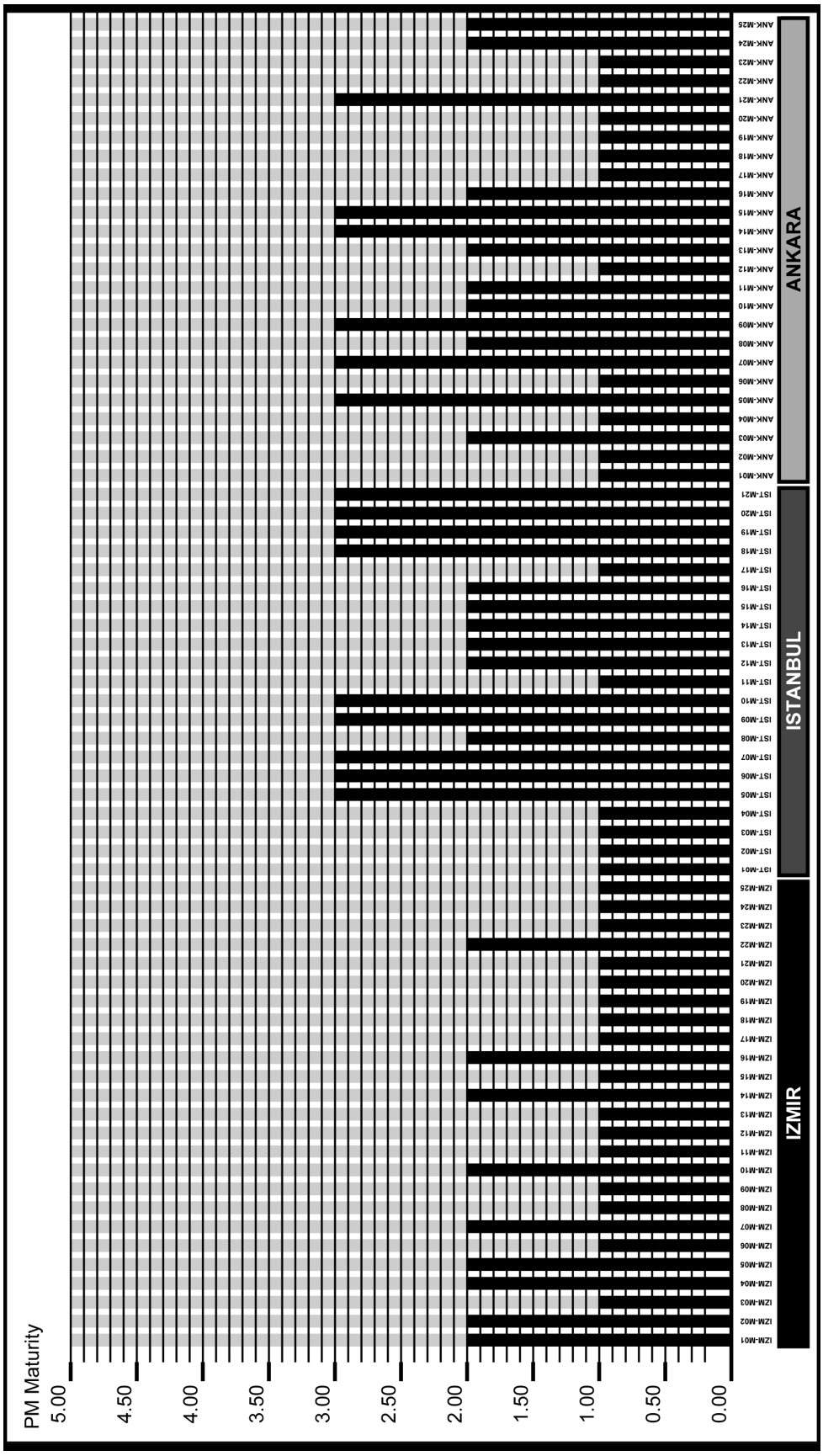


Figure 4.24 Q24 – Project Quality Management – Quality Control

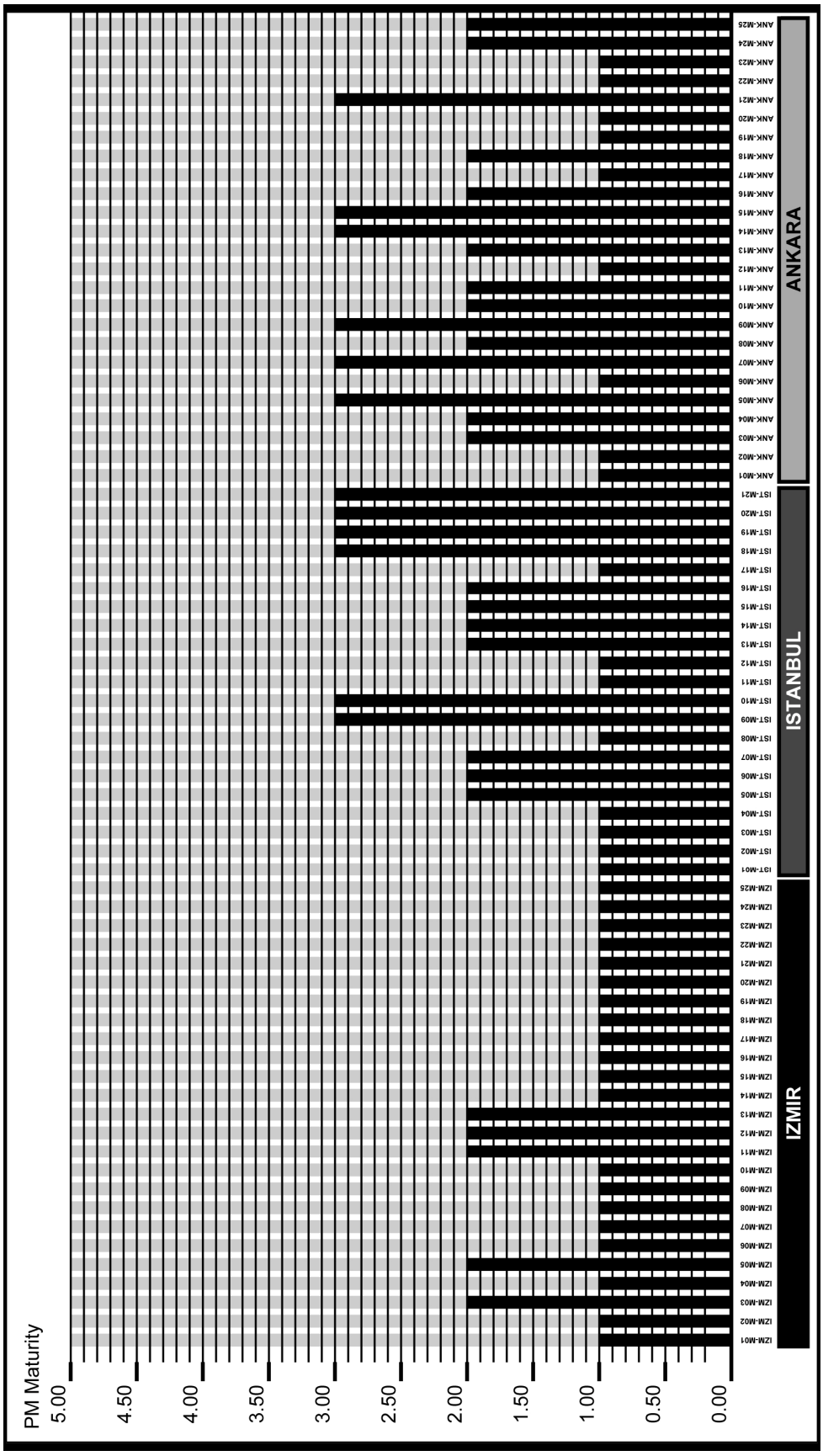


Figure 4.25 Q25 – Project Quality Management – Management Oversight

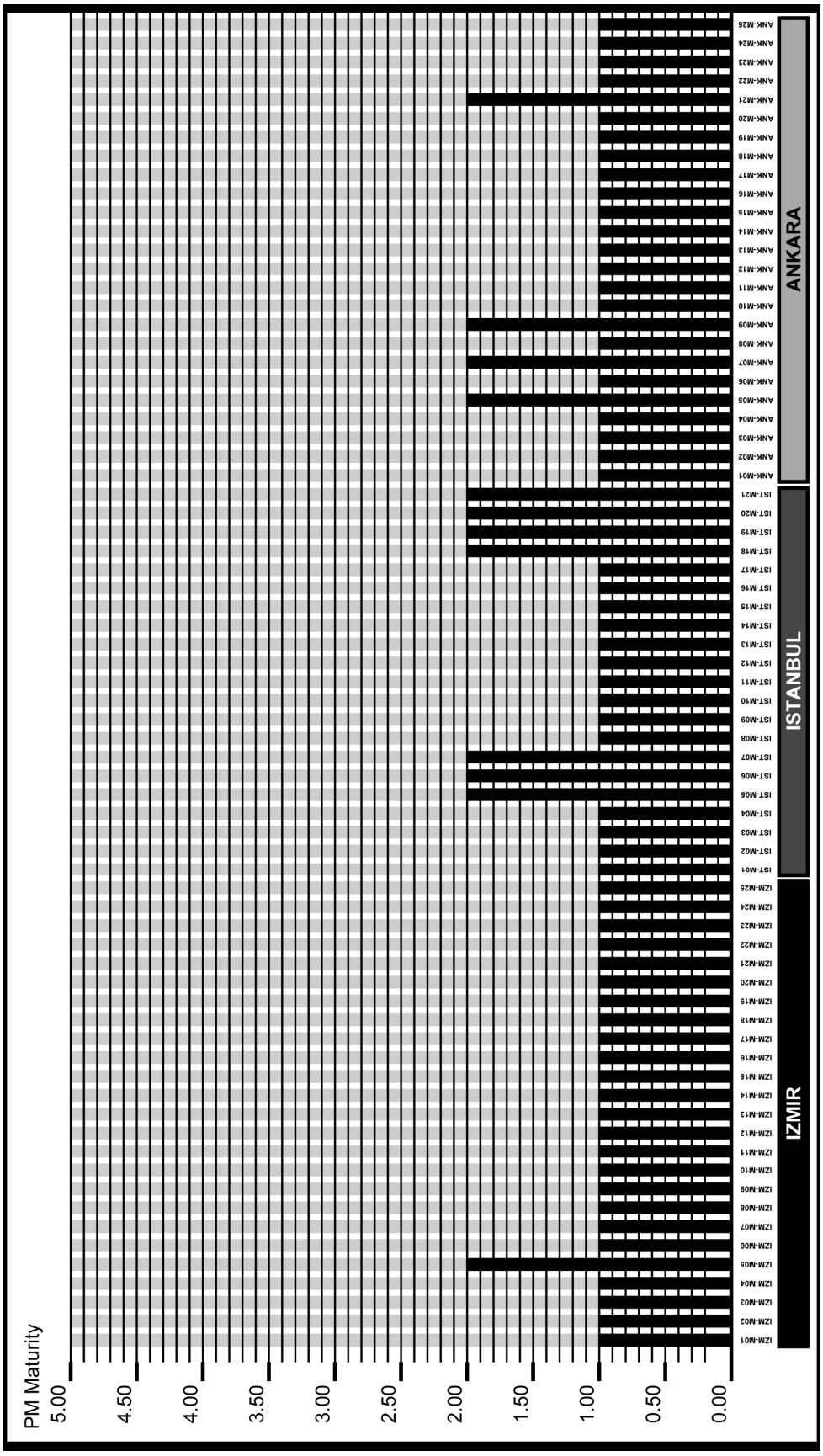


Figure 4.26 Q26 – Project Human Resource Management – Human Resource Planning

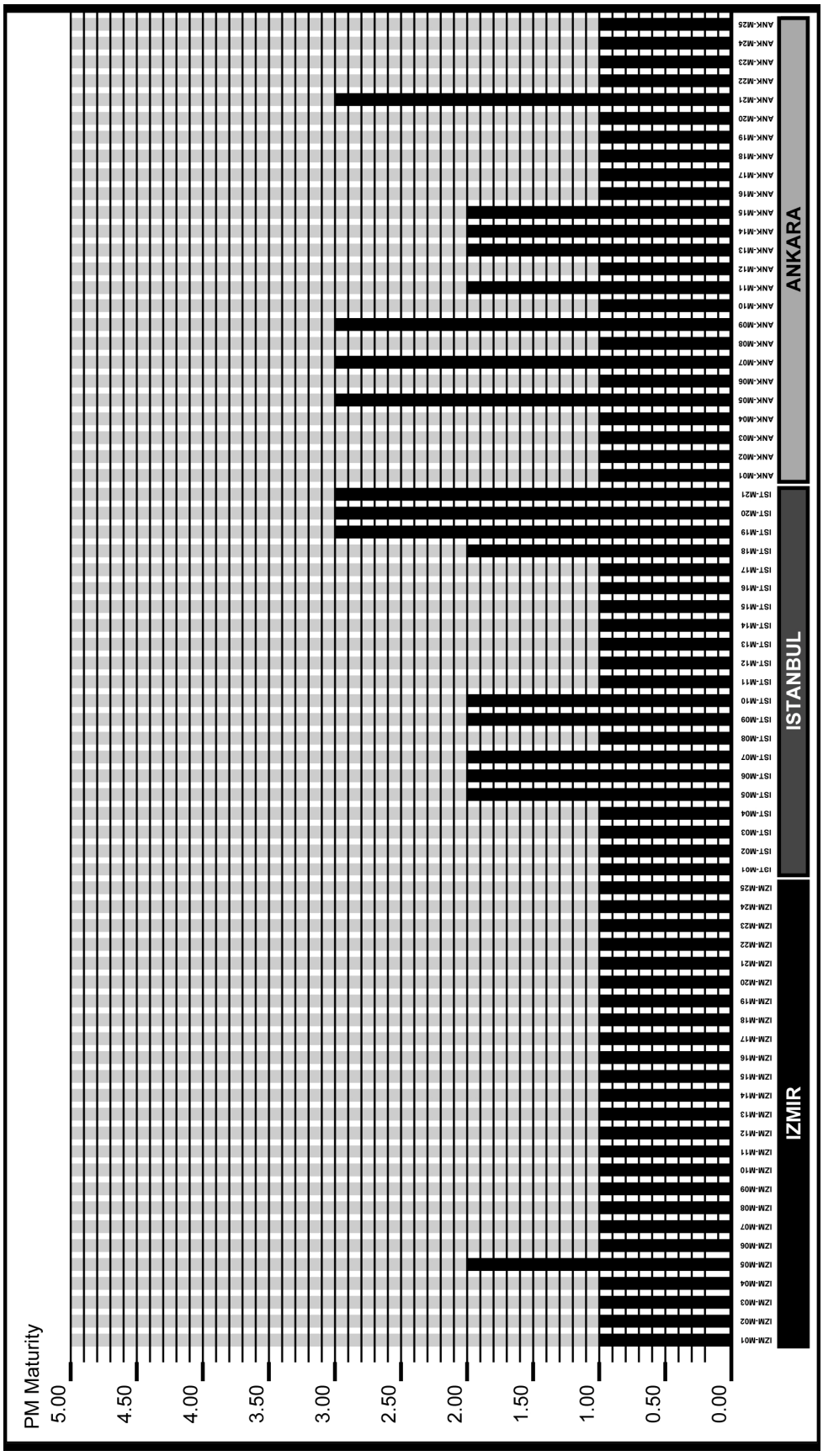


Figure 4.27 Q27 – Project Human Resource Management – Staff Acquisition

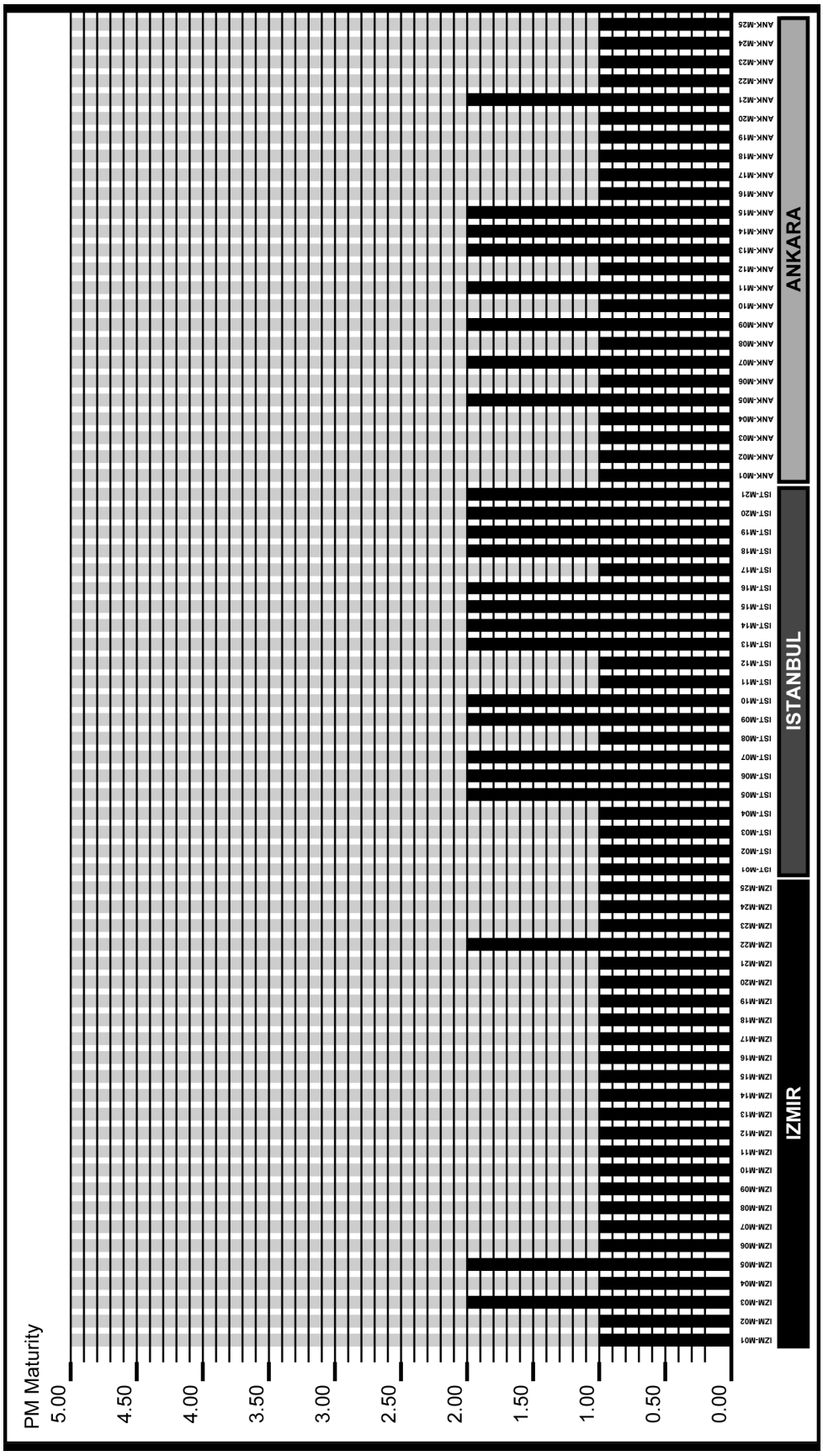


Figure 4.28 Q28 – Project Human Resource Management – Develop and Manage Project Team

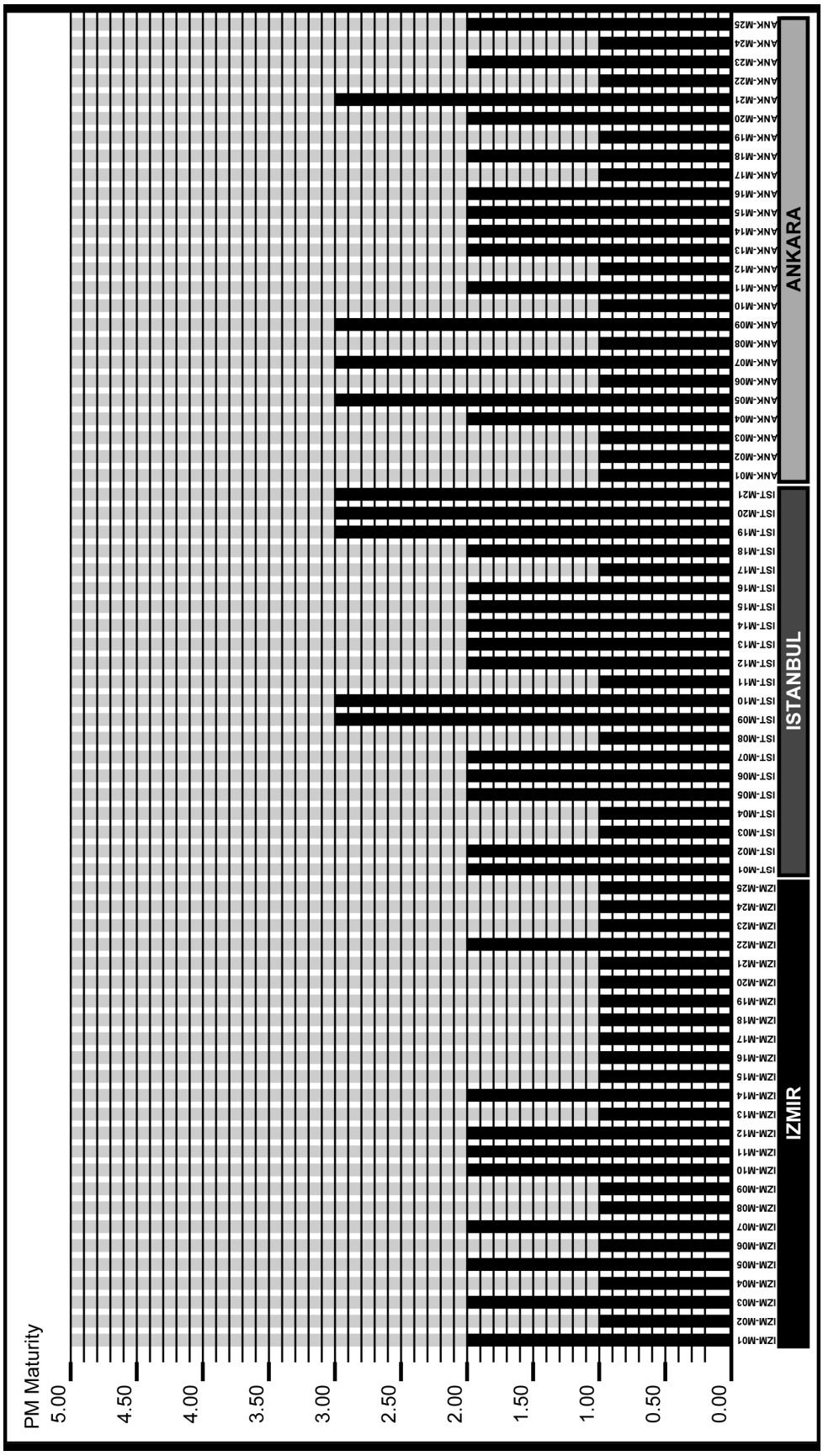


Figure 4.29 Q29 – Project Human Resource Management – Professional Development

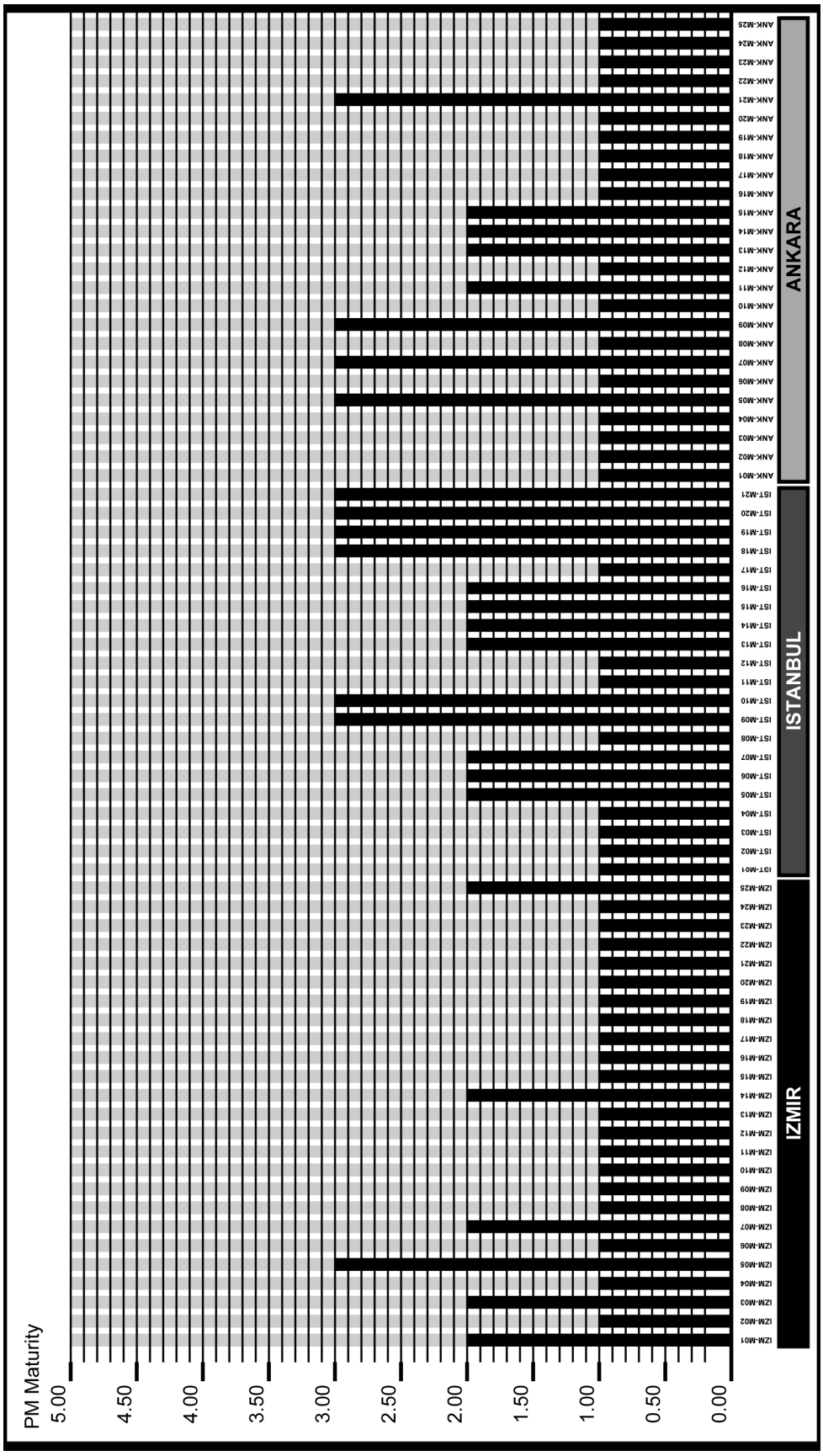


Figure 4.30 Q30 – Project Communication Management – Communication Planning

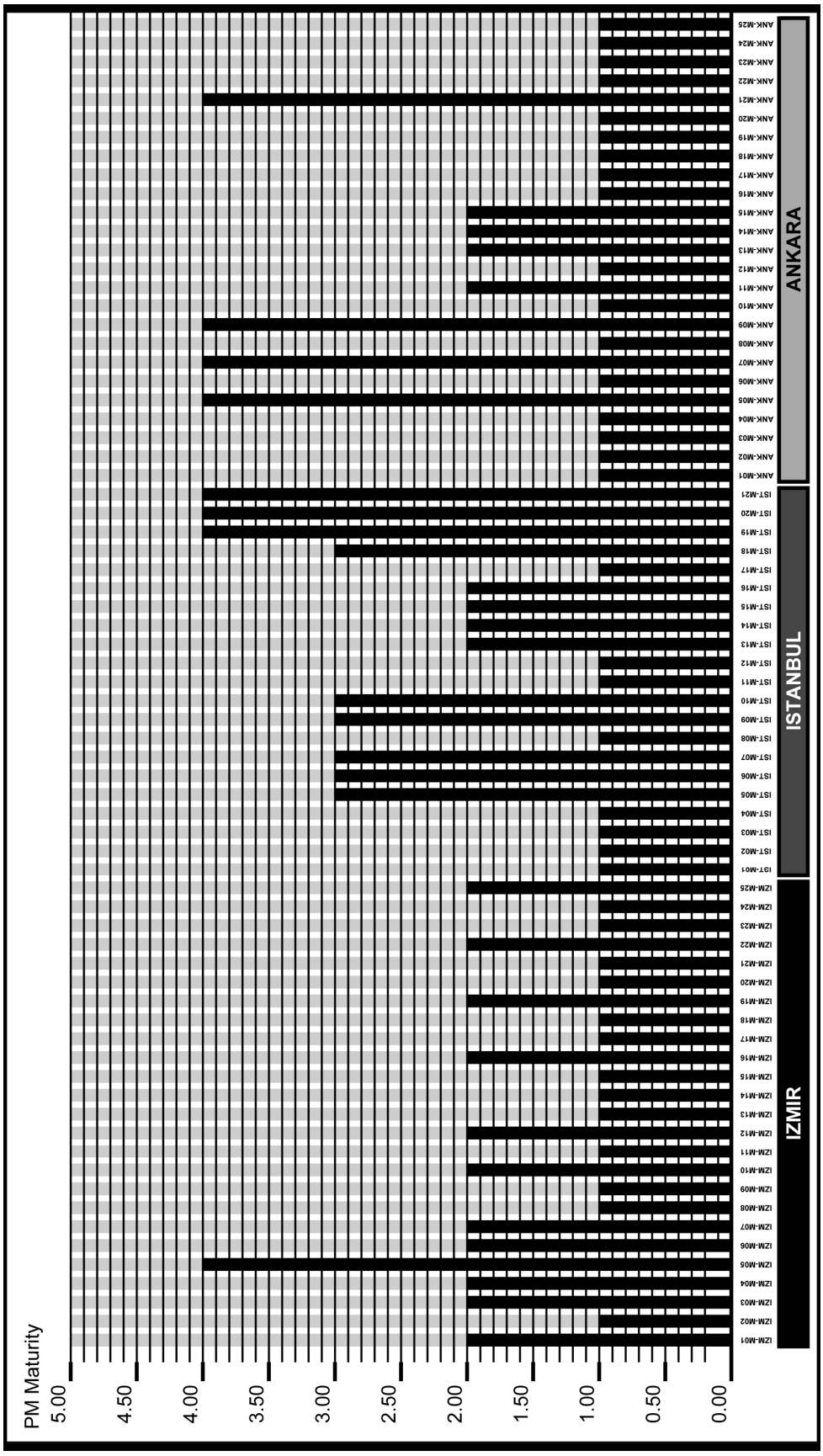


Figure 4.31 Q31 – Project Communication Management – Information Distribution

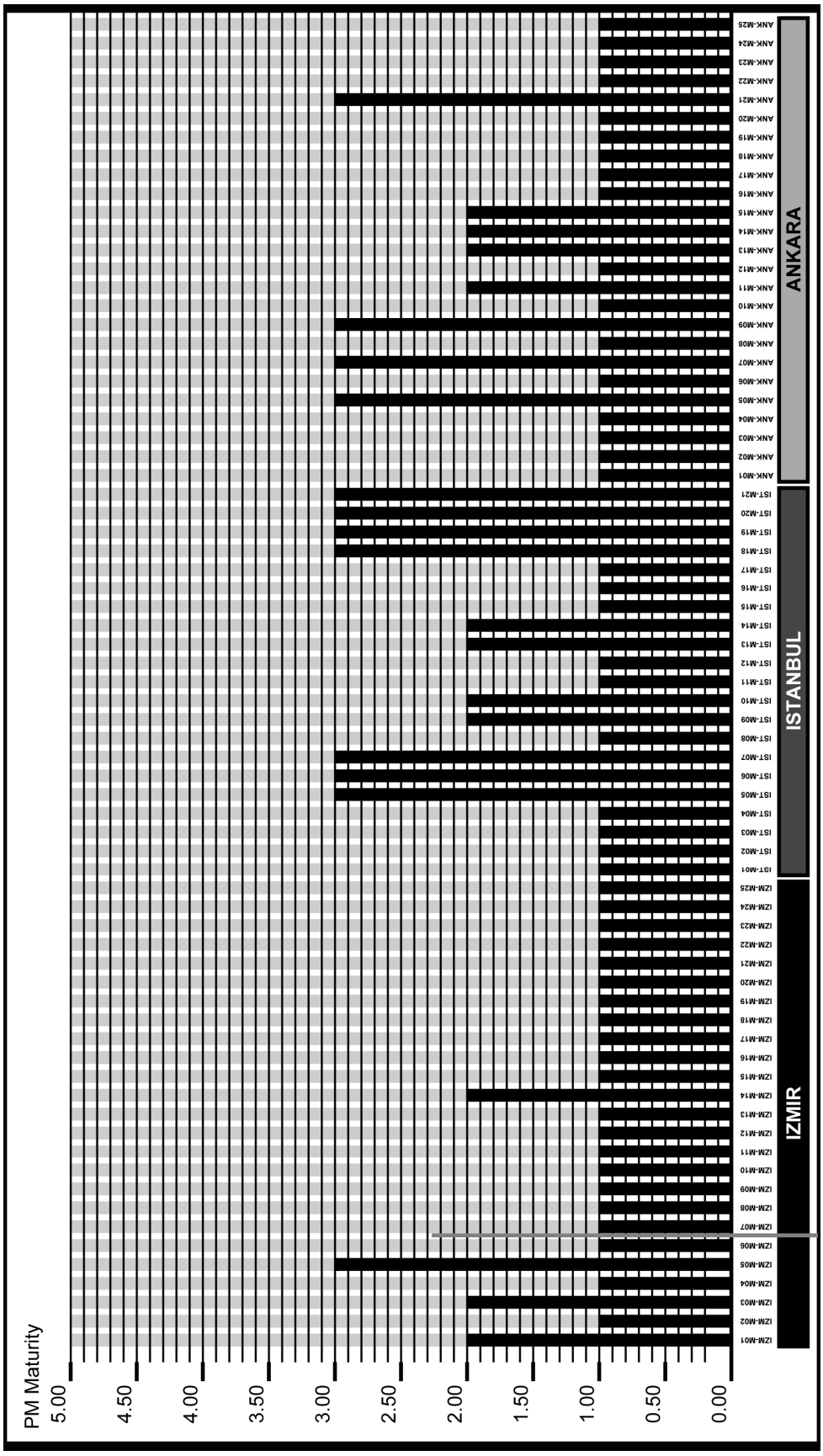


Figure 4.32 Q32 – Project Communication Management – Performance Reporting

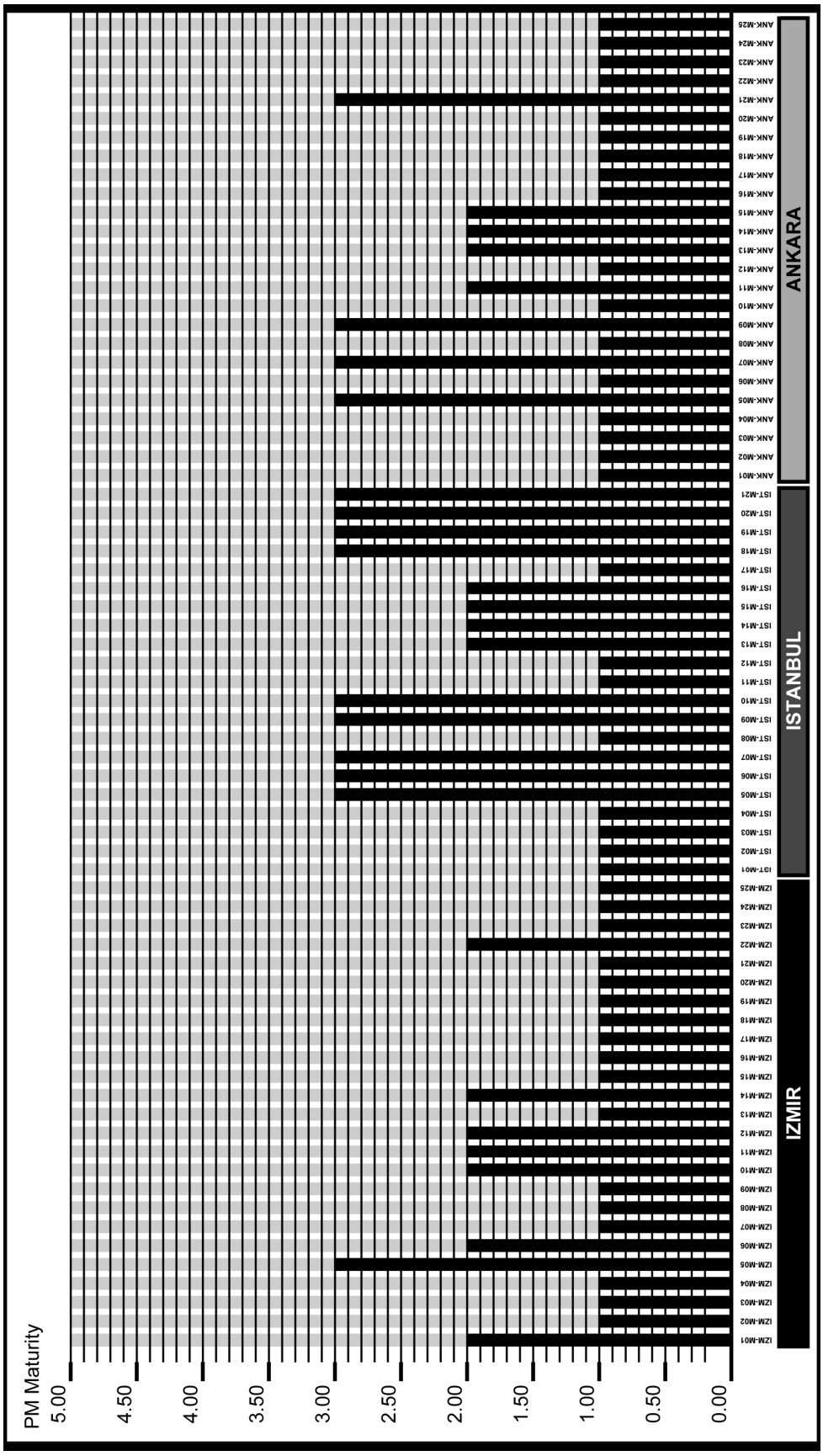


Figure 4.33 Q33 – Project Communication Management – Issues Tracking and Management

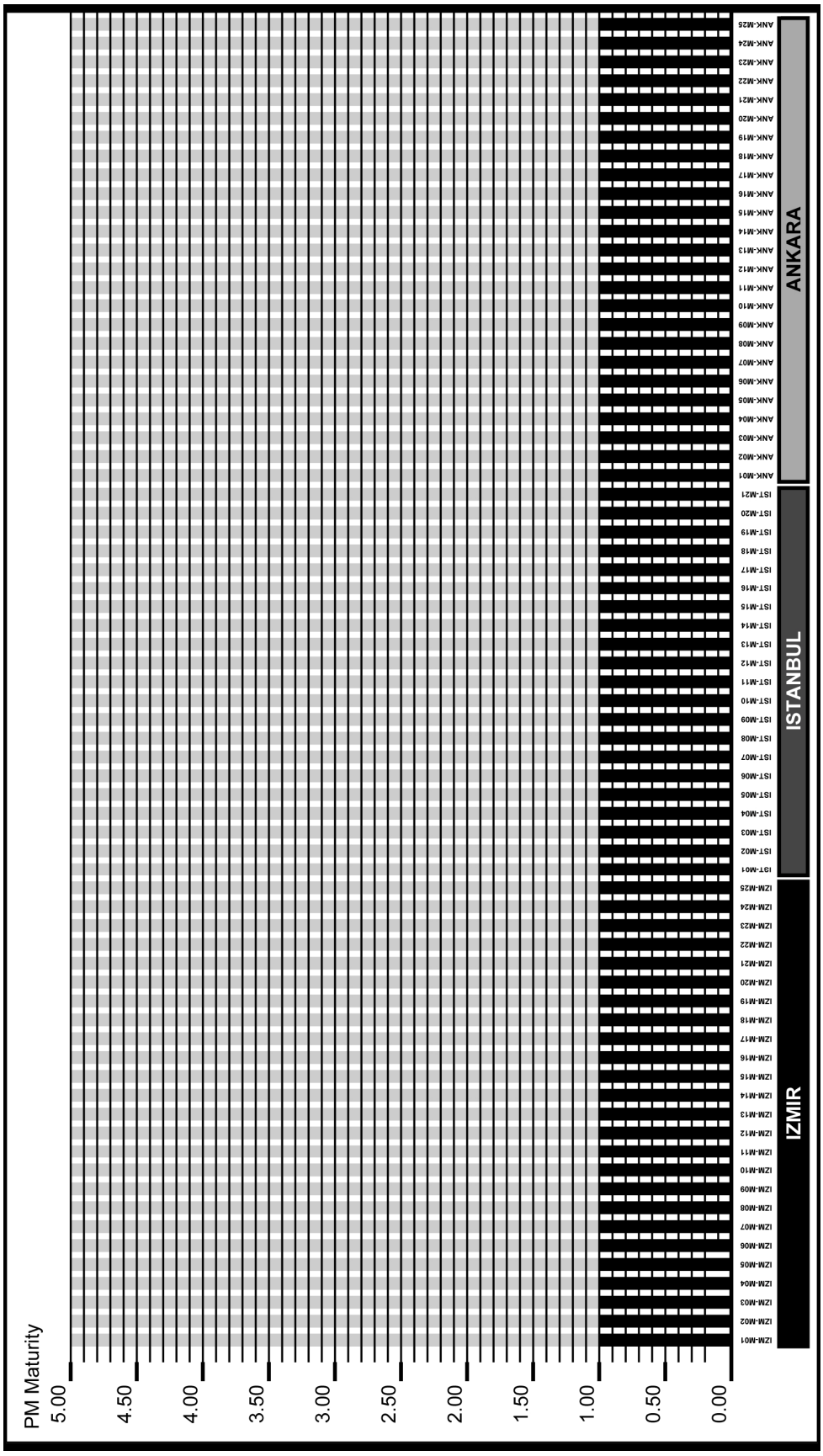


Figure 4.34 Q34 – Project Risk Management – Risk Identification

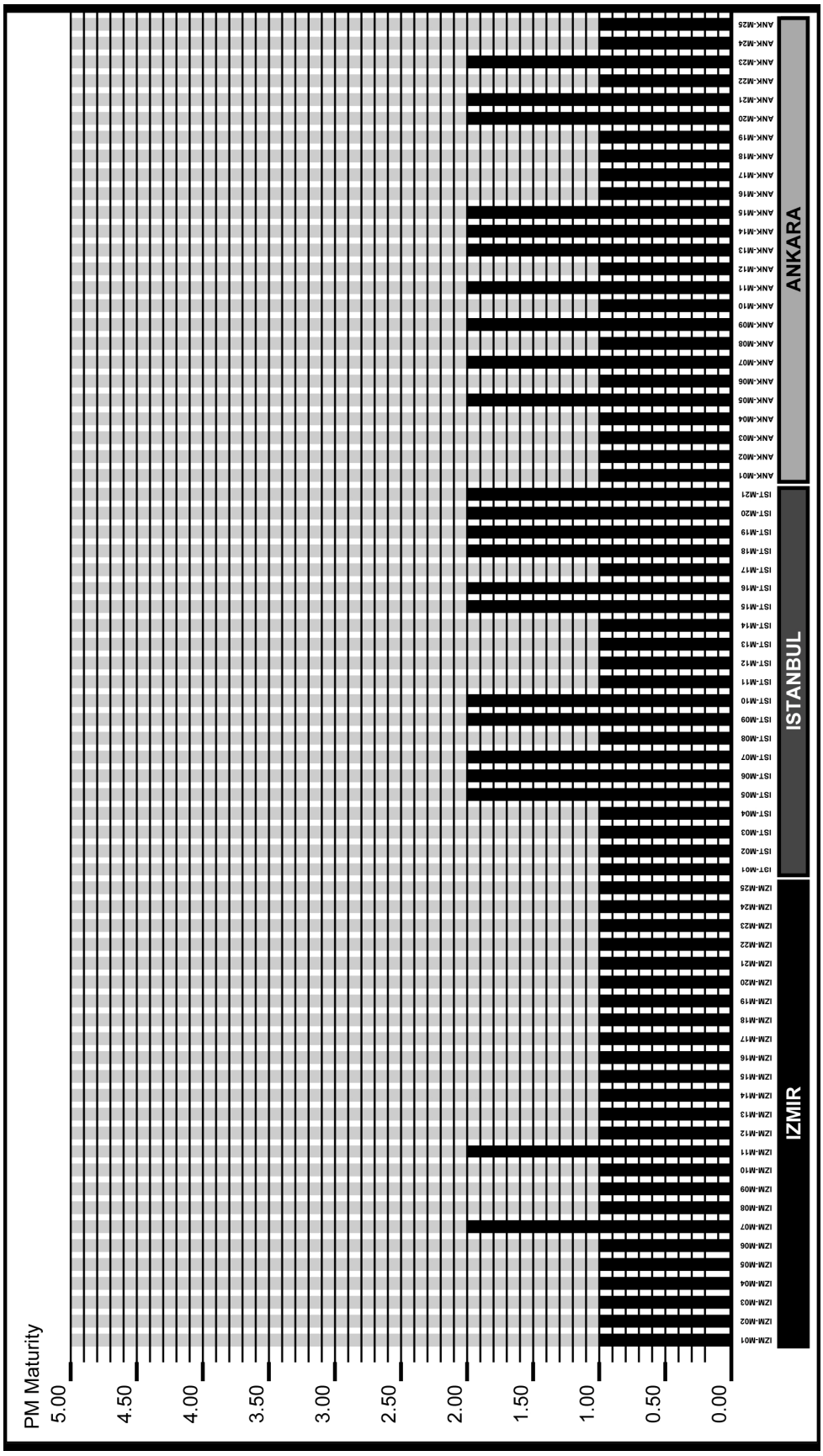


Figure 4.35 Q35 – Project Risk Management – Risk Quantification

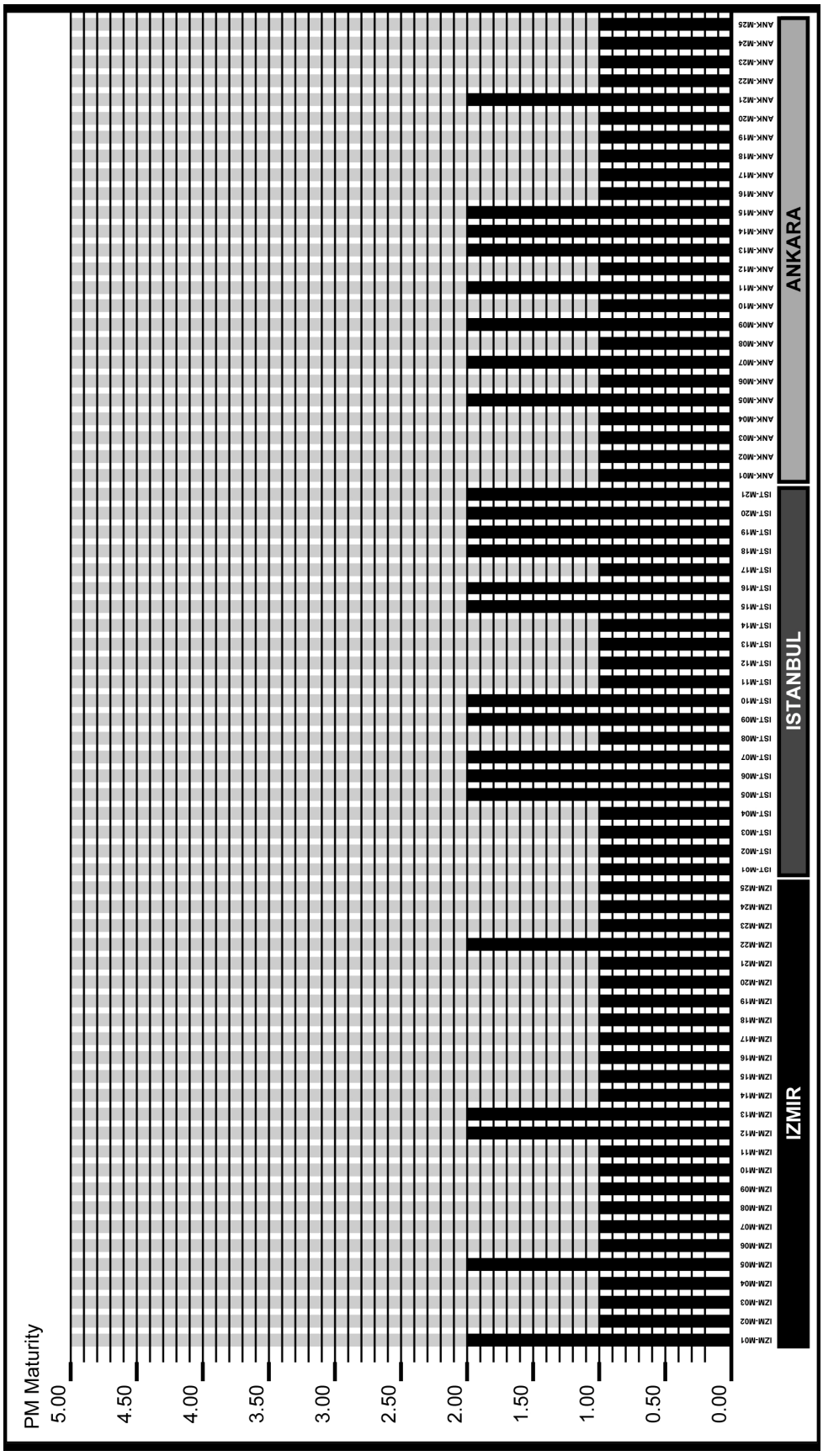


Figure 4.36 Q36 – Project Risk Management – Risk Response Development

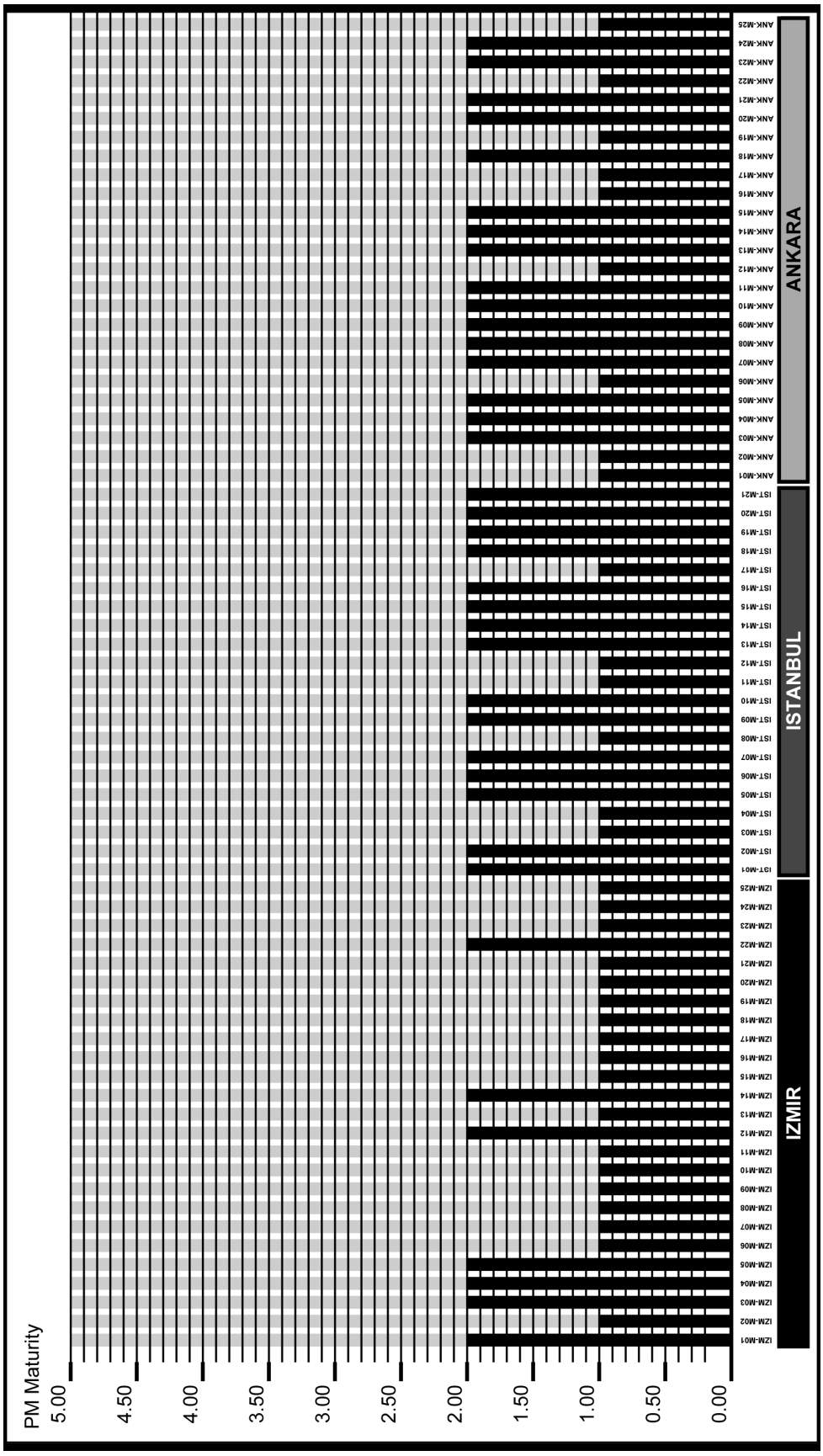


Figure 4.37 Q37 – Project Risk Management – Risk Control

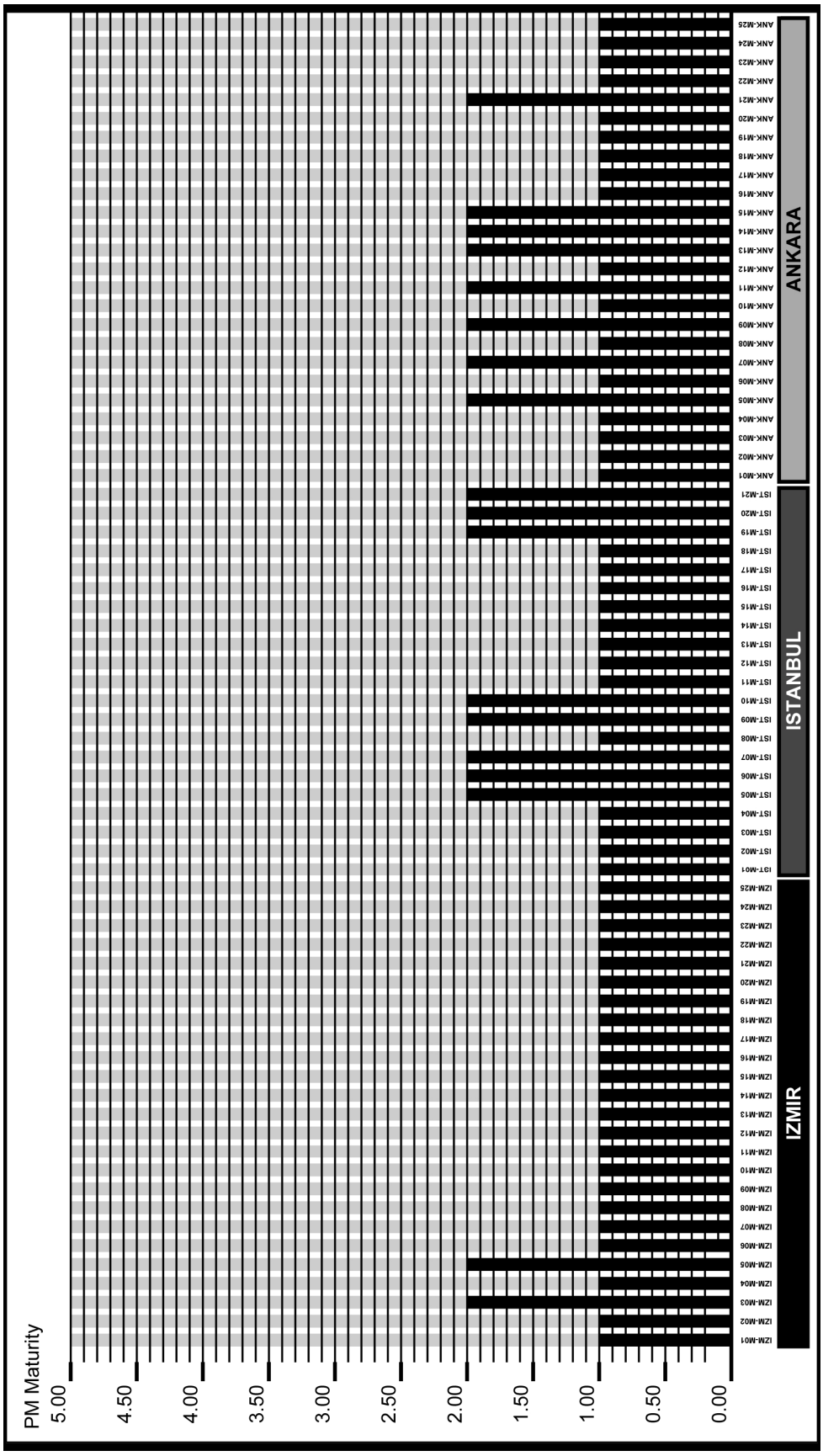


Figure 4.38 Q38 – Project Risk Management – Risk Documentation

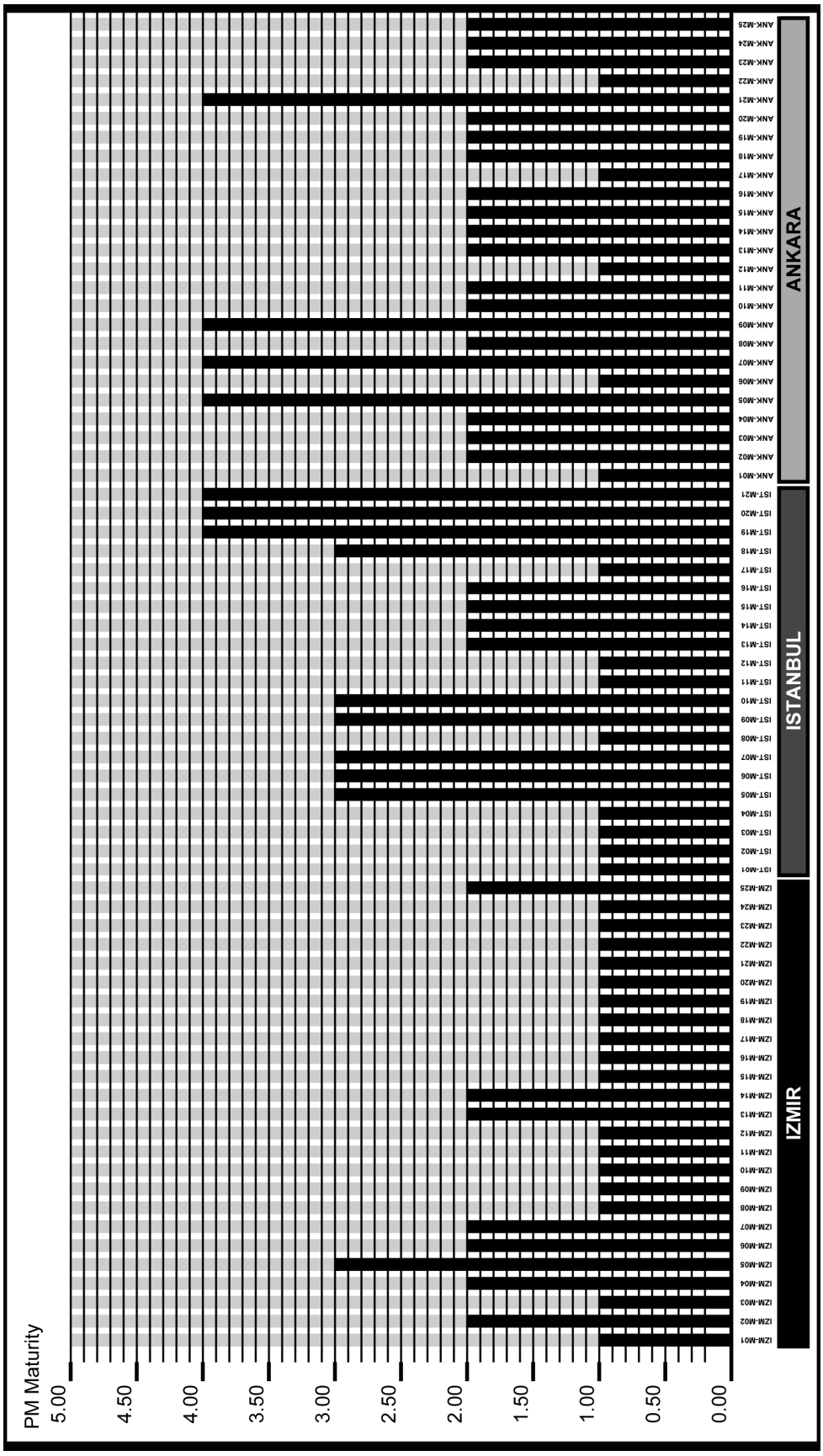
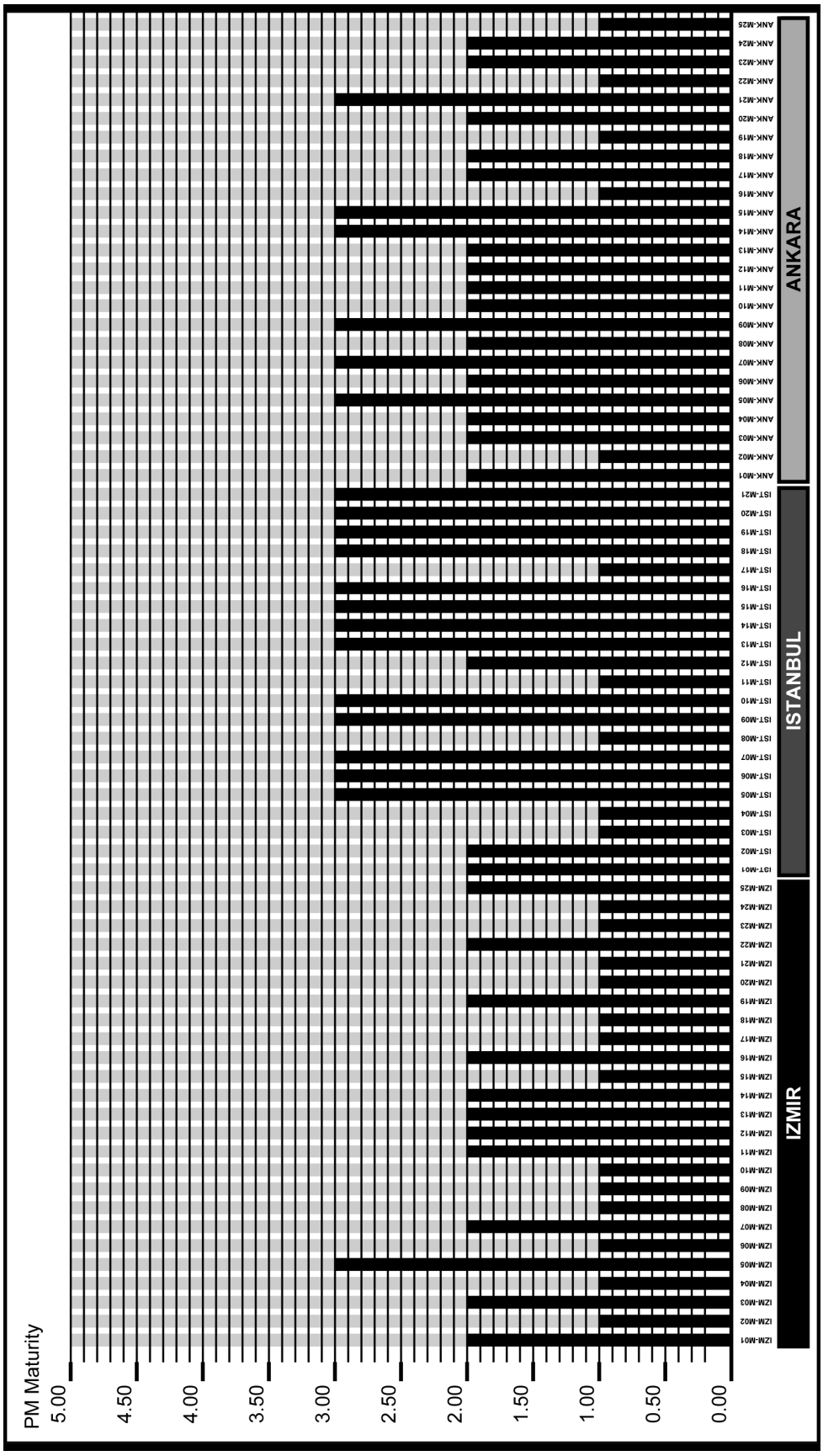


Figure 4.39 Q39 – Project Procurement Management – Procurement Planning



4.40 Q40 – Project Procurement Management – Requisition

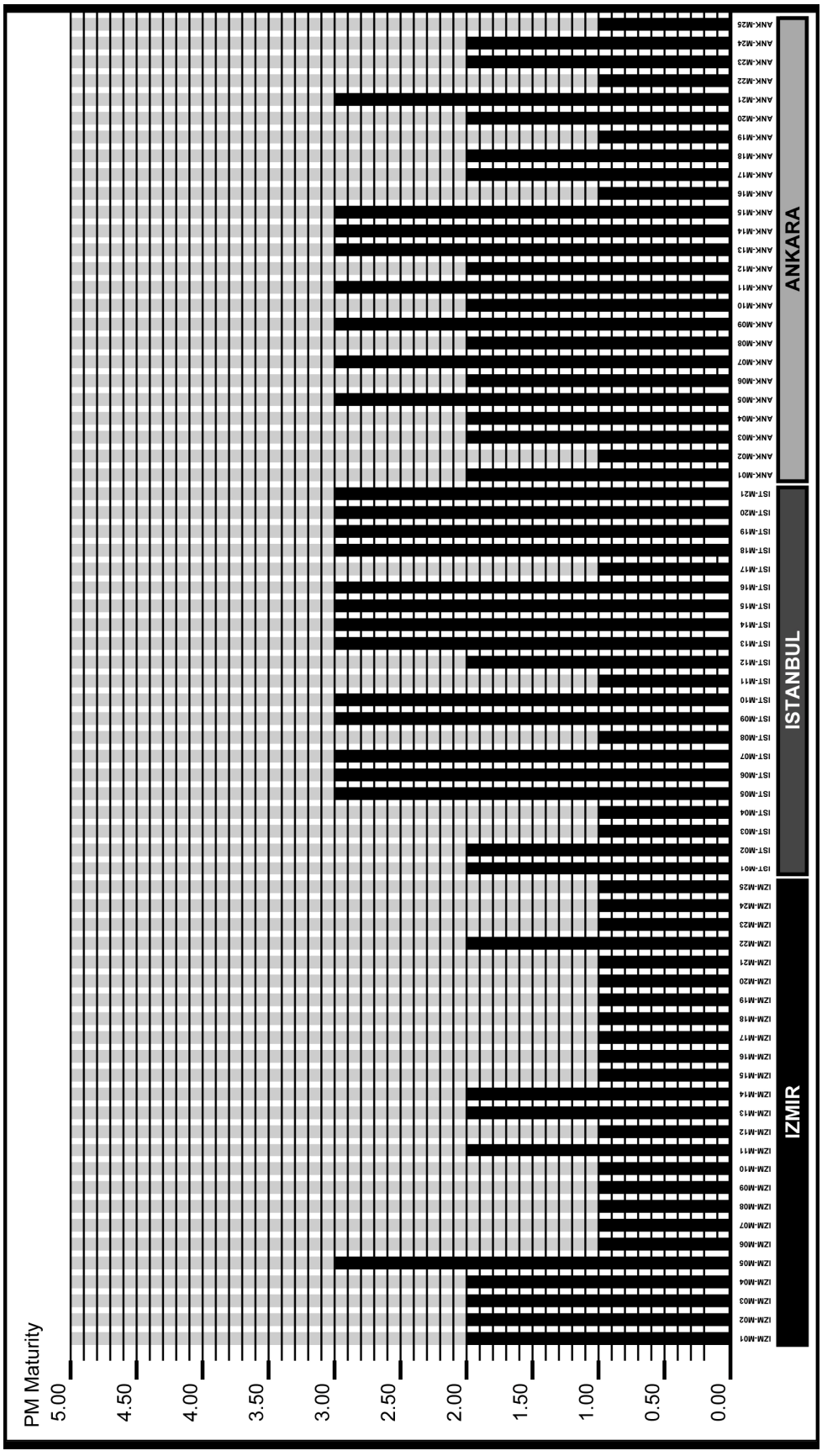


Figure 4.41 Q41 – Project Procurement Management – Solicitation / Source Selection

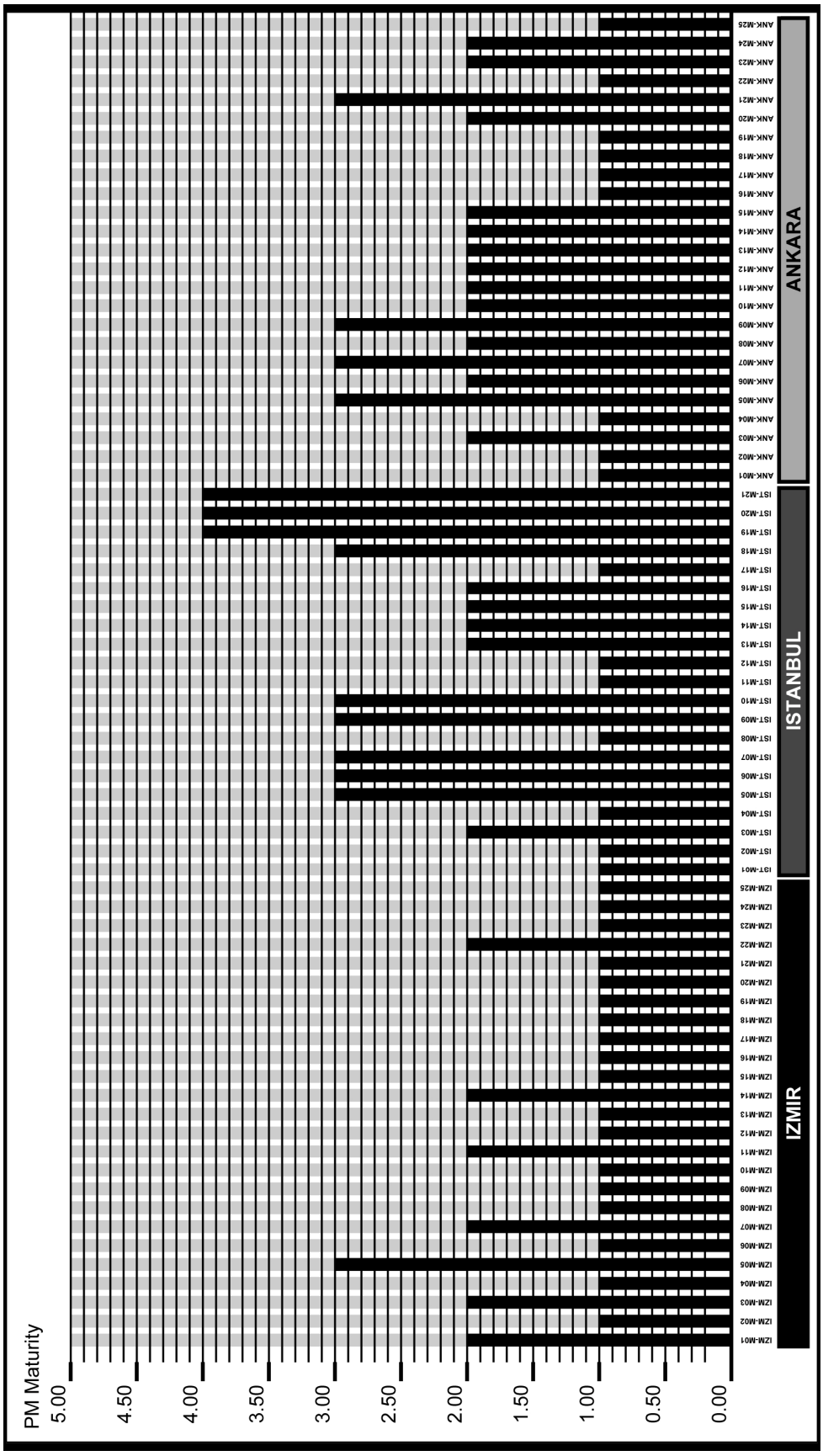


Figure 4.42 Q42 – Project Procurement Management – Contract Management / Closure

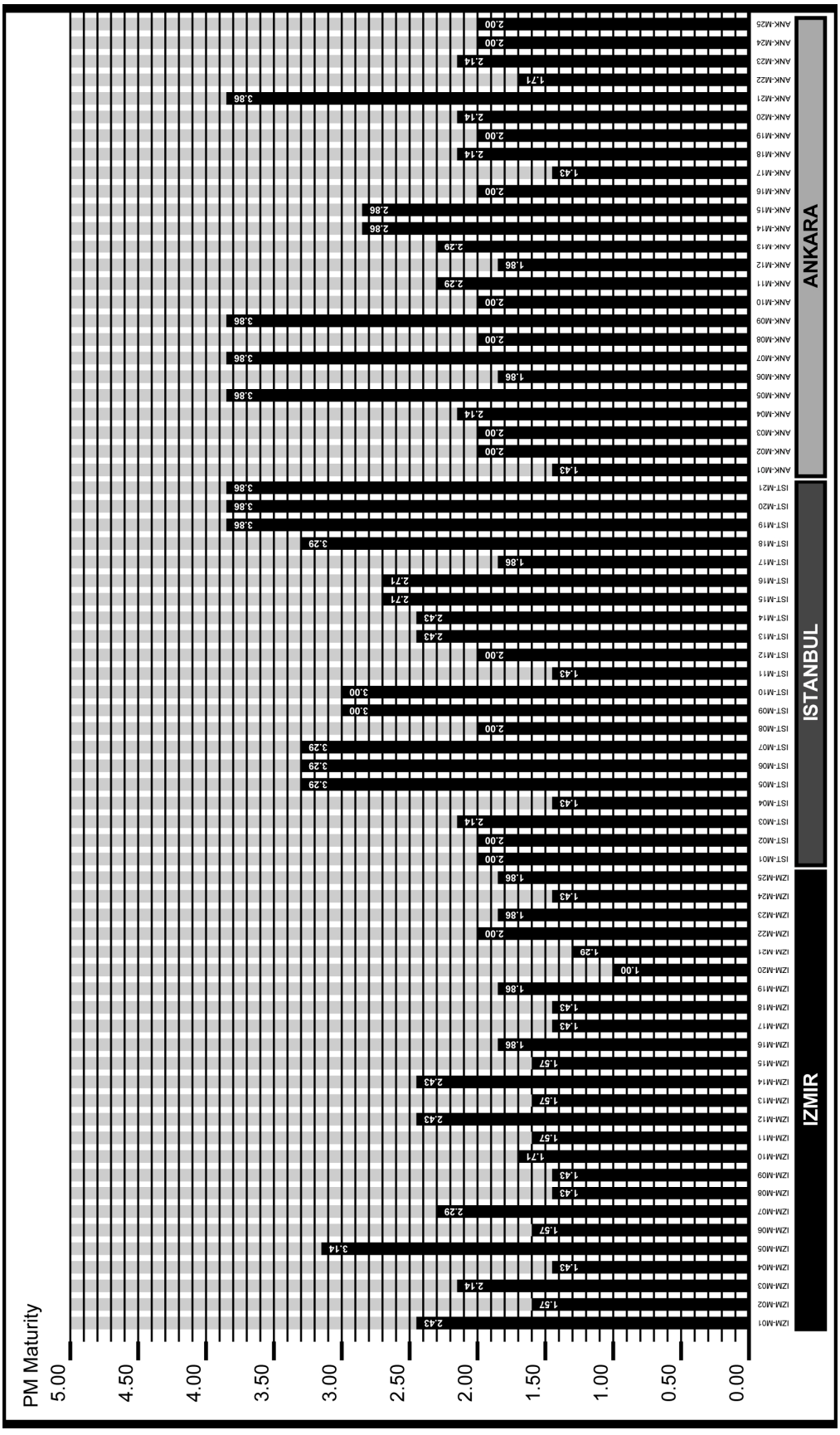


Figure 4.43 – Project Integration Management

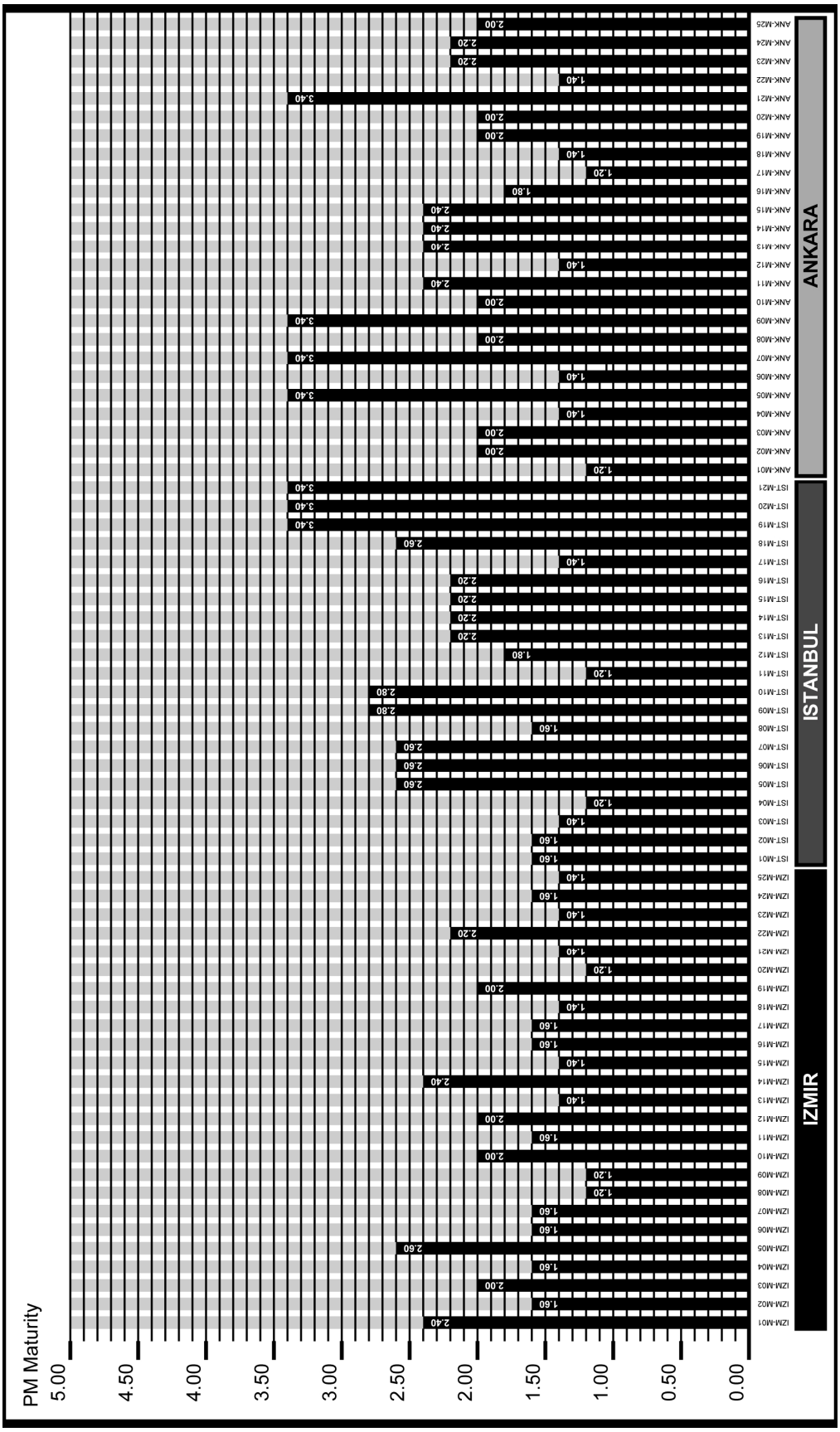


Figure 4.44 – Project Scope Management

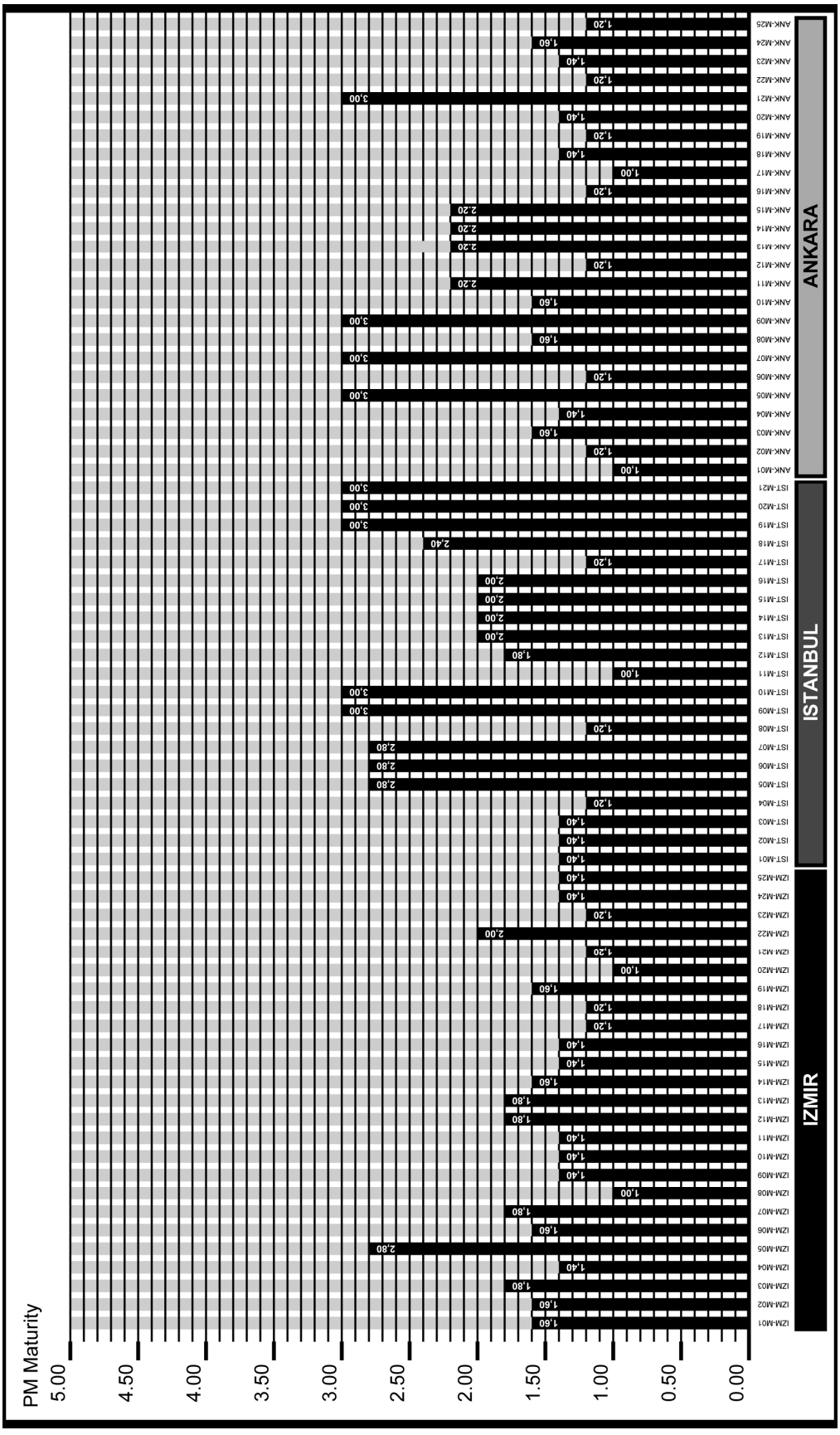


Figure 4.45 – Project Time Management

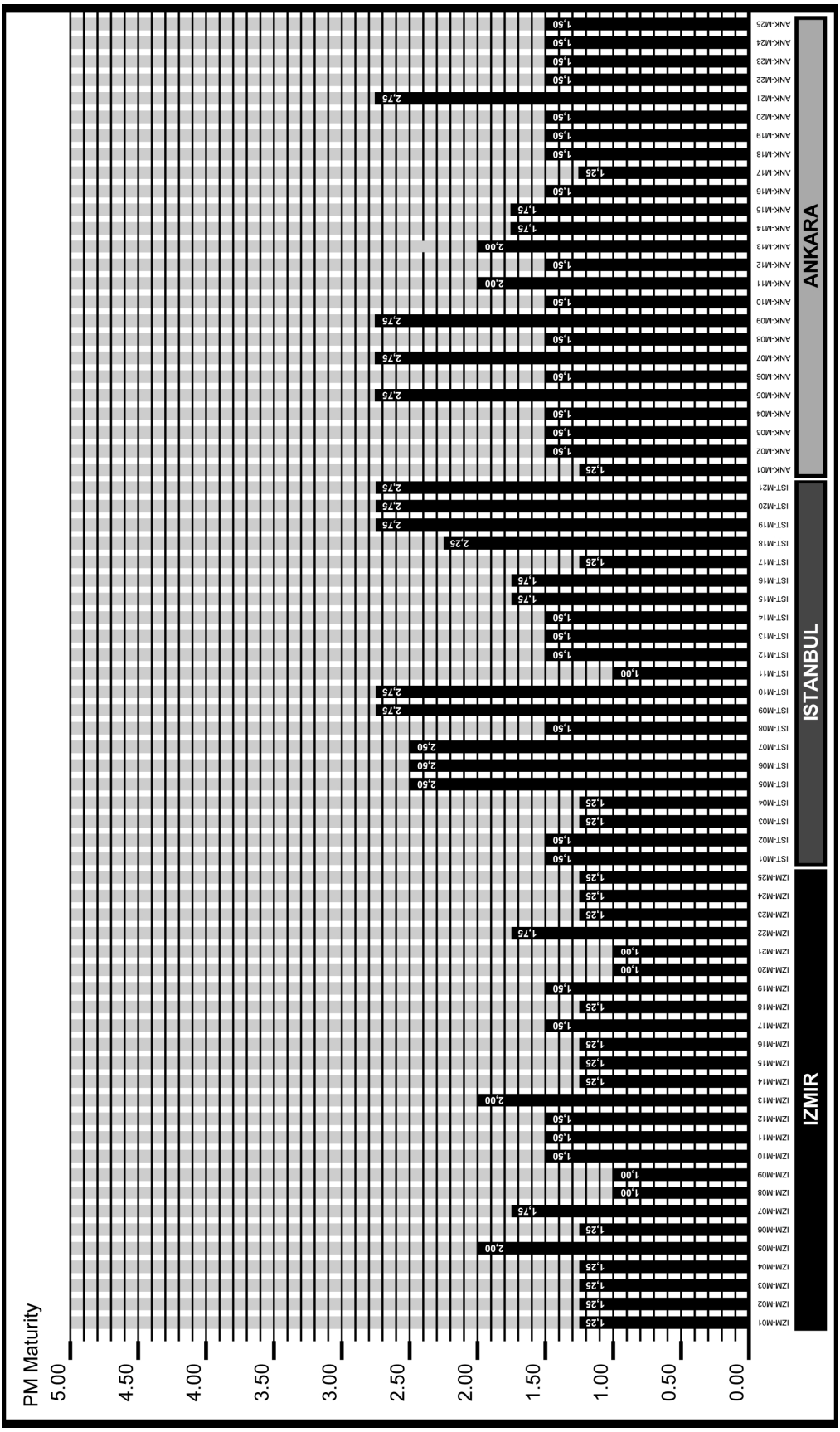


Figure 4.46 – Project Cost Management

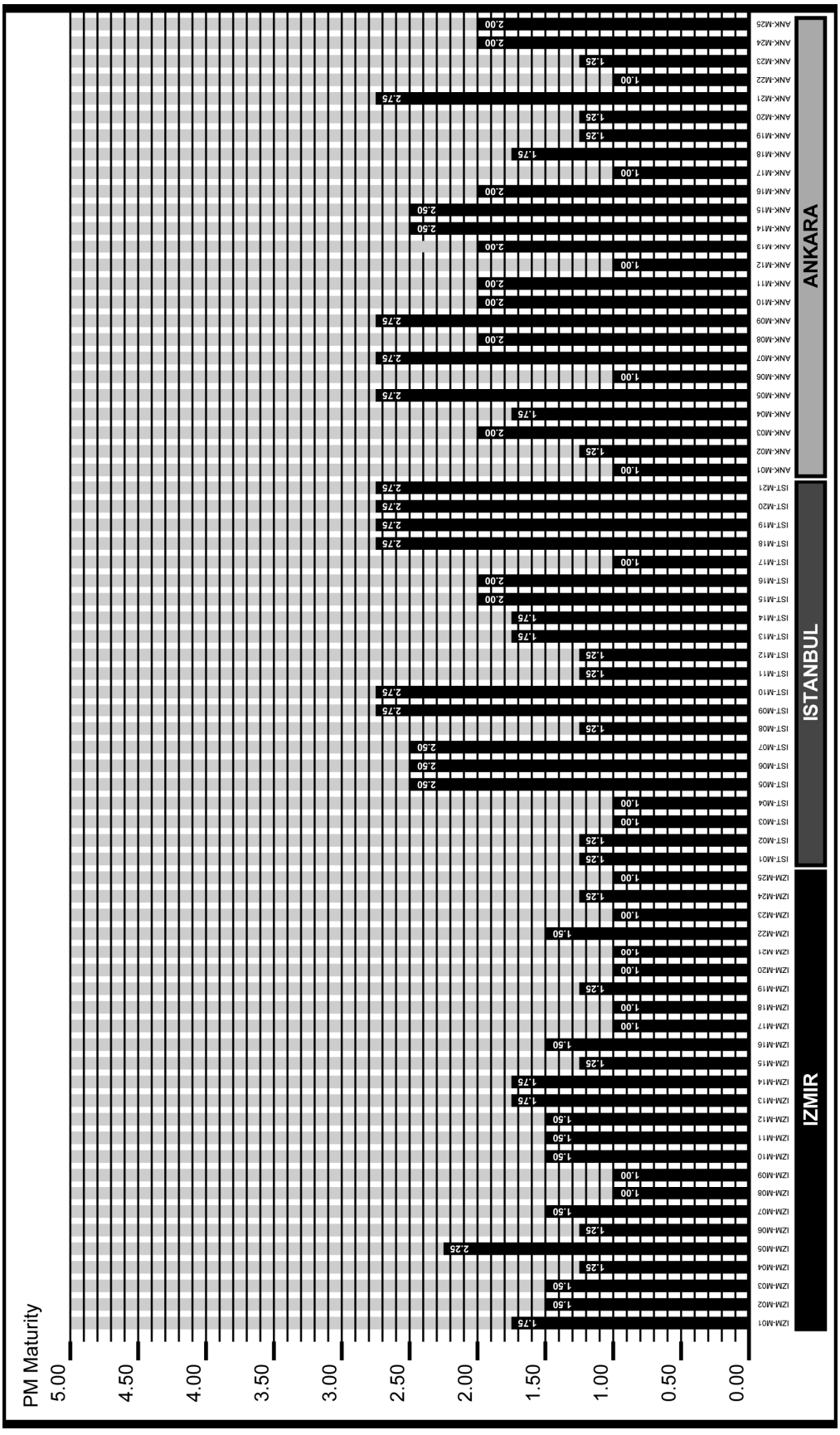


Figure 4.47 – Project Quality Management

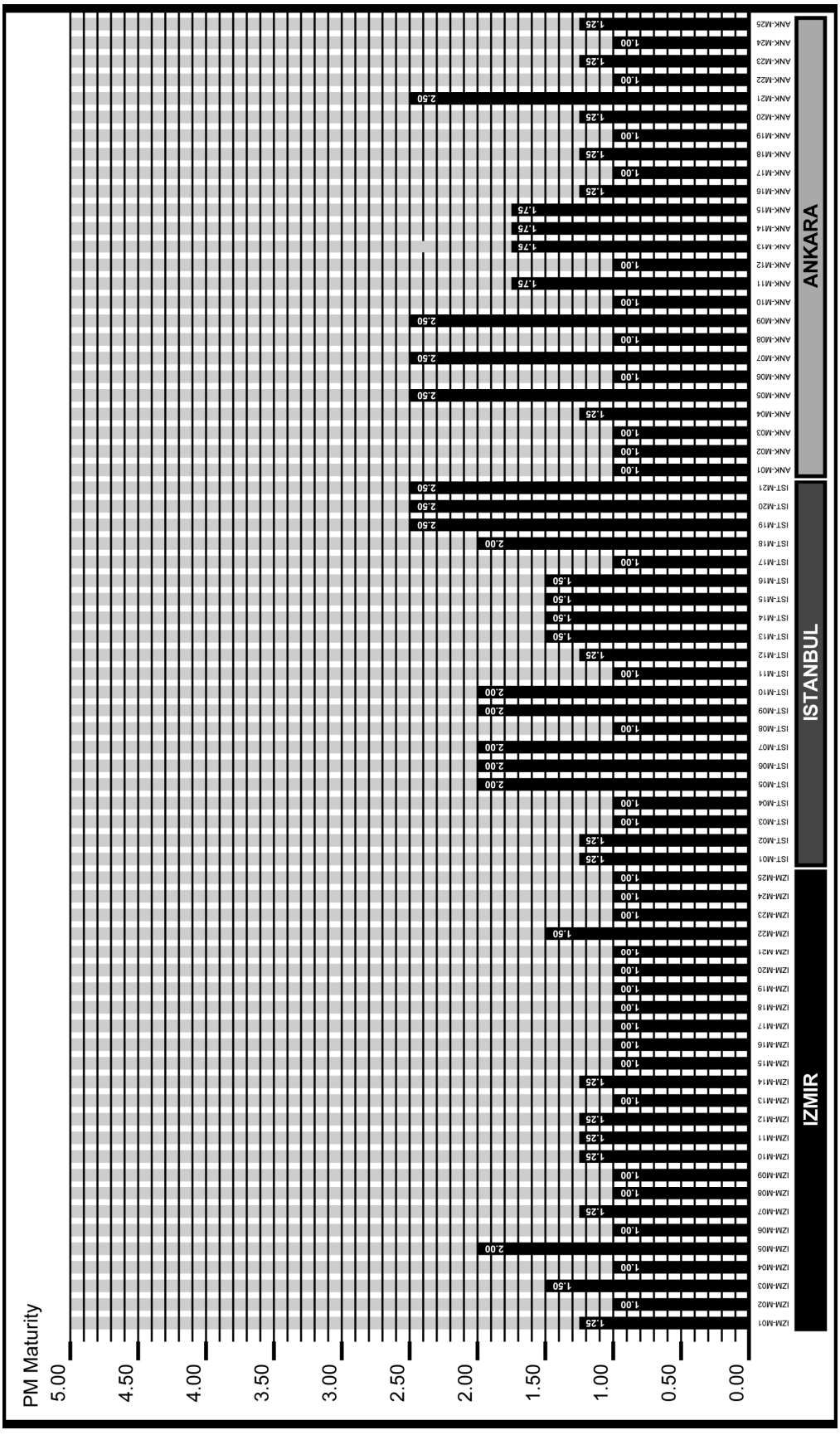


Figure 4.48 – Project Human Resource Management

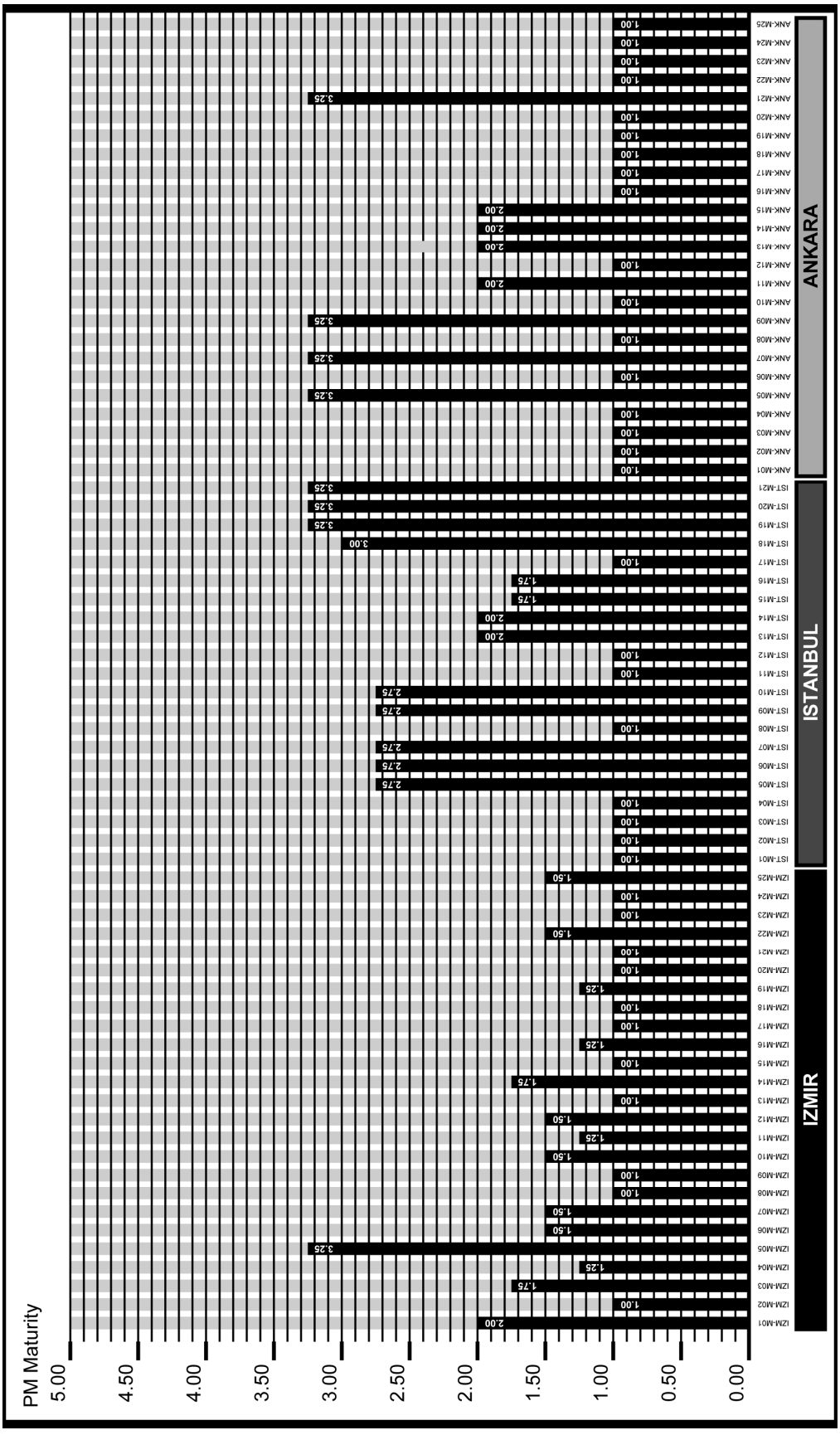


Figure 4.49 – Project Communications Management

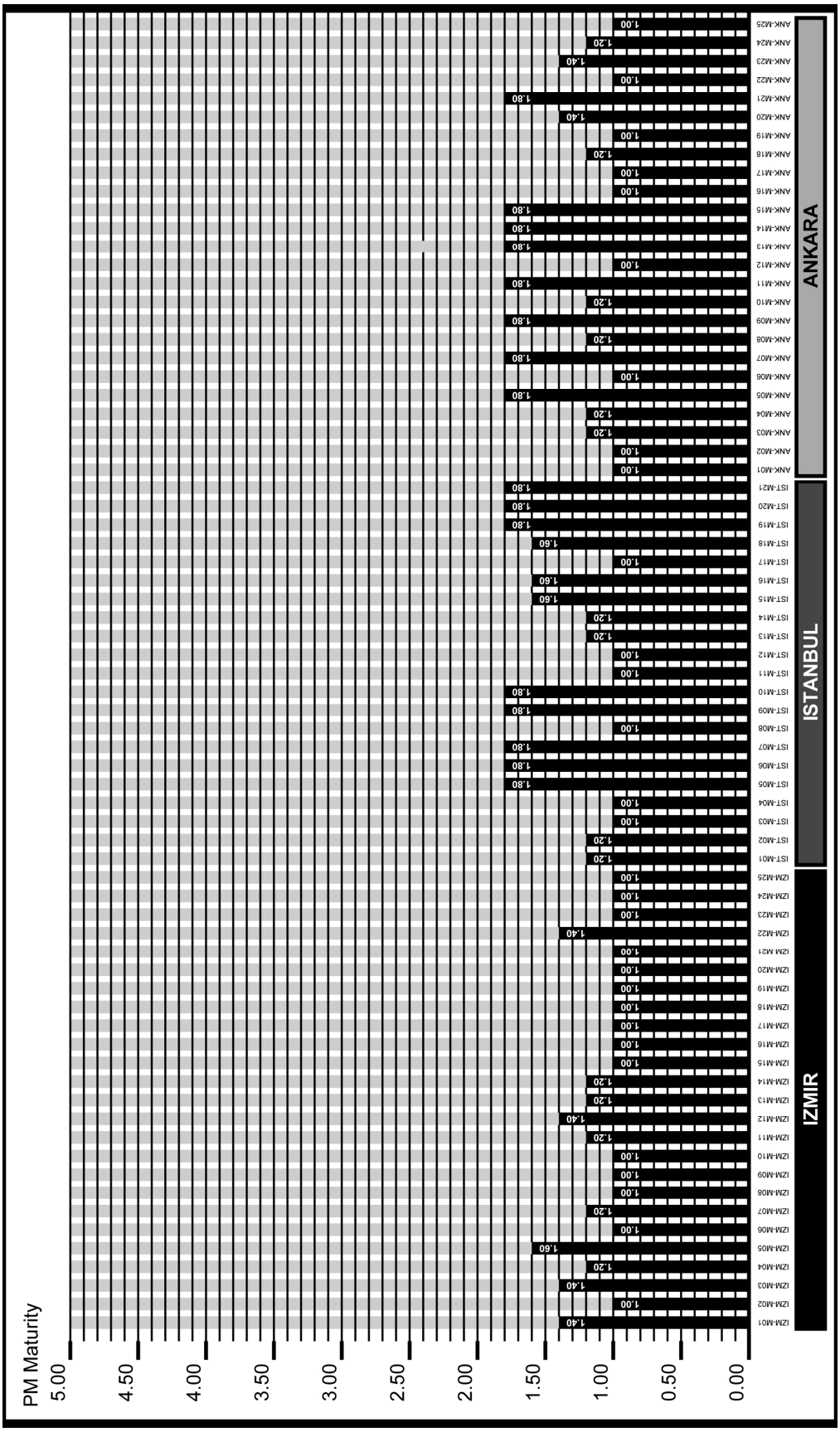


Figure 4.50 – Project Risk Management

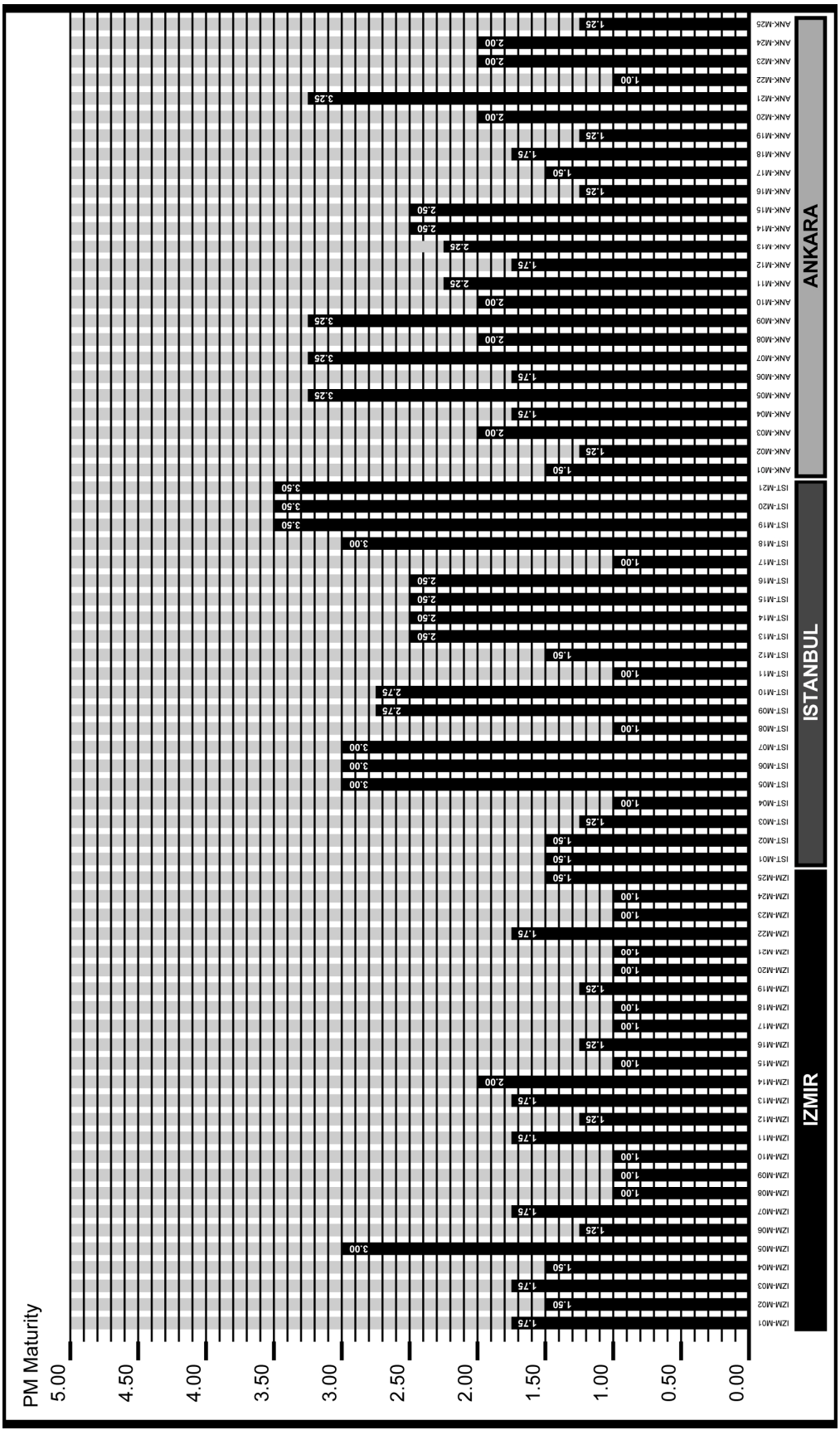


Figure 4.51 – Project Procurement Management

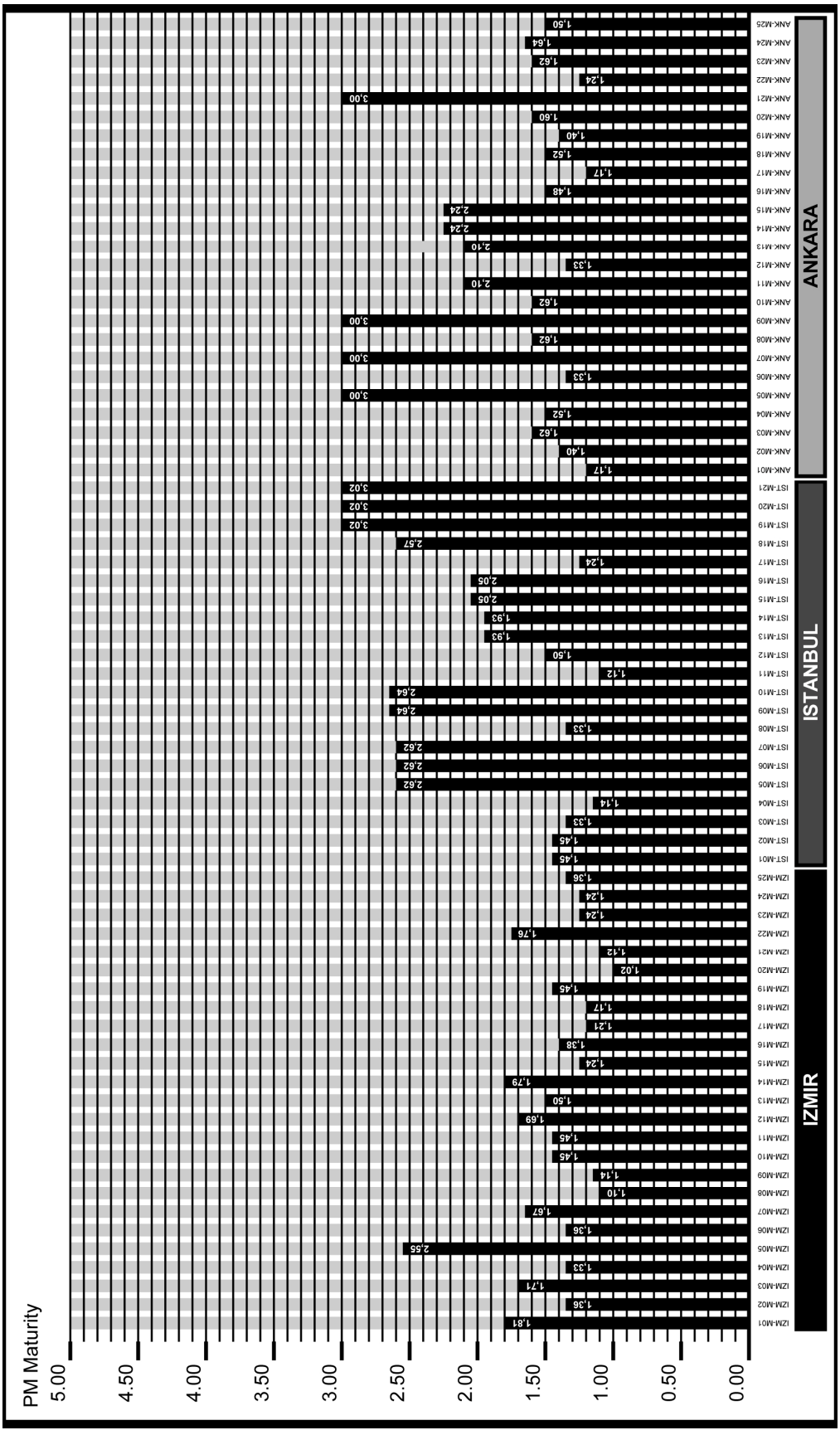


Figure 4.52 – Overall Arch-PMM

4.2. Maturity of Project Management Function Areas

Close investigation of PM Maturity levels presented in Figures 4.01 – 4.52 shows that offices have variety of maturity levels. Order of the maturity levels also shows significant differences between cities. In this section first these differences for 9 PM function areas will be analyzed. Second, Demographical data are interpreted. Third, PM maturity orders for different cities are studied. Finally, significant relations between demographical data and maturity levels are investigated.

The purpose of project integration management is to initiate the project, to coordinate its activities and integrates all efforts into a project management plan, to integrate, analyze and report the project results in carrying out the project management plan, to control the change to the baseline, to collect, integrate and organize project information system, to close the project in an orderly and disciplined system.

Table 4.1.Arch-PMM Functions in order of highest maturity levels

Order	Arch-PMM Function	Mean	Standard Deviation
1	ARCH-PMM Integration Management	2,24	0,75
2	ARCH-PMM Scope Management	2,00	0,64
3	ARCH-PMM Procurement Management	1,88	0,78
4	ARCH-PMM Time Management	1,77	0,64
5	ARCH-PMM Quality Management	1,69	0,61
6	ARCH-PMM Cost Management	1,67	0,53
7	ARCH-PMM Communications Management	1,60	0,80
8	ARCH-PMM Human Resource Management	1,38	0,49
9	ARCH-PMM Risk Management	1,29	0,32
	Overall Arch-PMM	**1,76**	**0,60**

Among the nine function areas, the total average maturity level of the project integration management was the highest (2.26) and it was a way higher than the over all average maturity (1.74) (Table 4.01). This is the case for the all three cities. Istanbul was the highest (2.66), second was Ankara (2.34) and the third was Izmir (1.79). The average score of (2.66) for Istanbul was also the highest and the only function area which reaches to the 3rd Level of the Arch-PMM (Organizational Standardization). It seems that Project Integration Management was highly mature among the other function areas and this result seems to repeat in all three cities. We observe similar results in different research studies also. Grant (2006) states that Project Integration Management has highest maturity level in his study. Supic (2005) also addresses high maturity levels for PM Integration Management in his study (Project Management Maturity of Selected Organizations in Croatia). While analyzing the architectural design offices, we observe that Project Integration Management in fact contains the most crucial stages of the architectural design process. An architectural design office, even it is underdeveloped in the Project Management maturity awareness, at least has to provide an architectural service which has to reach specific stages in starting the project, controlling the project activities, organizing the project information system, completing the project and in the integration of all these. Although building programs are quite different from eachother, in the architectural design service due to its traditional type and structure, these differences are not excessive during the design process compared to other sectors. This might explain the top score for the maturity level of Project Integration Management in architectural design offices. In parallel to this, another additional reason is that due to the similarities of the architectural design processes, especially project repetitions and experience may also be helping the maturity of the architectural design office to achieve a higher increase in the sub-function areas (i.e., Scope Definition, Deliverables Identification,…) of the PM Integration Management compared to the other PM function areas.

On the otherhand, The nature of the architectural design process is very much fragmented. The service of the other parties (i.e., civil engineers, mechanical engineers, electrical engineers, city planners, etc.) are vital for the completion of architectural design of a building. This might also force higher maturity levels for Project Integration Management, since traditionally integration of these resvices are a built-in function for architectural design offices.

Project Scope Management ensures that the project includes all the work required completing the project successfully. Project Scope Management covers sub-functions of Business Requirements Definition, Technical Requirements Definition, Work Breakdown Structure, Scope Change Control.

Traditionaly project scope is defined by the architect with close communication to the customer. Program and quality standards of the building are clearly defined at the very beginning of the architectural design process. Later on, traditional design process itself has stages (sketch drawings, preliminary design, design, shop-drawing etc.) that ensure the scope of the project is achieved. For doing this sub-phases of Project Scope Management are carried out in all phases of the architectural design process. Each of these sub-processes requires revised scope planning appropriate to that level of design detail. Cost estimation and activity and resource definition are also separately revised for each stage. At the final stage (i.e., shop drawings) scope of the project reaches a very clear definition therefore one may also make more accurate cost estimating which also in turn increases the maturity level of Project Scope Management.

The average maturity score of the project scope management (2.01) was the second highest function area among the all nine areas. This score achieved in the all three cities. Istanbul was the highest (2.23), Ankara was the second (2.11) and Izmir was the third (1,70) with a big gap from the other two cities.

Project time management develops and manages the project schedule, to ensure the project complete within the approved time frame, to define the project activities, to execute the schedule, to control the plans during project execution.

Project time management (1,79) was slightly over the total average of the Arch-PMM (1,74). The same order again continued in the all three cities with the highest score in Istanbul (2.11), secondly with Ankara (1.73) and thirdly with Izmir (1.52). In this function area Istanbul seems to be a way away from the other two cities.

Since architectural design projects require contribution and integration of the other design professions schedule development becomes a sine-qua-non. In the traditional setting most of the time sequencing of design activities is very well defined. This makes it easy to develop, control and integrate the schedule of architectural design project. Therefore, architectural design services are matured in Project Time Management.

Project cost management aims to determine the total cost of the project, to ensure the project completes within the approved budget, to estimate the cost of the

identified resources, to involve in developing a project baseline, comparing progress against baseline and controlling costs.

The maturity level of Project cost management was (1.60) slightly below the total average of the nine function areas (1.74) and the third lowest function area among the all nine project magement function areas. The order of the three cities again didn't change for this function area. Again Izmir was the third (1.36) and after Istanbul (1.94) and Ankara (1.74). In this function area the maturity level of Izmir was also one level lower than the other two cities and also one level lower than the average of the all three cities.

Architectural design offices most of the time receives customers with two basic requirements; the rough scope of the building and the budget that they allocate for the building. Therefore, from the beginning of the architectural desing process "the cost" of the building is at the top of the agenda in most of the meetings. Cost estimating, budgeting and control are done simultaneously by both the architect and the customer. This might explain matured levels of Project Cost Management and awareness of cost issues.

Project quality management targets to satisfy the client, to conform the requirements, to ensure the fitness to requirements and to ensure the design is fit for use.

The average maturity level of project quality management (1.70) was slightly below the total average of the nine function areas (1.74). The average of two cities, Istanbul (1,94) and Ankara (1.82) were close to each other and again clearly higher than Izmir (1.36). The project quality management maturity level of Izmir was one level lower than the two cities and the overall of the three cities.

In the 6th edition of PRINCE 2 (2003), it is asserted that the project has an appropriate quality management system, such that it can meet the legal, aesthetic or functional requirements for the project. A quality policy should be developed early in the project.

Customer's needs and requirements define the quality of the building. Architect provides her/his design services around these requirements. Therefore, capturing these requirements, documenting and finding architectural solutions that might match these requirements are vital. These processes basically cover quality planning, assurance and control issues. Since architectural design offices work in a very competitive environment, survival of the office depends on the quality of work conducted. That is why along with Project Integration Management, Project Scope Managemetn, Project

Time Management, Project Cost Management and Project Quality Management ranked at the top 5 fuctions in terms of maturity levels.

Project Human Resource Management identifies the requisite skills required for specific architectural design and management activities, to identify individuals who have those skills, to assign roles and responsibilities, to manage and ensure high productivity of resources and to forecast future resource needs.

The maturity level of the project human resource management (1,42) was the second lowest function area among the nine function areas and one level lower than the overall Arch-PMM Maturity (1.74). This time two cities Izmir (1.14) and Ankara (1.42) were in the lowest maturity level and one level lower than Istanbul (1,63). The total average maturity level of the three cities (1.40) was one level lower than the overall average Arch-PMM maturity level of the all three cities (1.74).

Mainly architectural design offices contain of up to 7 staff. Usually, architectural design offices with this staff structure managed by the company owner architect. All the staff in the office deals with the all current on going projects. Only a few offices have an extra leader who are generally working for the company owner architect for longer periods. These kind of architectural design office's staff deals with every part of the on going projects, some may professionalized in specific areas like 3D-modeling. If the office needs a new staff, the manager ask for the help of the other staff. So, the management of the staff depends on the experience of the office leader or the office owner architect. This might explain the low maturity level of Project Human Resource Management for the architectural design offices.

The purpose of project communications management is to determine the information and communications need af all the project stakeholders. Thomas et al (2003) stated that effective communication is one of the major challenges to a project's success.

The maturity level of project communications magement (1.62) is again slightly lower than the overall average Arch-PMM muturity of the three cities. The maturity order of the three cities again didn't change in this project management function area. Istanbul (2.00) was a way ahead from the other two cities; Ankara (1.52) and Izmir (1.36). Ankara just reaches the 2nd level with only %2 difference.

Project Risk Management aims to identify analyze, respond and control risk factors during the architectural design process, to understand the risk events and to determine the best way to deal with the risks.

Among the nine function areas, the total average maturity level of the project integration management was the lowest (1.30) and it was a way lower than the over all average maturity (1.74). This was also the same in the all three cities. All the three cities achieved their lowest maturity in project risk management. Project Risk Management was the only project function area that all three cities were in 1st level (Initial) of Arch-PMM. Istanbul was the highest (1.43), second was Ankara (1.34) and the third was Izmir (1.13). The average score of (1.13) Izmir was also the lowest level of the Arch-PMM (Initial). It seems that Project Integration Management was highly immature among the other function areas and this result seems to repeat in all three cities.

Grant indicates a similar result (Table 4.01) and state that it was also instructive to note that repeated practices in the project risk management knowledge area art the least mature of all knowledge areas (Grant 2006).

Kwak also asserts the same results for Risk Management and declares that Risk Management's PM Maturity Level was the lowest among all 8 functional management categories. Risk Management was the only Functional Management category where overall PM Maturity rating was below 3. Kwak concludes that companies should put more effort on Risk Management area by affirming the potentiality for substantial improvement (Kwak 1997).

Collofello states that an effective risk management culture involves entire team and is not just limited to management (Collofello 1997).

Architectural design processes are generally similar to each other even the building types are different. The starting of a new project and initial scopes are well defined. Also, the designing process and the main deliverables are clear for the all architects. Additional information like main deliverables, design standards, sample contracts, etc. are prepared by the chamber of architects and physical limitations and legislations are provided by the municupalites or government offices. So, during a architectural design process risks might be accepted and this might be why the maturity of Project Risk Management is lowest among the all 9 PM function areas.

The purpose of project procurement management is to plan all purchases, to plan acquisitions and to plan the contracts.

Among the nine function areas, the total average maturity level of the project procurement management was the third highest (1.90). Two cities reached the 2nd Arch-PMM Level (Planned) with Istanbul (2.27) and Ankara (2.02). Izmir (1.40) was again the most immature.

Dixon states that for many projects, procurement can represent the highest percentage of expenditure. Therefore, all major procurements should be subject to carefull appraisal and management. Dixon states that a procurement strategy should be prepared very early in the project although, recognizes in practice, that such a move is usually driven an external influence, for example, the urgency of the project (Dixon 2000).

Even for a field which has no development in PM awareness like architecture, the overall PM maturity levels show us that actually they are not as low as it is expected.

4.3. Demographical Data

In the third phase, architects were asked to fill a questionnaire. This questionnaire gives demographical information about the architect and his/her architectural design office. The first 10 questions are one parted and last 6 questions are two parted with a total of 16 questions.

In the 1st question, the average yearly turnover of the architects were asked. The answers were varieted between 5 different choices (Figure 4.53).

1. 0 – <120.000 YTL
2. 120.000 – <250.000 YTL.
3. 250.000 – <500.000 YTL.
4. 500.000 – <2.000.000 YTL.
5. over 2.000.000 YTL.

The average yearly turnover of the architects in three cities reflects the aggretation between 500.000 YTL – <2.000.000 YTL with the highest percentage (figure 4.53). When we analyze the answers, the aggregation in Ankara focuses on the last three choice and no one marks the first two choices. The aggregation in Istanbul is on the 4th (%52) and on the 2nd (%24) choices. The average yearly income dramatically drops in Izmir and the aggregation focuses on the 2nd choice (%45).

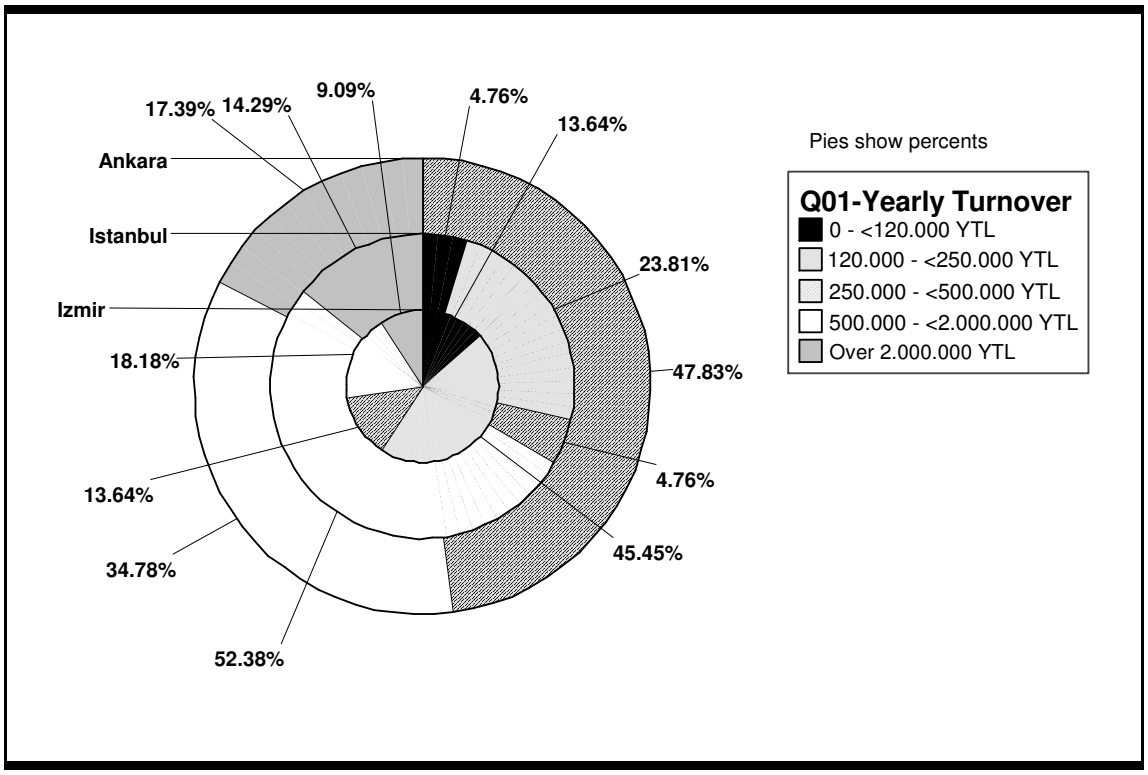


Figure 4.53. Yearly Turnover for all three cities.

This question was asked for to identify the yearly designed areas by the architects. These results give us clear disparities between the three cities. Since none of the architects in Ankara (Figure 4.54) and Istanbul mark the first choice while %24 of the architects in Izmir mark 0 -<20.000 m2 for the yearly designed areas. None of the architects in Izmir design more than 250.000 m2 yearly. However, the architects who design more than 250.000 m2 increases in Istanbul to %24 and in Ankara to %32. Architects who were designing more than 100.000 m2 in Ankara was %44 and in Istanbul was %66 and in Izmir was only %18. It seems that the arhitectural design offices in Izmir design less than from the ones in Ankara and Istanbul.

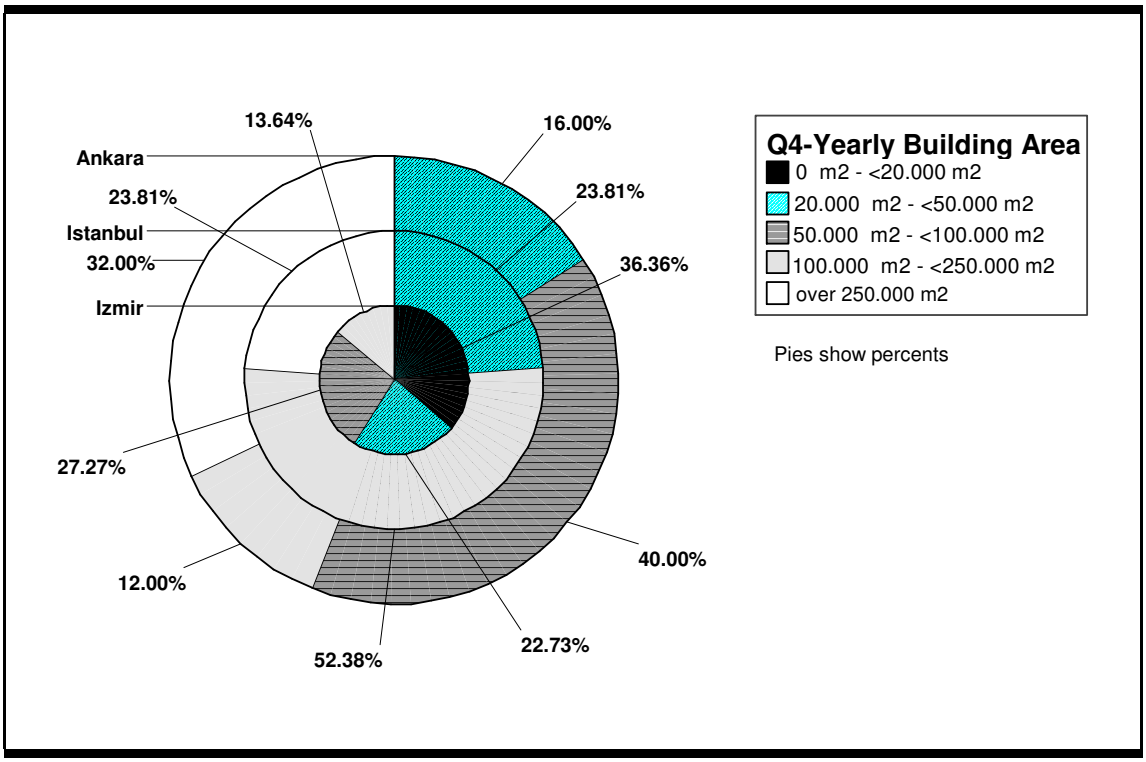


Figure 4.54. Total Area of The Buildings Designed Yearly for the Three Cities.

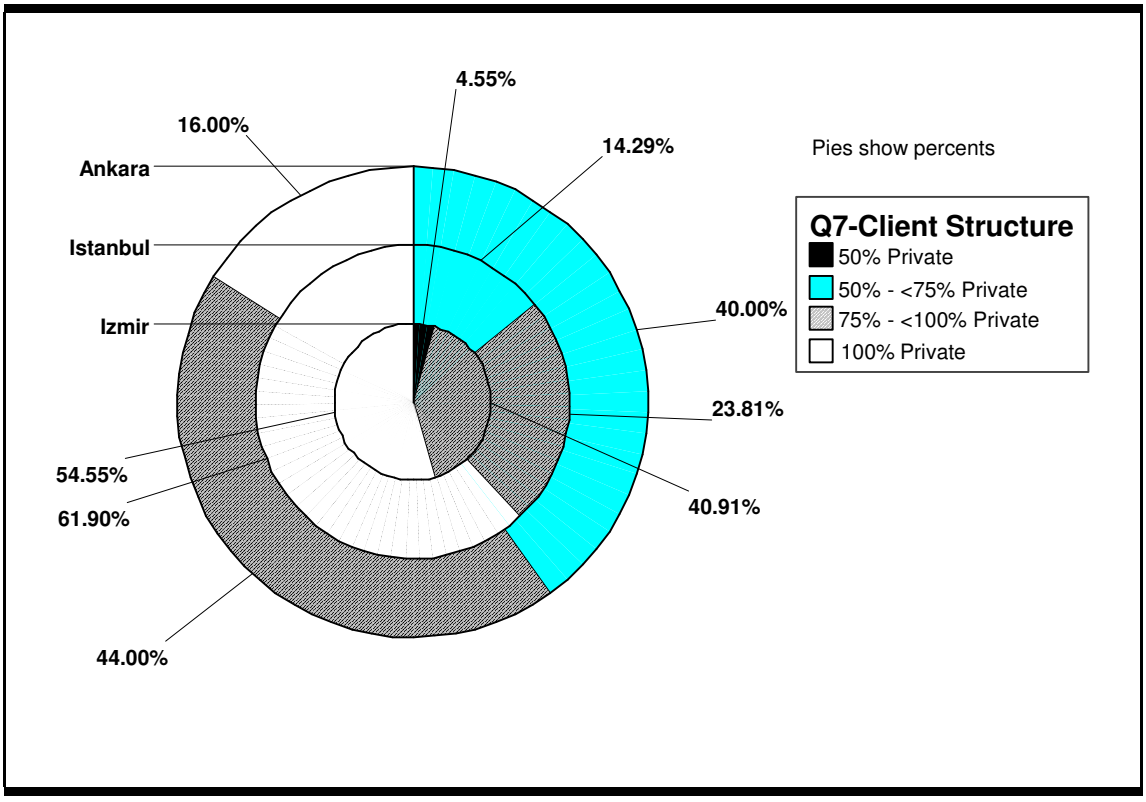


Figure 4.55. Client Structure for the three cities (Government)

The purpose of question 7 was to identify the client structure of the architectural design office. Figure 4.55 shows that all the architectural design offices provide architectural design service for the private sector. None of the architectural design office provide service only for the government. However, 39% of the offices only work for the private sector. 98% off all the architectural design office provide over 50% of their services for the private sector.

Figures 4.55 shows there are some significant differences between the cities. In the figure we see that 62% of the architects in Istanbul only works for the private sector. On the other hand, this percentage reduces to 16% in Ankara since being closer to the govenment office in the capital city (Ankara) might be the reason for this figure.

Except only one architectural design office in Izmir, all the participants (98,6%) to this study use a CAD software and 80% of all the architects use 3D Modelling Software in their offices. However, only 3% of the architects use a Project Management Software and again only 3% of the architects use a Payroll software. None of the architectural design office use a Enterprise Resource Planning Software.

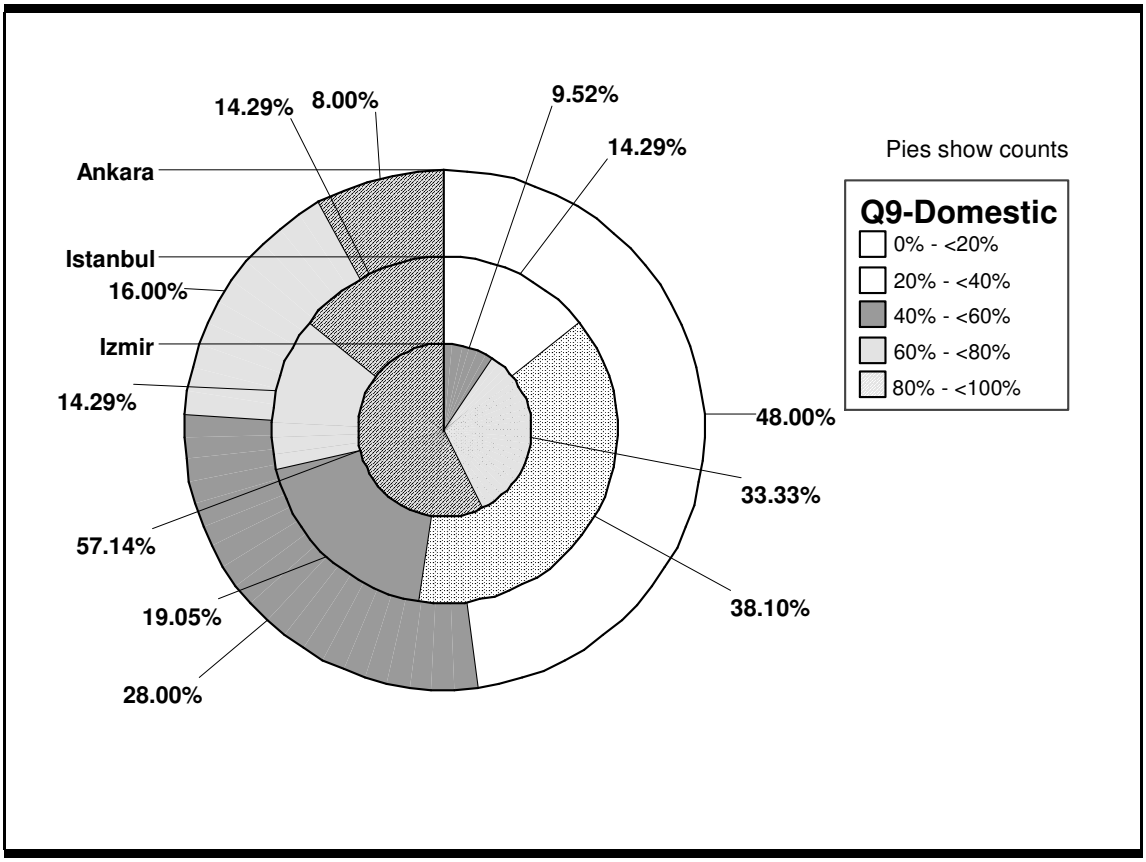


Figure 4.56. Domestic - Area of activity of the architects for the all three cities.

Figure 4.56 show that 56% of all architectural designs of the architectural design offices are realize in the domestice zone and the rest of their services are equally in national and international area. This 22% international architectural design percentage might be a proof in the increase of international services in Turkey. This criteria for Ankara even reaches to 35%. Figure 4.59 with a 2% of international architectural designs done by the architects in Izmir which is a significant difference from the other two cities. In the same figure, it seen that the domestic architectural design services reaches up to 81%.

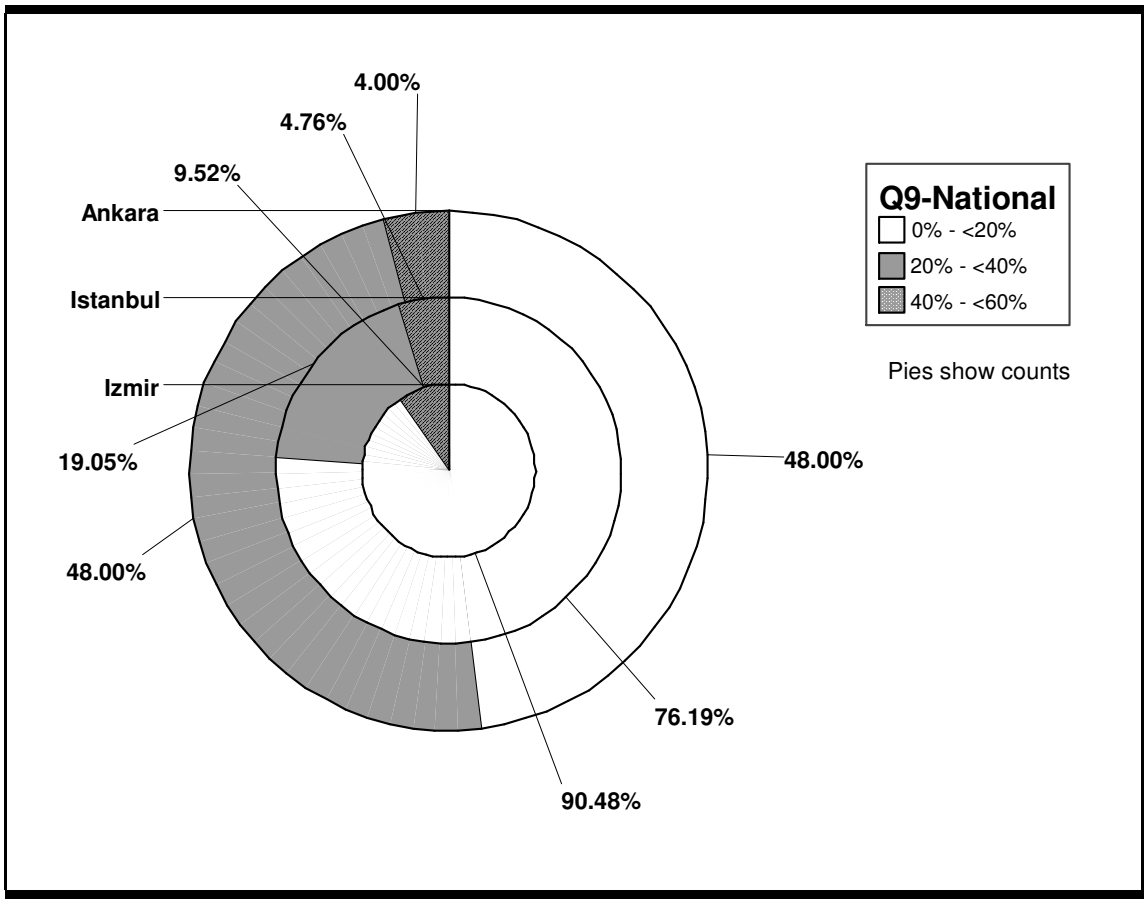


Figure 4.57. National - Area of activity of the architects for the all three cities.

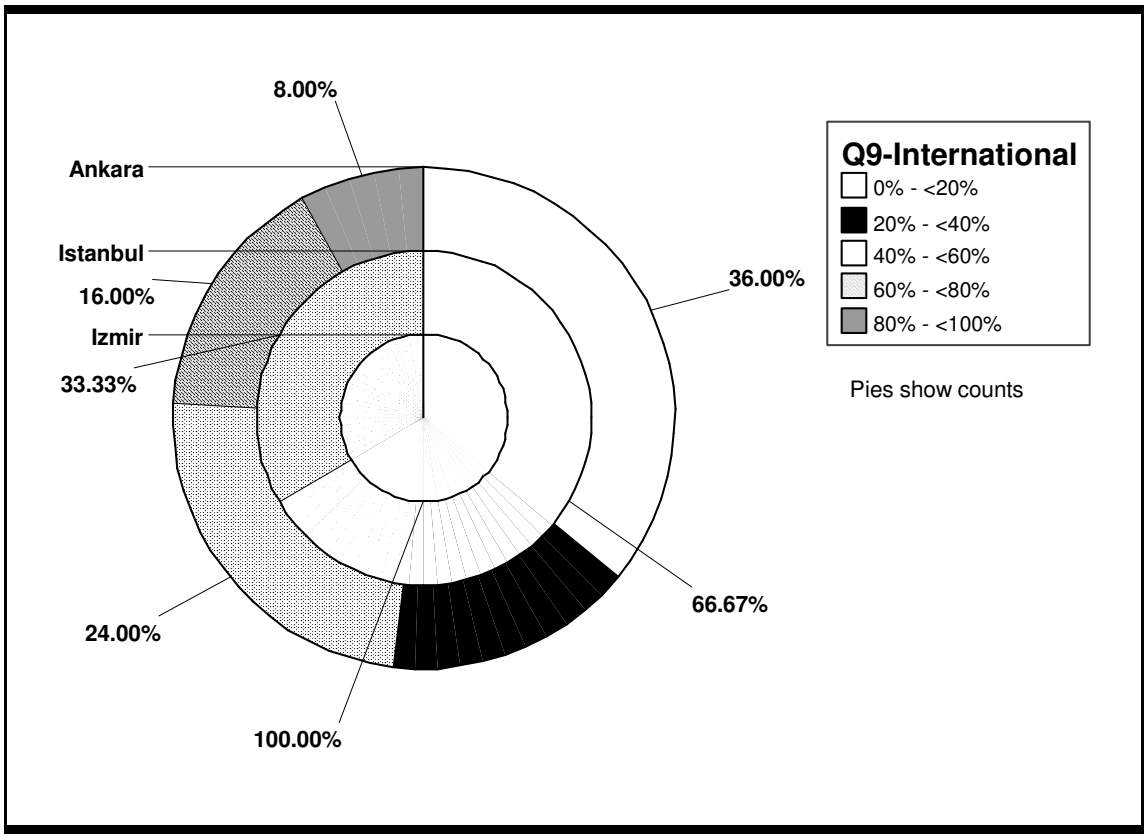


Figure 4.58. International - Area of activity of the architects for the all three cities.

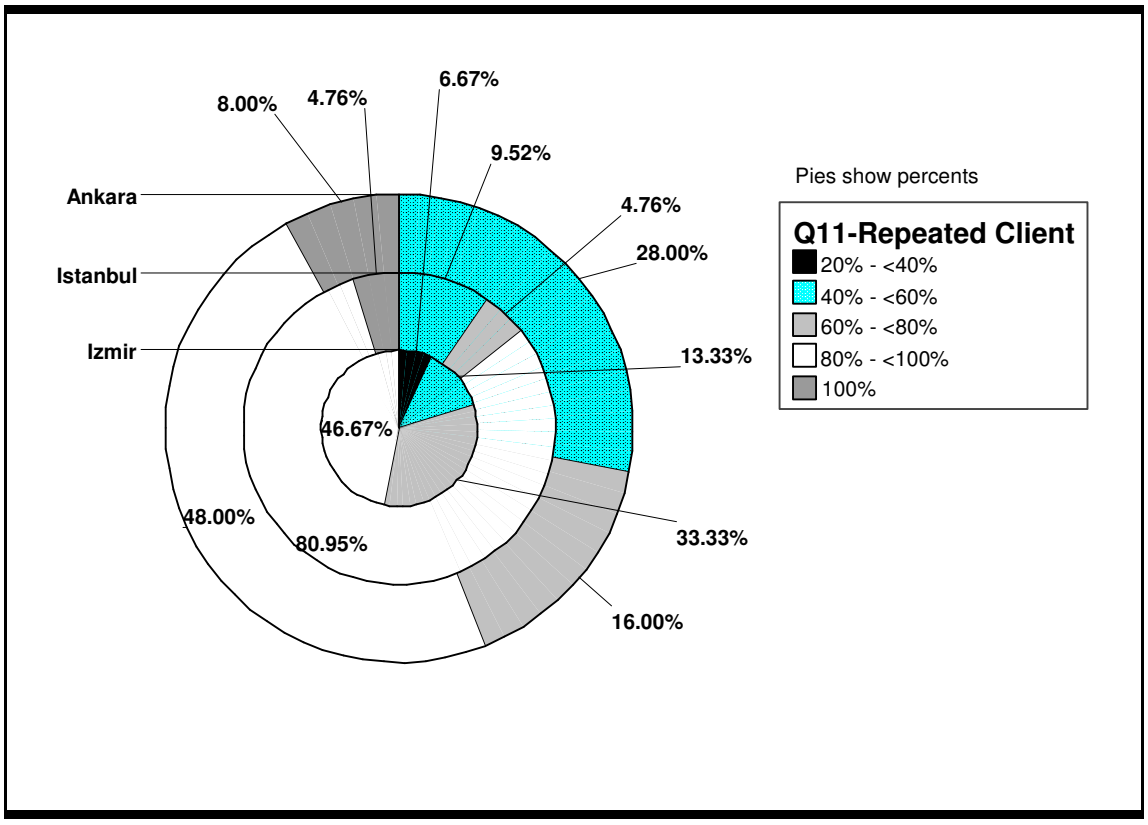


Figure 4.59. Repeated Clients of the architects in three cities.

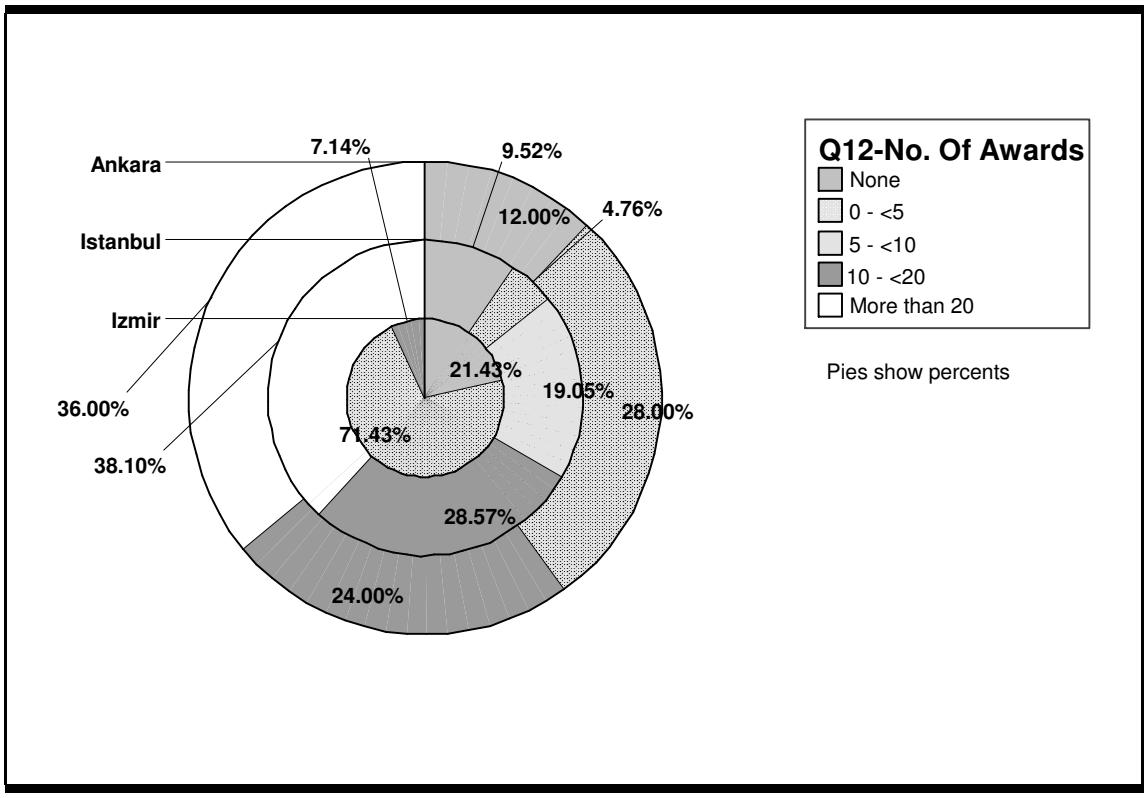


Figure 4.60. Number of awards in three cities

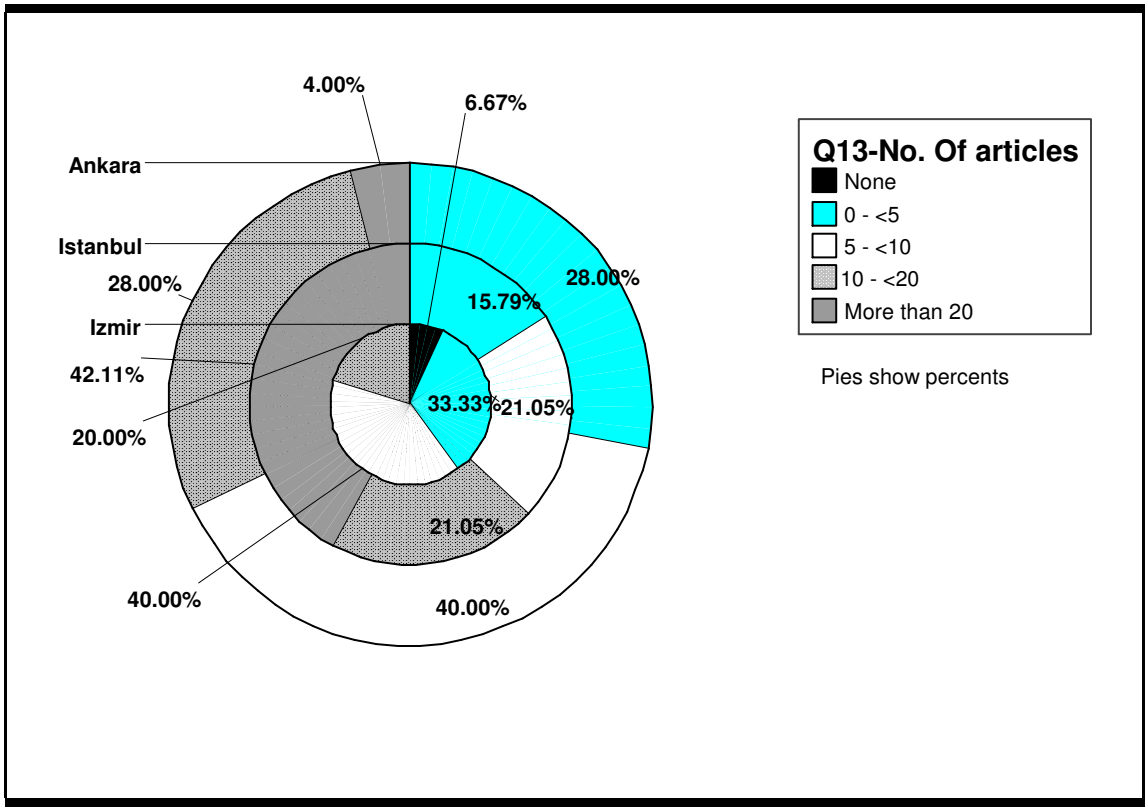


Figure 4.61. Number of published articles in three cities.

61% of the architects claim that 80% of their clients come back to their office for a new project and 92% of the architects believe this criteria is important or very important.

The ratio of the repeated clients is highest in Istanbul. 85% of the clients work with the same architect 80% or over (Figure 4.59). This ratio reduces to 56% in Ankara and 55% in Izmir.

Figure 4.60 indicates that 88% of the architects won an award and 53% of them have at least 10 awards. On the other hand, 12% of the architects have no awards. Architects who have more than 20 awards in Ankara reaches up to 36% and in Istanbul reaches up to 37% but none of the architects in Izmir have more than 20 awards and 91% of the architects in Izmir have no awards or less than 5.

All of the architects at least one or more published articles about their designs. 17% of the architects have more than 50 published articles. 63% of the architects in Istanbul have more than 16 published articles. In Ankara, this ratio reduces to 32% an it is only 10% for Izmir (Figure 4.59). It seems that the architects in Istanbul have more publishes articles on their architectural design works.

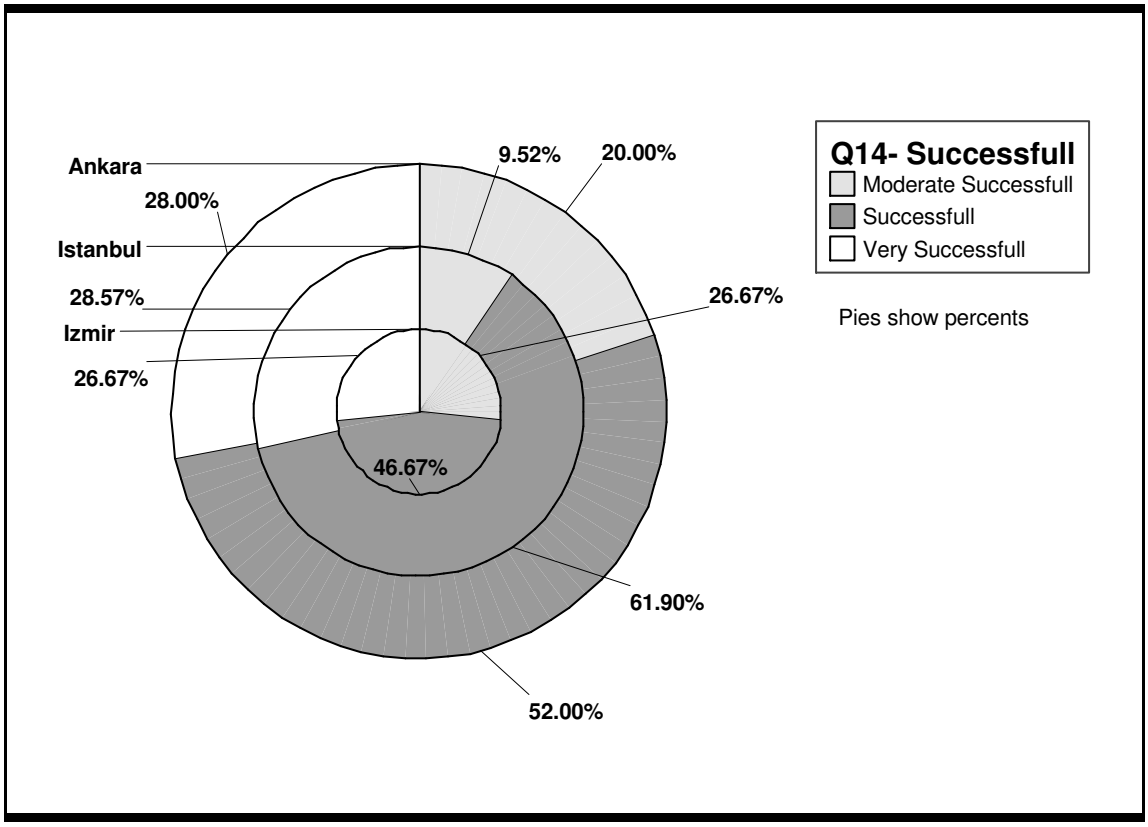


Figure 4.62. Self rating in three cities.

72% of the architects find themselves successful according to their competatives and none of the architects believe that they are not successful. Also 75% of the architects claim that this criteria is important or very important. There are no significant differences between the three cities on this criteria.

Only 26% of the architects believe that their profitability is high agains the other architectural design offices (Figure 4.63). 74% of the architects claim that their profitability do not satisfy them. 68% of the architects in Ankara are not satisfied with their profitability, this ratio increases to 81% in Istanbul. 43% of the architects in Istanbul believe that their profitability is low but in Izmir this ratio reduces to 27%.

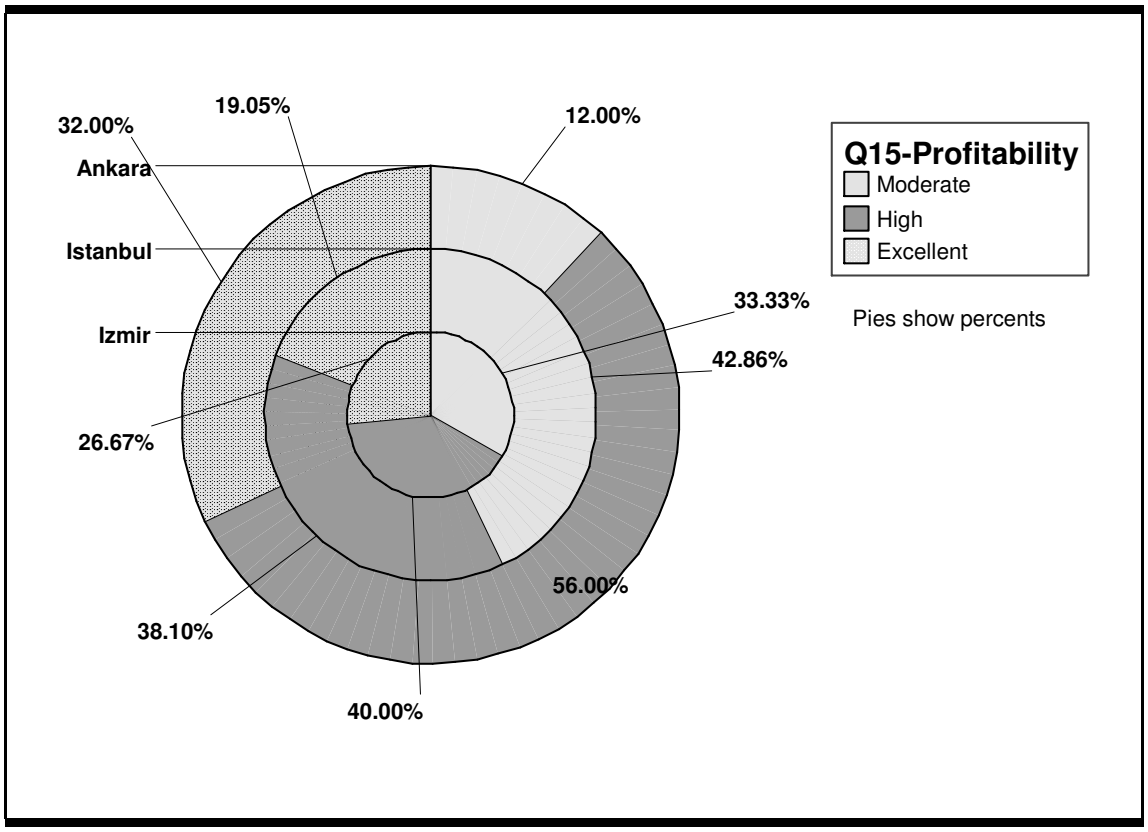


Figure 4.63. Profitability in three cities

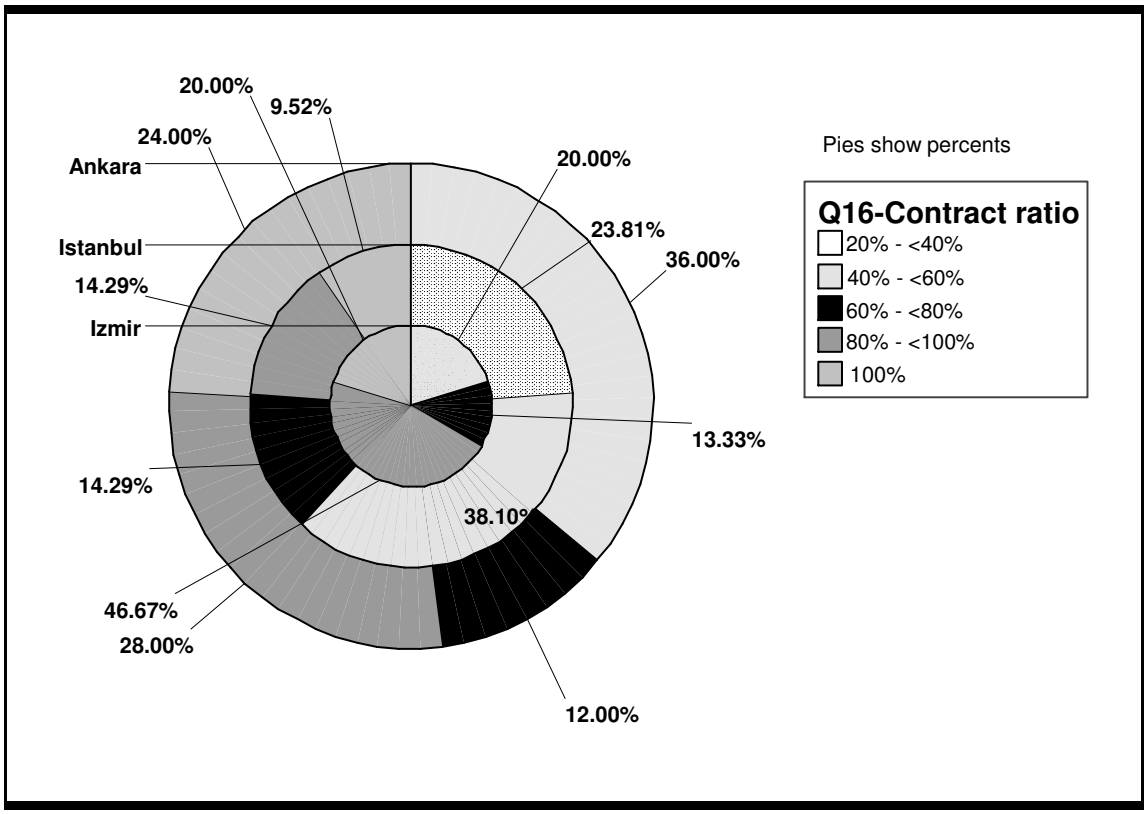


Figure 4.64. Biddings resulting with a contract – all three cities

Only 26% of the architects believe that their profitability is high agains the other architectural design offices (Figure 4.63). 74% of the architects claim that their profitability do not satisfy them.

The main staff structure of the architectural design offices is composed of 4-6 staff with a ratio of 41% (Figure 4.65). Second common staff composition is the architectural design offices with 7-11 staff. Third common one is 15% of the architectural design offices have 16 or more staff. Staff strcuture of the architectural design offices differ in three cities. 32% of the architectural design offices in Ankara have 11 or more staff. While this ratio was 28% in Ankara, there are no offices in Izmir composing of 11 or more staff.

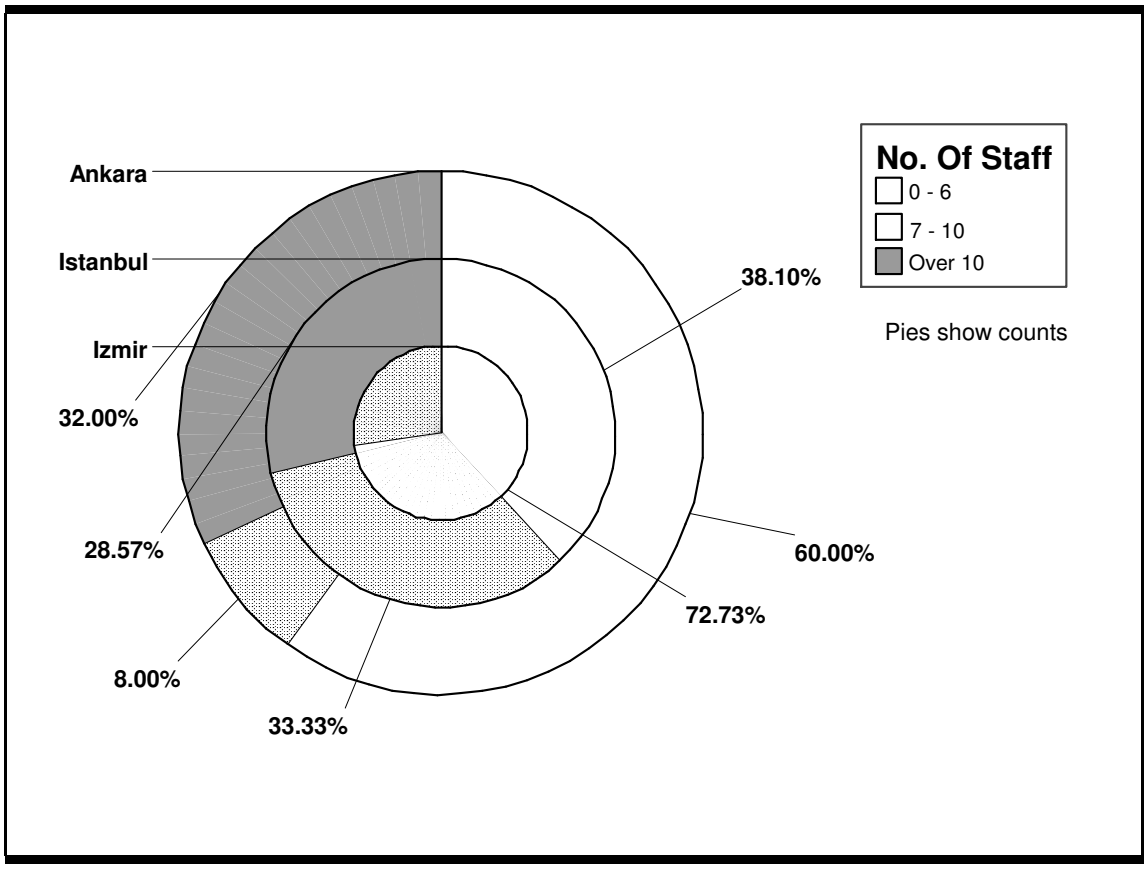


Figure 4.65. Number of staff

4.4. PM Funtional Maturity Levels for Izmir, Istanbul and Ankara

The Arch-PMM semi structured servey has been applied to the architects in Izmir, Istanbul and Ankara. After the PM Maturity levels of these architectural design offices in these three different cities have been assessed, these offices have been split to three seperate groups according to the cities they were located. Afterwards, according to the cities, the PM Maturity averages of sub-functions have been calculated in a format that would show each sub-function levels of 9 different PM fuction area. Table 4.02 shows the average and Standard deviation of the Arch-PMM sub-function areas of the architecural design offices.

When Table 4.02 is examined in terms of Izmir, we spot that the most matured Arch-PMM sub-function is Work Breakdown Structure. While the Work Breakdown Structure is inside the 10 most matured Arch-PMM sub-functions in Istanbul and Ankara, it could not reach the first rank as in Izmir.

During the initiation of an architectural design process the main deliverables like architectural drawings (site plans, sections, elevations, plans, material list, etc.) are quite clear for the architectural design offices. These drawings even at the minimum level, are accepted by all architects as project deliverables. In this case site plans, plans, sections, elevations, etc are default deliverables for architectural design project. This might explain why architectural design offices' maturity level on forming a Work Breakdown Structure is higher then the other areas. It may be observed that an architectural office might reach the 3rd level of maturity for Work Breakdown Structure. Maturity level for Work Breakdown Structure is observed to be in 1st, 5th, 6th order respectively in Izmir, Istanbul and Ankara. The average maturity levels in Izmir are the lowest among these cities. Because offices in Izmir are less aware of project management concepts, their idea of project management mostly relies on basic concepts such as Work Breakdown Structure. Also international and national design projects are seen more frequently in the offices at Ankara and Istanbul. This might increase their awareness for professional PM practice.

Table 4.2.Average and Standard Deviation of the Arch-PMM Sub-function areas

	İZMİR	Avr.	Std.Dev.		İSTANBUL	Avr.	Std.Dev.		ANKARA	Avr.	Std.Dev.
11	Q11 - Work Breakdown Structure	2,24	0,44	2	Q02 - Deliverables Identification	2,86	0,73	2	Q02 - Deliverables Identification	2,56	0,77
1	Q01 - Scope Definition	1,96	0,68	4	Q04 - Project Management Plan Execution	2,86	1,01	3	Q03 - Project Management Plan Development	2,48	0,77
7	Q07 - Project Information System	1,96	0,45	5	Q05 - Change Control	2,71	1,01	12	Q12 - Scope Change Cotrol	2,40	1,00
2	Q02 - Deliverables Identification	1,92	0,49	7	Q07 - Project Information System	2,67	0,73	1	Q01 - Scope Definition	2,32	0,48
3	Q03 - Project Management Plan Development	1,92	0,40	11	Q11 - Work Breakdown Structure	2,62	0,50	6	Q06 - Project Closure	2,32	0,85
8	Q08 - Scope Planning and Management	1,92	0,57	1	Q01 - Scope Definition	2,57	0,60	11	Q11 - Work Breakdown Structure	2,32	0,48
13	Q13 - Activity and Resource Definition	1,88	0,33	3	Q03 - Project Management Plan Development	2,52	0,81	4	Q04 - Project Management Plan Execution	2,28	0,89
18	Q18 - Cost Estimating	1,88	0,53	8	Q08 - Scope Planning and Management	2,48	0,87	7	Q07 - Project Information System	2,24	0,83
5	Q05 - Change Control	1,68	0,85	6	Q06 - Project Closure	2,43	0,93	13	Q13 - Activity and Resource Definition	2,24	0,60
15	Q15 - Schedule Development	1,68	0,56	13	Q13 - Activity and Resource Definition	2,38	0,59	5	Q05 - Change Control	2,20	0,96
22	Q22 - Quality Planning	1,64	0,57	18	Q18 - Cost Estimating	2,38	0,59	8	Q08 - Scope Planning and Management	2,16	0,90
4	Q04 - Project Management Plan Execution	1,56	0,82	40	Q40 - Requistion	2,38	0,86	18	Q18 - Cost Estimating	2,16	0,37
31	Q31 - Information Distribution	1,56	0,71	41	Q41 - Solicitation / Source Control	2,38	0,86	39	Q39 - Procurement Planning	2,12	0,93
6	Q06 - Project Closure	1,52	0,65	12	Q12 - Scope Change Cotrol	2,29	1,06	41	Q41 - Solicitation / Source Control	2,12	0,73
40	Q40 - Requistion	1,52	0,59	19	Q19 - Cost Budgeting	2,24	0,77	19	Q19 - Cost Budgeting	2,08	0,49
12	Q12 - Scope Change Cotrol	1,48	0,59	42	Q42 - Contanct Management / Closure	2,24	1,09	40	Q40 - Requistion	2,04	0,68
10	Q10 - Technical Requirements Definition	1,44	0,51	22	Q22 - Quality Planning	2,19	0,81	22	Q22 - Quality Planning	1,96	0,61
16	Q16 - Schedule Control	1,44	0,58	31	Q31 - Information Distribution	2,19	1,12	10	Q10 - Technical Requirements Definition	1,88	0,67
9	Q09 - Bussiness Requirements Definition	1,40	0,50	15	Q15 - Schedule Development	2,14	0,85	25	Q25 - Management Oversight	1,88	0,78
41	Q41 - Solicitation / Source Control	1,40	0,58	16	Q16 - Schedule Control	2,14	0,79	9	Q09 - Bussiness Requirements Definition	1,80	0,71
19	Q19 - Cost Budgeting	1,36	0,49	24	Q24 - Quality Control	2,14	0,85	16	Q16 - Schedule Control	1,80	0,71
24	Q24 - Quality Control	1,36	0,49	39	Q39 - Procurement Planning	2,10	1,09	24	Q24 - Quality Control	1,80	0,82
29	Q29 - Professional Development	1,36	0,49	17	Q17 - Schedule Integration	2,05	0,86	42	Q42 - Contanct Management / Closure	1,80	0,71
33	Q33 - Issues Tracking and Management	1,36	0,57	33	Q33 - Issues Tracking and Management	2,05	0,92	29	Q29 - Professional Development	1,72	0,74
39	Q39 - Procurement Planning	1,36	0,57	10	Q10 - Technical Requirements Definition	2,00	0,71	17	Q17 - Schedule Integration	1,64	0,76
14	Q14 - Activity Sequencing	1,32	0,56	29	Q29 - Professional Development	2,00	0,71	23	Q23 - Quality Assurance	1,64	0,49
42	Q42 - Contanct Management / Closure	1,32	0,56	25	Q25 - Management Oversight	1,90	0,83	31	Q31 - Information Distribution	1,64	1,11
17	Q17 - Schedule Integration	1,28	0,54	30	Q30 - Communications Planning	1,90	0,83	37	Q37 - Risk Control	1,64	0,49
30	Q30 - Communications Planning	1,28	0,54	14	Q14 - Activity Sequencing	1,86	0,79	14	Q14 - Activity Sequencing	1,48	0,77
37	Q37 - Risk Control	1,28	0,46	32	Q32 - Performance Reporting	1,86	0,91	15	Q15 - Schedule Development	1,48	0,77
21	Q21 - Cost Control	1,20	0,41	9	Q09 - Bussiness Requirements Definition	1,76	0,70	21	Q21 - Cost Control	1,48	0,77
23	Q23 - Quality Assurance	1,20	0,41	21	Q21 - Cost Control	1,76	0,83	27	Q27 - Staff Acquistion	1,48	0,77
25	Q25 - Management Oversight	1,20	0,41	37	Q37 - Risk Control	1,71	0,46	30	Q30 - Communications Planning	1,48	0,77
32	Q32 - Performance Reporting	1,20	0,50	28	Q28 - Develop and Manage Project Team	1,62	0,50	32	Q32 - Performance Reporting	1,48	0,77
36	Q36 - Risk Response Development	1,20	0,41	27	Q27 - Staff Acquistion	1,57	0,75	33	Q33 - Issues Tracking and Management	1,48	0,77
28	Q28 - Develop and Manage Project Team	1,12	0,33	23	Q23 - Quality Assurance	1,52	0,51	35	Q35 - Risk Quantification	1,40	0,50
35	Q35 - Risk Quantification	1,08	0,28	35	Q35 - Risk Quantification	1,52	0,51	28	Q28 - Develop and Manage Project Team	1,32	0,48
38	Q38 - Risk Documentation	1,08	0,28	36	Q36 - Risk Response Development	1,52	0,51	36	Q36 - Risk Response Development	1,32	0,48
26	Q26 - Human Resource Planning	1,04	0,20	20	Q20 - Performance Measurement	1,38	0,50	38	Q38 - Risk Documentation	1,32	0,48
27	Q27 - Staff Acquistion	1,04	0,20	38	Q38 - Risk Documentation	1,38	0,50	20	Q20 - Performance Measurement	1,24	0,44
20	Q20 - Performance Measurement	1,00	0,00	26	Q26 - Human Resource Planning	1,33	0,48	26	Q26 - Human Resource Planning	1,16	0,37
34	Q34 - Risk Identification	1,00	0,00	34	Q34 - Risk Identification	1,00	0,00	34	Q34 - Risk Identification	1,00	0,00

The standard deviation of the Scope Definition shows the minimum difference among the most matured top ten items of each city. Scope Definition in Izmir is (0,68), (0,60) in Istanbul and (0,48) in Ankara. We might say that the issue of Scope Definition also shows similarities with Work Breakdown Structure. In an architectural design office offering architectural design service, it is natural that the Scope Definition part has reached a certain maturity level. Because of being obliged to use the contract prepared by the chamber of architects and due to the main items defined by the contract, it is expected to see the initiation and scope definition is mature up to a certain level. Again this might be why the maturity of the Scope Definition function is higher even in the offices that are immature in other function of PM. The Scope Definition concept is ranked 4th in Ankara, 6th in Istanbul, and 2nd in Izmir as one of the most matured subject. As mentioned above, again parallel to comments about the Work Breakdown Structure, in Izmir where the overall maturity average is lower than the other two cities, the Scope Definition ranks higher than Ankara and Istanbul. Other function areas apart from areas like Scope Definition and Work Breakdown Structure could be considered as potential development areas for operating in Izmir.

According to Wysocki Work Breakdown Structure is very vital for the process improvement so he adds that the usage of high-level Work Breakdown Structure, all of the suggested improvement initiatives can be prioritized (Wysocki 2004).

Scope Definition also shows similarities with Work Breakdown Structure according to the Standard deviation values. In the three cities, the Standard deviation value is not very high and there seems to be a consistency among the three.

From the answers obtained, it is observed that most of the architectural design offices nowadays started to use a CAD program and draw their designs utilizing them. The other stakeholders' (civil engineers, mechanical engineering, electric engineers, municipalities, city planners, contractors, consultancy companies, etc.) of the design process also using the common CAD programs. This kind of structure in the design process both accelerates and eases the design process. We observe that the architectural design offices and the other stakeholders they are working with, as a result of this cooperation, eased up the information flow among them. The development of a common digital design system among the offices might be the outcome of CAD systems might also help the integration of the information system among the stakeholders of the building design process. Therefore, the Project Information System ranks 8th in Ankara, 4th in Istanbul and 3rd in Izmir.

Deliverables Identification is highly related to Work Breakdown Structure. In order to achieve a certain level of PM maturity for the Deliverables Identification, the Work Breakdown Structure also has to be matured at a certain level. As mentioned earlier, it is observed that the Work Breakdown Structure subject has reached a certain level in architectural designs offices. As a result of this, among the three cities, the maturity level of the Deliverables Identification is within the most matured top ten function. However, in architectural design offices that do more business, have more staff and design more complex buildings it might be expected to get more detailed deliverables to be submitted to the client at the end of the design process. This might be why the Deliverables Identification is (2,86) in Istanbul, (2,56) in Ankara while it is (1,92) in Izmir. With these values the Deliverables Identification ranks 4th in Izmir, and 1st in Ankara and Istanbul. However, while the average PM maturity levels of the design offices in Ankara and Istanbul are greater than Izmir, it might be explained with the Standard deviation of the Deliverables Identification in Ankara and Istanbul being higher than in Izmir. The Standard deviation value of the Deliverables Identification subject is (0,48) in Izmir, (0,73) in Istanbul, (0,77) in Ankara. The more business an architectural design office conducts, the more experience it gets. This experience makes deliverables very clear at the beginning of the project.

Wysocki points that correct and complete activity definition is what generates an accurate Work Breakdown Structure. All time and cost estimates and scheduling is dependent upon a correct Work Breakdown Structure. Without that the project is certain to fail (Wysocki 2004),

As a matter of fact when the PM maturity level averages of the three cities are analyzed, maturity levels of offices in Ankara and Istanbul are both higher and diverse than offices in Izmir. Meanwhile, in all three cities the lowest maturity is (1,00The highest maturities are observed as (2,24) with Work Breakdown Structure, (2,86) and (2,56) with Deliverables Identification order respectively Izmir, Istanbul and Ankara. This might be the reason why the Standard deviation values are higher in Ankara and Istanbul and the values are lower in Izmir. The average Standard deviation values are as follows: Izmir (0,48), Ankara (0,68), Istanbul (0,75). So we may say that there is a stronger correlation in PM maturity levels of the architectural design offices in Izmir compared to the ones in Ankara and Istanbul.

When Figure 4.12 and Table 4.02 are examined together interesting values are encountered related to the Project Scope Management-Scope Change control. While the

Scope Change Control is the 3rd most developed Arch-PMM sub-function area for Ankara, it is seen only as the 12th in Izmir and Istanbul. The average of Scope Change Control for Izmir, Istanbul and Ankara are respectively (1,48), (2,29) and (2,40). Among the architectural design offices, rather different maturity levels are determined for Scope Change Control. Particularly, this difference between cities can be observed more easily.

Ankara is the capital city of Turkey. So, as all the state offices are in the capital city, it is natural that the biddings are also conducted from the same place. In order to keep their close relations actively with the state offices, most construction companies established their head offices in Ankara. While the state offices and the main construction companies are in Ankara, they are willing to chose and architectural design office which is also established in Ankara in order to cooperate easily. When the Figure 4.55 is studied, it is seen that architectural design firms in Ankara conducts more govenmental projects. This might be why the architectural design offices in Ankara have higher maturity levels for Scope Change Control.

In this study, similar findings that Grant has highlighted are derived. It is noticed that in terms of the Scope Change Control Ankara followed by Istanbul notably have significant differences than Izmir. As the architectural design offices in Ankara and Istanbul reach to level 3 and even level 4, all offices in Izmir except one are at level 1 and some are at the level 2. The most considerable reason in reaching level 2 for these offices is the necessity to pay extra attention to larger and more visible projects.

Grant indicates similar results and states that 40% of the respondents reported level 3 maturity or higher and remainings are level 2 or below. Grant also adds that the level 3 organizations rely upon a formal scope change control system and documented and repeatable processes for reporting and analyzing scope changes. Level 2 or below organizations have defined and documented a change control process and this process is followed for the larger, more visible projects (Grant 2006).

PM Plan Development can be seen in the PM maturity levels of each of the three cities ranking in the top ten. The average for the architectural design offices in Istanbul is (2,52) , (2,48) for the ones in Ankara and (1,92) for Izmir. The ranking in Istanbul is 8^{th}, 2^{nd} in Ankara, and 5^{th} in Izmir, the averages for the Ankara and Istanbul are quite close to each other. This might show that the PM Plan Development maturity levels of the architectural design offices in Istanbul and Ankara could be considered at the same level.

When the most matured top ten levels of each three cities are examined, even though their ranking differences, it is seen that 90% of the top ten is the same. This may be accepted as an indicator that shows in general the same items are mature at the same proportions even though the three cities have differences among their average values.

In the same table when the least matured 10 items are examined, as it is in top 10, Similar results can be found. Among the three cities, the most immature function is observed as the Risk Identification. In each of the three cities the PM maturity level is (1,00) and the Standard deviation is (0,00). This indicates that the results are totally correlated. It is observed that the Project Risk Management is the least matured item among the three cities followed by the Human Resource Management.

Analyzing the table, it is observed that in all of the architectural design offices in the three cities, the Project Risk Management and the Project Human Resource Management have been neglected as PM functions. In other words, these two PM function areas might be the potential development areas of the architectural design offices.

When the number of staff working in an architectural design office and the PM maturity levels are analyzed together, interesting results are obtained. Referring to the PM maturity averages of the three cities, Istanbul has the highest rate with (2,02) followed by Ankara with (1,78) and Izmir with (1,41). Table 4.03 shows that average number of staff working in architectural design offices differ for each city. For example in Istanbul 34% of the offices employ between 7-11 staff while in Ankara only 8% of the offices employ between 7-11 staff. Offices employing more than 11 staff are 28% and 32% respectively in offices in Istanbul and Ankara. However in Izmir there are no offices employing 11 or more staff.

The highest averages in Istanbul are (2,88). The number of staff working in these architects offices are 17, which also indicates the office having the most staff. For the sake of anlysis architectural offices are grouped in two. First group consists of architectural design offices which employ 1-6 staff member. Second group consists of architectural design offices which employ 7 or more staff members.

The architects having a staff of 10 in their offices with a PM maturity of (2,62) follow the (2,98) group. None of the offices with a number of less than 7 staff achieve the PM maturity average of (2,00). The highest PM maturity level of (1,46) for this group belongs to IST-M12. 6 people works in this office.

The architects who have the highest PM maturity level with the number of 27 staff are ANK-M05, ANK-M07, ANK-M09 and ANK-M21. The architect with the highest PM maturity level of (2,52) in Izmir is IZM-M05 with a staff number of 9. At the same time this office has the most staff in Izmir.

All of the offices in all three cities which have the most staff also have the highest level of PM maturity of the city they are located. Again when the averages of the three cities are examined; the average of the offices in Ankara with a staff number of 7 or more is (2,35), (2,48) in Istanbul and (1,71) in Izmir. When the offices with less than 7 staff examined the level is (1,41) in Ankara, (1,28) in Istanbul and (1,33) in Izmir.

According to McBride, organizational size are juged largely on the number of personnel and McBride further indicates that it was readily evident that there was a strong correlation between organization size and system theory based project management capability, and between organization process maturity and system theory based project management capability but weaker evidence of a correlation between project size and a system theory based project management capability. McBride also adds that PM activities are highly correlated to both organization size and organizational process maturity (McBride 2004).

Table 4.3. Significant Correlations Between Variables.

No.	Variables	Correlation Coefficient (r)
1	Overall Arch-PMM - Arch-PMM Integration Management	0,97
2	Overall Arch-PMM - Arch-PMM Scope Management	0,96
3	Overall Arch-PMM - Arch-PMM Time Management	0,97
4	Overall Arch-PMM - Arch-PMM Cost Management	0,94
5	Overall Arch-PMM - Arch-PMM Quality Management	0,93
6	Overall Arch-PMM - Arch-PMM Human Resource Management	0,97
7	Overall Arch-PMM - Arch-PMM Communications Management	0,96
8	Overall Arch-PMM - Arch-PMM Risk Management	0,93
9	Overall Arch-PMM - Arch-PMM Procurement Management	0,96
10	Overall Arch-PMM - Number of Staff	0,80
11	Overall Arch-PMM - Yearly Turnover	0,73
12	Overall Arch-PMM - Yearly Building Area	0,59
13	Overall Arch-PMM - Payroll Software Utilization	0,65
14	Overall Arch-PMM - Domestic Area Activity	-0,53
15	Overall Arch-PMM - International Area Activity	0,35
16	Overall Arch-PMM - Providing Contracting Services	-0,28
17	Arch-PMM Risk Management - Domestic Area Actvity	-0,57
18	Arch-PMM Risk Management - International Area Activity	0,45
19	Number of Staff - Yearly Turnover	0,57
20	Yearly Turnover - Yearly Building Area	0,67
21	Number of Staff - Payroll Software Utilization	0,74
22	Number of Staff - Accounting Software Utilization	0,46
23	Arch-PMM Human Resource Management - Payrol Software Utilization	0,70

Table 4.3. demonstrates the PM maturity levels of the architectural design offices and the correlation of demographic data of these offices. Table 4.3. indicates that

there may be different levels of correlations between the variables. These correlations can be observed at strong, moderate and low levels. For example we may assert that there is a strong relation between overall ARCH-PMML and PM Fuction Areas. The correlation values between them varies form 0,927 to 0,973. We may perform the similar observations between the PM fuction areas and the Number of Staff and also between PM fuction areas and the Yearly Turnover.

It is perceived that the strongest relation is between the PM Integration Management (r=0,973) and the Overall Arch-PMML. This relation is respectively followed by Project Human Resource Management and Project Time Management. This high relation level can be observed in other PM function areas.

Correlation between Overall Arch-PMM and 9 PM function areas is naturally expected, since averages of these very 9 PM function areas form the Overall Arch-PMM. However, the strong correlation between each of the 9 PM function is an other issue. This might show that maturity of PM functions are closely interdependent to each other. One may find it easy to guess maturity levels of all other PM function areas by just looking at a few of them. Another explanation could be that PM maturity levels are improving cooperatively together. If you want to improve one PM function area it is better for you to work on the others also. Kwak 1997, Hillson 2001 and Voivedich 2001 also describes the improvement of PM Maturity by parallel findings.

The high levels of correlation between the entire PM Function Areas and their correlation between the Overall Arch-PMML in fact states how the architectural design offices have a strong relation between each other regarding the PM function areas that are evaluated during the assessment of PM maturity levels and their sub function areas.

High correlation values between the number of staff and all PM function areas also can be observed between yearly turnover, yearly building area, payroll software and accounting software utilization and international activity areas.

For example, the relation between the number of staff and yearly turnover may be the indication of an increase in yearly turnover as the number of staff increase in an architectural design office.

It is interesting to observe a relation between the Number of Staff and the ones utilizing Payroll Softwares like the expected relations between the Number of Staff and the Yearly Turnover. The increase in Payroll Softwares utilization may be accepted as a corollary result of an increase in the Number of Staff. A similar relation is found between the Number of Staff and the utilization of the Accounting Software. So we may

assert that this relation is positively assisted both with the Payroll Software and Accounting Software utilization. So a relation between the utilization of these types of softwares and the Project Human Resource Management is might be possible. The correlation between Payroll Sofwares and Project Human Resourcce Management is (r=0,70). This can be analyzed by looking at the relation of the Number of Staff with the Project Human Resource Management and that is is observed in a positive way. This may be an indication of an increase in the Project Human Resource Management maturity level when the staff number increases. In other words, it is perceived that there might be a strong relation also between the number of staff working in an architectural design office and overall Arch-PMM level. Or we may state a relation between the staff numbers of the architectural design offices that works internationally.

Similar relations may be inversely revealed that the office with a high turnover may need more architects like the office with more staff may have a high turnover. It may be expected a decrease in the yearly turnover of an office which is reducing staff number. Perhaps one of the most important conclusion supported by this study is that the maturity levels of the PM Function Areas of the architectural design offices are currently very consistent with the number of staff and yearly tunovers. The strong relation between these may be an important indicator in the development of the overall maturity level of an architectural office.

When Table 4.3. examined, between the demographic data of the architectural design offices and the PM maturities, correlations are observed both in the positive and negative directions.

The architectural design offices after their activity areas, split into three main groups were asked to state their avtivity percentages according to these areas. The service activity areas of the architectural desin offices, play an important role here. The 1st section that is described as the domestic activity area, states the city that the architectural design office is located and its service percentage within the 300 km radius. Excluding the 1st section, the 2nd section defines all the remainig service percentage of Turkey . The 3rd section states the service percentage of that architectural design office in the international arena. The service activity areas of the architectural design offices play a major role between the PM maturity level of that architectural design office. A negative correlation is observed in the activity in the domestic area with all the Arch-PMM sub-functions and with Overall Arch-PMM. This is mostly in between the domestic activity area and Project Risk Management and then in Project Quality

Management. In the International activity area on the other hand, a positive correlation in terms of Arch-PMM sub-functions is also seen. As a result of this, a lower proportion might be excepted in the maturities of all PM function areas of an architectural design office which is more active in the Domestic area compared to an architectural design office that is more active in the international arena.

One of the variables that has negative correlation values between the Overall Arch-PMM and its sub-functions is the architectural design offices that give contracting services. Normally, more matured Project Management function areas may be expected with the companies giving contracting service. In other words, an architectural design office giving contracting service may be considered being more mature in terms of Project Management fuction areas compared to the ones that do not give contracting service. But when Table 4.3. is examined the direction of this relation turns out to be negative not positive. So it is better to examine some data here.

14 out of 71 architectural design offices that were interviewed has stated that they give contracting service besides architectural service. While there are 12 offices in Izmir giving conracting service, there are only 2 offices in Istanbul and none in Ankara. Besides a negative correlation between the Yearly Turnover and the Domestic activity area is also observed on Table 4.3. When the architectural design offices in Izmir are examined it appears that most of them are offices with a low Yearly Turnover giving service in the domestic area. The negative correlation of their Domestic activity areas with their Arch-PMM function areas was mentioned earlier. Possibly because of these reasons the negative correlation between the Arch-PMM sub-function areas and contracting might be explained as follows. It might be expected from the architectural design offices with lower Project Management maturity to be more active in the domestic area and to have a low Yearly Turnover. These offices with low yearly turnover may be bound to give contracting service to increase their income. As a result of this the correlation among them might have been on the negative direction.

4.5. The Imperfections of the Model

The ARCH-PMM presented in this study has some obvious interperfetions. The most remarkable ones are listed below:

During the application of ARCH-PMM Semi Structured Survey, the assessment should be conducted by an expert on relevant PM practices and processes and also with the architectural design processes and practice in order to achieve coherent results. The application of the assessment by an expert will also help to complete the assessment according to the planned time period. Otherwise, the completion time will be delayed and participants and experts may loose their concentrations.

The participants should be ready to cooperate and ready to share their organizational information during the ARCH-PMM Assessment Survey and the Interviews in order to understand the actual and proper status of their PM processes and practices. Otherwise there can be some inaccurate results.

During the interviews the selection of the related professionals in the architectural design offices is vital important. All the answers from the related professional should not be counted as the sufficient answer for the current PM practice. More managers or the authorized professionals should be interviewed in order to achieve reliable results.

CHAPTER 5

CONCLUSION

5.1. Contributions of ARCH-PMM Model

This study is the first attempt that focuses on architectural design offices' PM practices and processes. Arch-PMM Model is developed by help of the other PM maturity models in other industries. The model is tested for validation. 71 architectural design offices participated for this validation process. The validated model is the major contribution of this dissertation. Architectural design offices might use this model for measuring their PM maturity levels.

The result of the assessment provides the necessary information for the architects to improve their PM processes and activities. This development creates the appropriate creative environment for the architectural design processes and activities.

Architectural design offices should benchmark their performances with the other design companies by using ARCH-PMM Semi Structured Assessment Questionnaire. This helps the design offices to identify their current PM processes and their actual status of PM practices and processes among the other architectural design offices.

ARCH-PMM Semi Structured Assessment Questionnaire should be repeated periodically. This repetition of the assessment encourages the architectural design offices to continue their continuous development of PM practices and processes on architectural design services.

ARCH-PMM Semi Structured Survey could be applied to more architectural design companies. The contribution of the applications of the assessment will increase the validity of the assessment and will help to evaluate the ARCH-PMM Model.

During the application of the ARCH-PMM Semi Structured Assessment Questionnaire, the assessment should be conducted by an expert on PM practices and architectural design processes in order to achieve coherent results.

An other primary contribution of this study shows us that the PM practices, processes, and maturity levels have dependent relations with the architectural design processes and practices. The architectural design company with a higher level of ARCH-PMM seems to create more time and appropriate environment to deal with the

architectural design processes and problems. The architectural design office with a lower level of ARCH-PMM has to deal with other activities (which are not directly related to architectural design processes) and looses time instead of focusing and concentrating on architectural design processes.

Since averages of these very 9 PM function areas form the Overall Arch-PMM, correlation between the 9 PM function areas and Overall Arch-PMM is obtained by this study as naturally expected. However, one very important conclusion of this dissertation is the strong correlation between each of the 9 PM functions areas in architectural design offices. This might indicate the close interdepency between each other of the maturity of PM functions.

This study found differences between PM Maturity levels when comparing across architectural design offices. In these cases where differences were noted, it was generally the architectural design offices with more staff and higher yearly turnover that were most matured.

This study indicates that the maturity levels of Project Integration Management and Project Scope Management of the architectural design offices are higher than the maturity levels of other PM function areas. The analysis of the architectural design offices shows that Project Integration Management in fact contains the most crucial stages of the architectural design process. Even an undeveloped architectural design office on PM function areas has to reach specific stages like the initiation of an architectural design project, controlling the project activities, etc. Although the

While examining the architectural design offices, Project Integration Management and Project Scope Management function areas were found to contain the most important points in producing architectural project. The outlines that are contained in these two function areas are approved by all architectural design offices. Even an architectural design office which is hardly developed in terms of Project Management function areas is aware of the outlines of these two function areas. Even though the architects are creating the architectural designs of the buildings by utilizing numerous different programs, the architectural design process and outlines of these different buildings look quite alike. Maybe this might be the reason why the Project Integration Management and Project Scope Management are the most matured first two function areas in terms of Project Management maturity for containing the main functions like Initiation of a Project, Project closure, scope definiton, work breakdown structure and scope change cotrol that are approved by all the architectural design offices.

Again when the architectural design offices are examined, it is observed that the Project Human Resource Management with Project Risk Management in terms of Project Management function areas are the lowest two PM function areas. In the analysis in chapter 4, we have experienced that the architectural design offices had generally 1 - 6 staff when they were examined demographically. All of the architectural design offices that have this kind of a staff structure are dealing with everything about their on going projects. A general formation of a project team and conception of work distribution has not developed. All the major decisions are made by the company owner architect. This might be why the Project Human Resource Management is one of the two least matured PM function areas among 9.

The major outlines of architectural design process and its own relative important points were determined during the architectural design process because the Project Integration Management and Project Scope Management contain all major stages and these stages are approved by all the architects. Due to the client's focusing especially on the cost, and the architectural design offices' concentrating on these major demands, the other risks are seen as acceptable and violable. This might be the reason for the Project Risk Management to be the least matured one of all the PM function areas.

This study states that the architectural design offices have differences in all 9 Project Management function area maturities, and the architectural design offices in different cities have also a difference in their Arch-PMM maturity levels. This study also makes it clear that the Project Management maturities of the architectural design offices in Istanbul and Ankara are generally more matured compared to the ones in Izmir. Additionally, differences were obtained both in the Project Management maturity levels and demographical structures of the architectural design offices in different cities. It is seen that the Yearly turnovers, yearly building areas and average staff numbers of the architectural design offices in Ankara and Istanbul are invariably higher than the ones in Izmir. The architectural design offices in Istanbul and Ankara have retrieved the opportunity to conduct more architectural designs in terms of the economies and the opportunites of these cities to expand outwards. An increase in turnover in these two cities both caused an increase in the yearly turnovers and in the staff number. Thus, the architectural design offices in Izmir are obliged to sustain themselves with less designs because of the economy and job opportunities of their location. As a result of this the architectural design offices in Izmir have to design fewer projects with fewer staff. This

causes an increase in the PM maturities with proportion to the developing demographic structures of the offices in Istanbul and Ankara, whereas the PM maturities in the offices in Izmir are lower.

The overall PM maturity of an architectural design office is formed by the average of 9 PM fucntion areas and the average of each function area normally/naturally effects the overall Arch-PMM. If an architectural design office intends to develop its Project Maturity, If a development in the Project Maturity of an architectural design office is intended, an improvement in all of 9 PM function areas has to be fulfilled primarily. Therefore, the architectural design offices should close up the low function areas of the Project Maturity levels to the ones at higher levels. In this way both the maturity of all the Project Management areas will be balanced and the Project Management areas that are already developed will be developed more. This balanced development in all function areas will be helpful in an easier development of the overall Project Management maturity of an architectural design office. The criteria and level definitions to be reached by an architectural design office in every level of Project Maturity is explained in detail in Chapter III.

5.2. Concluding Remarks and Recommendations for Further Research

The Arch-PMM Model developed in this dissertation has many potential application areas as well as imperfections and limitations. The methodology developed in this study is expected to assess the PM Maturity level of an architectural design office in order to provide necessary imformation to make improvement in their PM processes and activities. It should be stresses that the development of this model is the most important issue. The following areas mentioned below are recommended for further research:

This model should be applied to more architectural design offices. During the application the interviews should surely be planned in advance and the length of the interview should be emphasized to the participants. If possible instead of only one member of the architectural design office, a couple of members should be interviewed separately. This should not be limited only for Izmir, Istanbul and Ankara, but should be applied in different cities and countries and the results should be evaluated by analyzing with benchmarking. Demographic questions should be improved or modified surely.

Previously interviewed architectural design offices should be interviewed again and both the change in their Project Management maturity levels should be observed and the improved, modified new demographic questions should be applied.

Market penetration strategies for architectural design offices could be another area of research.

Clustry of architectural design offices might further benefit the analysis process by providing more clear understanding of PM maturity levels.

This model also serves as a benchmarking tool for architectural design offices for developing their PM processes.

Architectural design office is a major stakeholder of Building Construction Process. A PM maturity development in the stakeholder of a process depends on the cooperation and also integration with the other stakeholders. Therefore this model should not be applied only to the architectural design offices but also to the other stakeholders of the Building Construction Process (i.e., civil engineering offices, mechanical engineering offices, electrical engineering offices, city planning offices, consultancy companies, contracting companies, municipalities, building supervising companies, etc.). A benchmarking should be done by adding the results both obtained from the other stakeholders and the Project Management maturity.

BIBLIOGRAPHY

Ambrose, J.E. 1992. *Building Construction and Design*. (Van Nostrand Reinhold. New York. USA).

Aouad, G., Cooper, R., Kagioglou, M., Hinks, J, Sexton, M. 1998. *A Synchronised Process/IT Model to Support the Co-maturation of Processes and IT in the Construction Sector*, (Time Research Institute, University of Salford, UK).

Arditi, D. and Günaydin, H.M. 1997. Total Quality Management in the Construction Process. *International Journal of Project Management*, Vol. 15 (4). Pp. 235 – 243.

Atkinsoy, G. 1995. *Construction Quality and Quality Standards: The European Perspective*. (Spon. London. England).

Bamberger, J. 1997. Essence of the Capability Maturity Model. *IEEE Computer* June 1997, pp. 112 – 114.

Barrett, P. 1993. *Profitable Practice Management: For The Construction Proffesional*. (E & FN Spoon. New York. USA).

Benneth, J. 2000. *Construction, The Third Way: Managing Cooperation and Competition In Construction*. (Architectural Press. UK).

Bergman, L and Ohund, S. 1995. Development of an Assessment Tool to Assist in the Implementation of Concurrent Engineering, Proceedings of Conference on Concurrent Engineering: A Global Perspective, 1995, pp. 499 – 510.

Birnberg, H.G. 1999. *Project Management For Building Designers and Owners*. Association for Project Managers: (CRC Press. Boca Raton, Fle. USA).

Born, G. 1994. *Process Management to Quality Improvement: The Way to Design, Document and Re-engineer Business Systems*. (John Wiley and Sons. NY. USA).

Brookes, N.J., Blackhouse, C.J., Burns, N.D. 2000. Improving Product Introduction Through Appropriate Organisation: The Development of the SIMPLOFI Positioning Tool, *I MECH E Part B Journal of Engineering Manufacture*, Volume 214, Number 5, 15 May 2000, pp.339-364.

Burke, R. 1993. *Project Management: Planning Control*. (John Wiley and Sons. Chichester. NY. USA).

Carpenter, T.G. 2001. *Environment, Construction and Sustainable Development*. (Wiley. Chichester. West Sussex. England).

CERC Report 1993.Final Report on Readiness Assessment for Concurrent Engineering for DICE, Submitted by: CE Research Centre, West Virginia University, USA.

CIOB Report. 2002. Code of Practice For Project Management For Construction and Development. (Blackwell Science. UK).

CIRIA Report 1999. Standardisation and Pre-assembly: Adding Value to Constrcution Projects, CIRIA Report No. 176, CIRIA, London, UK.

Coble, R.J. 2000. *The Management of Construction Safety And Health*. (Balkema, Rotterdam. Holland).

Collofello, J.S. 1997. Integrating Risk Management into an Undergraduate Software Engineering Course. 27th Annual Conference. 'Teaching and Learning an Era of Change'

Crawford, J.K. 2006. *Project Management Maturity Model*. (Auerbach Publications, New York, USA).

Daskalantonakis, M.K., Motorola Co. 1994. Achieving Higher SEI Levels. *IEEE Computer Society Press*, Vol. 11 (4), pp. 17 – 24.

De Graaf, R. and Sol, E.J. 1994. Assessing Europe's Readiness for Concurrent Engineering, Proceedings of Conference on Concurrent Engineering: Research & Application, 1994, pp. 77 – 82.

Dixon, M. 2000. *Project Management: Body of Knowledge.* Chapter 1, pp 40, 4th Edition. Association for Project Management. (Project Management Institute. Newtown Square, PA, USA)

Egan, J. 1998. *Rethinking Construction*, Report of the Construction Task Force on the Scope for Improving the Quality Efficiency of UK Construction Industry, Department of the Environment, Transport and the Regions, London, UK.

Eickelmann, N. 2004. Measuring Maturity Goes beyond Process. *The IEEE Computer Society*, 0740 – 7459, July/august 2004, pp. 12 – 13.

Emmith, S. 2000. *Architectural Management In Practice*. (Longman. UK).

Finkel, G. 1997. *The Economics of Construction Industry*. (M.E. Sharpe. Arman, NY. USA).

Finnemore, M. and Sarshar, M. 2000. Linking Construction Process Improvement to Business Benefit, Bizarre Fruit 2000 Conference, University of Salford, 9 – 10 March 2000, pp. 94 – 106.

Froese, T., Waugh L., Pouria, A. 2001. PM 2020: Future Trends in Information Technologies for Project Management. Proceedings of 2001 Conference of the Canadian Society of Civil Engineers, Victoria, BC. (May 30 – June 2, 2001). Paper C15.

Fryer, Baroy G., 1997. *The Practice of Construction Management*. (Blackwell Science. Cambridge, Mass. USA).

Goetsch, David K. 1995. *Implementing Total Quality*. (Prentice Hall. NY. USA).

Gould, F.E. 2000. *Construction Project Management*. (Prantice Hall. NY. USA).

Gould, F.E. 2002. *Managing The Construction Process: Estimating, scheduling and Project Control*. (Prentice Hall. N.J. USA).

Gravallese, M. 1993. *Corporate Architects: Building A Better Building Industry: Evaluating and Implementing Total Quality Management*. (American Institute of Architects. Washington DC. USA).

Griffith, A. 2000. *Managing Systems For Construction*. (Pearson Education. UK).

Groak, S. 1992. *The Idea of Building: Thought and Action In The Design and Production of Building*. (E & FN Spoon. London. England).

Halpin, D.W. 1992. *Planning and Analysis of Construction Operation*. (Wiley. New York. USA).

Harigopal, U and Styadas, A. 2001. *Cognizant Enterprise Maturity Model (CEMM)*. IEEE Transactions on Systems, Man, and Cybernetics-Part C: Applications and Reviews, Vol. 31 (4), pp. 449 – 459.

Harpam, A. and Hinley, D. 2006. *Just How Mature Your Organisation at Project Management*. (The APM Group, Buckinghamshire, UK).

Harper, Denis Raunsley. (1978). *Building: The Process and The Product*. (The Construction Press. NY. USA).

Harvey, Roger. (1993). *The Construction Industry of Great Britain*. (Newnes. Oxford. England).

Herbsleb, J., Carleton, A., Rozum, J., Siegel, J., and Zubrow, D. (1994), Benefits of CMM-Based Software Process Improvement: Initial Results, Software Engineering Institute, Technical Report, CMU/SEI-94-TR-3

Hillson, D.A. (2001). Benchmarking Organisational Project Management Capability, in Proceedings of the 32nd Annual Project Management Institute Seminars & Symposium (PMI 2001), Nashville, USA, (7-10 November 2001), Newtown Square, PA,
Project Management Institute.

Hoyle, D. (1998). *ISO 9000 Quality Systems Development Handbook: A Systems Engineering Approach*. (Butterworth-Heinemann. Oxford. UK).

Hutchings, Jonathan F. (1996). *CPM Construction Scheduler's Manuel*. (McGraw-Hill. New York. USA).

IACCM, (2003). Organisational *Maturity in Business Risk Management, The IACCM Business Risk Management Maturity Model (BRM3).* See http://www.risk-doctor.com/pdf-files/brm1202.pdf.

Illingworth, J.R. (2000). *Construction Methods and Planning*. E & FN Spoon. London.England.

Jacobs, J.C. and Trienekens, J.J.M. (2002). Towards a Metric Based Verification and Validation Maturity Model. *Proceedings of the 10th International Workshop on Software Technology and Engineering Practice (STEP'02).*

Karandikar, H.M., Fotta, M.E., Lawson, M., Wood, R.T. (1993). *Assessing Organizational Readiness for Implementing Concurrent Engineering Practices and Collaborative Technologies*, Concurrent Engineering Research Center, West Virginia University, Morgantown, WV. USA.

Khalfan, M.M.A., (2000). *Implementation of Concurrent Engineering in Construction-Readiness Assessment*. Department of Civil & Building Engineering, Loughborough University, Loughborough, Leics, UK.

Kwak, Y.H., (1997). *A Systematic Approach to Evaluate Quantitative impacts of Project Management*. Ph.D. dissertation, University of California, Berkeley, USA.

Kwak, Y.H. and Ibbs, C.W. (2002). Project Management Process Maturity (PM)² Model. *Journal of Management in Engineering*, Vol. 18 (3), pp. 150 - 155.

Langford, D.A. (2001). *Strategic Management In Construction*. Blackwell Science. Oxford. England.

Latham, M. (1994).*Constructing the Team, Final Report on Joint Review of Procurement and Contractual Agreements in the UK Construction Industry*, (HMSO, London, UK).

Lester, A. (2000). *Project Planning and Control*. (Butterworth-Heinemann. Oxford. UK).

Lewis, James P. (2001). *Project Planning, Scheduling and Control: A Hands-On Guide To Bringing Projects In An On Time and On Budget*. (McGraw-Hill. NY. USA).

Levy, Sidney M. (2000). *Project Management In Construction*. (McGraw-Hill. New York. USA).

Liebing, Ralph W. (2001). *The Construction Industry: Processes, Players and Practics*. (Prentice Hall. Upper Saddle River. NJ. USA).

Lientz, Bennet P. (1998). *Project Management for the 21st Century*. (Academic Press. San Diego. USA).

McBride, T., Henderson-Sellers, B., Zowghi D. (2004) Project Management Capability Levels: An Empirical Study. Asia-Pacific Software Engineering Conference (APSEC'04). Pp. 56 – 63.

Morris, P.W.G. (2001). Updating the Project Management Bodies of Knowledge. *Project Management Journal*, Vol. 32, pp. 21 – 30.

Munns, A.K., and Bjeirmi, B.F. (1996). The role of Project Management in Achieving Project Success. *International Journal of Project Management*, Vol. 14, pp. 81 – 88.

Nelson, Charles. (1996). TQM and ISO 9000 for Architects and Designers. (Mcgraw-Hill. New York. USA).

Nicholson, M.P. (1992). *Architectural Management*. (E & FP Spon, London. UK).

Nunnally, S.W. (2001). *Construction Methods and Management*. (Prentice Hall. Upper Saddle River. NJ. USA).

Obrren, James J. (1999). *CPM In Construction Management*. (McGraw Hill. Boston. USA).

Palmer, William. (1996). *Construction Insurance, Bonding and Risk Management*. (McGraw-Hill. New York. USA).

Paulk, M.C., Weber, C.V., Garcia, S.M., Chrissis M.B., Bush M. (1993). Key Practices off the Capability Maturity Model, Version 1.1, Software Engineering Institute, Technical Report, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA.

Pierce, David R. (1998). *Project Scheduling and Management For Construction*. (RS Means Co. Kingston, MA. USA).

PMBOK (1996). *A Guide to the Project Management Body of Knowledge*. (Project Management Institute, Newtown Square, PA, USA).

PMBOK (2000). *A Guide to the Project Management Body of Knowledge.* Second Edition. (Project Management Institute, Newtown Square, PA, USA).

PMBOK (2004). *A Guide to the Project Management Body of Knowledge*. Third Edition. (Project Management Institute, Newtown Square, PA, USA).

. Polley, S. (2001). *Understanding The Building Regulations*. (Spoon Press. UK).

WEB_1, 1989. Prince2. 10/09/2006. *Projects In Controlled Environments*. http://www.prince2.com

PRINCE 2 (2003). Managing Successfull Projects with PRINCE 2. Section 18, pp 253-261, 6th Edition, (Office of Government Commerce, USA).

Supic, H (2005). Project Management Maturity of Selected Organizations in Croatia. 8th International Conference on Telecommunications – ConTEL 2005, Zagrab, Croatia.

Thomas, S.R., Tucker, R.L., and Xiaoyi D.C. (1999). Compass: An Assessment Tool for Improving Project Team Communications. *Project Management Journal*, 30, 15-24.

Walker, P., Greenwood Dr.D. (2002). *Construction Companion to Risk and Value Management*. (RIBA. London. UK).

Wognum P.M., Stoeten, B.J.B., Kerhof M., De Graaf, R. (1996). PMO-RACE: *A Combined Method for Assessing Organisations for CE, Advences*. 113 – 120. (University of Toronto, Ontario, Canada).

Wysocki, R. (2004). *Project Management Process Improvement*. (Artech House. Norwood, MA, USA).

Voivedich, B, and Jones, M. (2001). Developing and Applying A Project Management Capability Maturity Model. PMI 2001 Symposium, Nashville, Tennessee, USA.

APPENDIX A

ARCH-PMM

Semi Structured Assessment Questionnaire Forms

Company Name							
Founder/Partners							
Year of Establishment							
City of establishment							
Adress							
Telephone **Fax** **website** **e-mail**							
experience (by years)	trainee	still educating	1-3 yr	4-5 yr	6-10 yr	over 10 yr	degree of education
Number of total staff							
Number of architects							
Number of engineers							
no. of technical person							
structure	constitutionalized	external	Note				
financing and accounting							
chartered accounted							
experience (by years)	trainee	still educating	1-3 yr	4-5 yr	6-10 yr	over 10 yr	degree of education
Related Person 1							
Related Person 2							
Related Person 3							
Related Person 4							

	Semi Structured ARCH-PMM SURVEY	L1	L2	L3	L4	L5
	Project Integration Management					
1	Scope Definition	☐	☐	☐	☐	☐
2	Deliverables Identification	☐	☐	☐	☐	☐
3	Project Management Plan Development	☐	☐	☐	☐	☐
4	Project Management Plan Execution	☐	☐	☐	☐	☐
5	Change Control	☐	☐	☐	☐	☐
6	Project Closure	☐	☐	☐	☐	☐
7	Project Information System	☐	☐	☐	☐	☐
	Project Scope Management					
8	Scope Planning and Management	☐	☐	☐	☐	☐
9	Busines Requirements Definition	☐	☐	☐	☐	☐
10	Technical Requirements Definition	☐	☐	☐	☐	☐
11	Work Breakdown Structure	☐	☐	☐	☐	☐
12	Scope Change Control	☐	☐	☐	☐	☐
	Project Time Management					
13	Activity and Resource Definition	☐	☐	☐	☐	☐
14	Activity Sequencing	☐	☐	☐	☐	☐
15	Schedule Development	☐	☐	☐	☐	☐
16	Schedule Control	☐	☐	☐	☐	☐
17	Schedule Integration	☐	☐	☐	☐	☐
	Project Cost Management					
18	Cost Estimating	☐	☐	☐	☐	☐
19	Cost Budgeting	☐	☐	☐	☐	☐

20	Performance Measurement	☐	☐	☐	☐	☐
21	Cost Control	☐	☐	☐	☐	☐
	Project Quality Management					
22	Quality Planning	☐	☐	☐	☐	☐
23	Quality Assurance	☐	☐	☐	☐	☐
24	Quality Control	☐	☐	☐	☐	☐
25	Management Oversight	☐	☐	☐	☐	☐
	Project Human Resource Management					
26	Human Resource Planning	☐	☐	☐	☐	☐
27	Staff Acquistion	☐	☐	☐	☐	☐
28	Develope and Manage Proect Team	☐	☐	☐	☐	☐
29	Proffesional Development	☐	☐	☐	☐	☐
	Project Communication Management					
30	Communications Planning	☐	☐	☐	☐	☐
31	Information Distribution	☐	☐	☐	☐	☐
32	Performance Reporting	☐	☐	☐	☐	☐
33	Issues Tracking and Management	☐	☐	☐	☐	☐
	Project Risk Management					
34	Risk Identification	☐	☐	☐	☐	☐
35	Risk Quantification	☐	☐	☐	☐	☐
36	Risk Response Development	☐	☐	☐	☐	☐
37	Risk Control	☐	☐	☐	☐	☐
38	Risk Documentation	☐	☐	☐	☐	☐

Project Procurement Management

39	Procurement Planning	☐	☐	☐	☐	☐	
40	Requistion	☐	☐	☐	☐	☐	
41	Solicitation/Source Control	☐	☐	☐	☐	☐	
42	Contract Management/Closure	☐	☐	☐	☐	☐	

KNOWLEDGE AREA MATURITY LEVEL

Project Integration Managment	☐	☐	☐	☐	☐	
Project Scope Management	☐	☐	☐	☐	☐	
Project Time Management	☐	☐	☐	☐	☐	
Project Cost Management	☐	☐	☐	☐	☐	
Project Quality Management	☐	☐	☐	☐	☐	
Project Human Resource Management	☐	☐	☐	☐	☐	
Project Communications Management	☐	☐	☐	☐	☐	
Project Risk Management	☐	☐	☐	☐	☐	
Project Procurement Management	☐	☐	☐	☐	☐	

ARCHITECTURAL DESIGN OFFICE'S MATURITY LEVEL	☐	☐	☐	☐	☐	

APPENDIX B

Semi Structured ARCH-PMM Assessment Survey

Part III

Demographical Questions

1. Mark your yearly turnover? (YTL - New Turkish Lira)

- ☐ 0 YTL - <120.000 YTL
- ☐ 120.000 YTL - <250.000 YTL
- ☐ 250.000 YTL - <500.000 YTL
- ☐ 500.000 YTL - <2.000.000 YTL
- ☐ over 2.000.000 YTL

2. Order the following construction systems by their frequency in your designs

- ☐ Reinforced Concrete
- ☐ Steel
- ☐ Wood
- ☐ Other (……..)

3. Mark the types of buildings below you designed during the last 24 months.

- ☐ Buildings for Transportation
- ☐ Residential
- ☐ Buildings for Tourism
- ☐ Sports and Recreation
- ☐ Health Complex
- ☐ Educational Buildings
- ☐ Cultural Buildings
- ☐ Urban Design, City Planning
- ☐ Industrial and Agricultural Buildings
- ☐ Financial and Commercial Buildings
- ☐ Environmental Development

4. Mark the total area of the buildings you design yearly.

- ☐ 0 m2 - <20.000 m2
- ☐ 20.000 m2 - <50.000 m2
- ☐ 50.000 m2 - <100.000 m2
- ☐ 100.000 m2 - <250.000 m2
- ☐ over 250.000 m2

5. Mark the percentage of the buildings you design include inspection and control services.

- ☐ None
- ☐ 0% - <33%
- ☐ 33% - <66%
- ☐ 66% - <100%
- ☐ Always

6. Mark the presentation techniques you use.

- ☐ Models
- ☐ Sketches and hand drawings
- ☐ 3D Models (CAD)
- ☐ 2D Models (CAD)
- ☐ 2D Drawings (Hand drawings)

7. Which one is your main client?

	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐
☐ Private	0%	0 - <25%	25-<50%	50%	50-<75%	75-<100%	<100%
☐ Government	100%	75-<100%	50-<75%	50%	25-<50%	0 - <25%	0%

8. Mark the software packages you use.

- ☐ CAD Software (e.g. AutoCAD, ArchiCAD, IdeMimar, IdeCAD,…)
- ☐ 3D Modelling Softwares (3DMAX, ArtLAntis, AutoCAD 3D, etc.)
- ☐ Project Management Softwares (MSProject, Primevera,…)
- ☐ Payroll software
- ☐ Accounting software
- ☐ Enterprise Resource Planning Software (e.g. Poly, ConstuctWare,…)

9. Mark your area of activity.

	Percentage
☐ Domestic (300km radius)	(……%)
☐ National	(……%)
☐ International	(……%)

10. Mark the services you are providing.

- ☐ Architectural Design
- ☐ Engineering Design
- ☐ Consultancy
- ☐ Contructing
- ☐ TUS

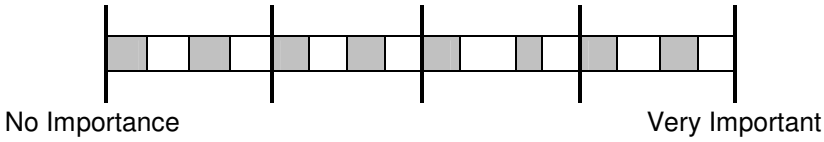
11. Mark the repeated clients.

- ☐ 0% - <20%
- ☐ 20% - <40%
- ☐ 40% - <60%
- ☐ 60% - <80%
- ☐ 80% - <100%

☐ 100%

Mark the importance of the above criteria for you.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐



No Importance Very Important

12. Mark the number of awards you won.

☐ None

☐ 0 - <5

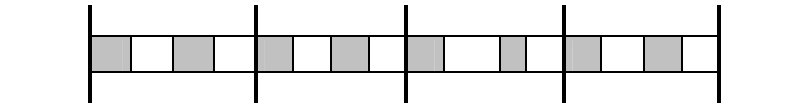
☐ 5 – <10

☐ 10 - <20.

☐ More than 20

Mark the importance of the above criteria for you.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐



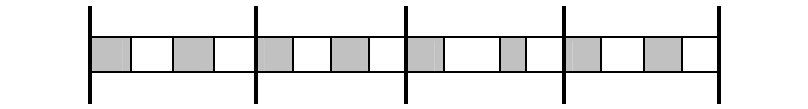
Not Important Very Important

13. Write the number of published articles about your designs.

☐ .....

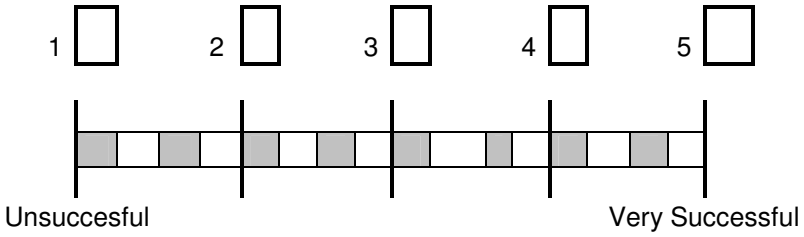
Mark the importance of the above criteria for you.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

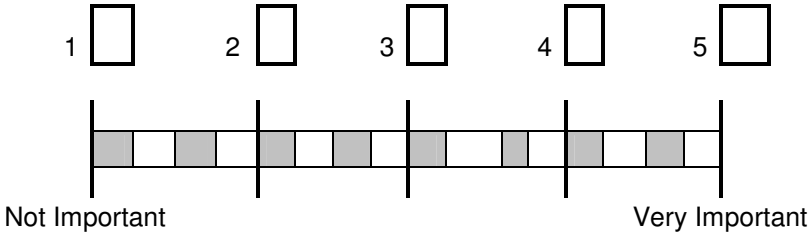


Not Important Very Important

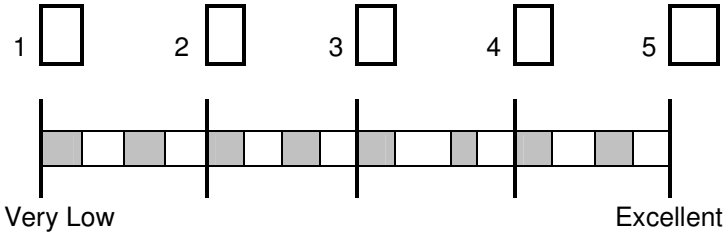
14. How successful do you rate yourself according to your competatives?



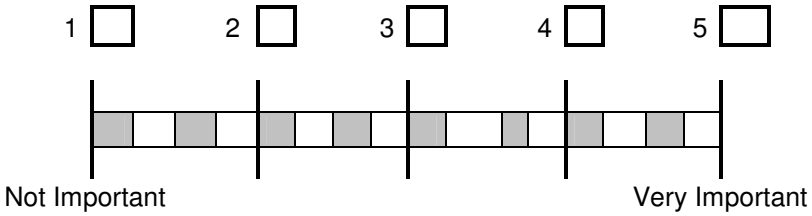
Mark the importance of the above criteria for you.



15. Mark your profitability against the other architectural design offices.



Mark the importance of the above criteria for you.



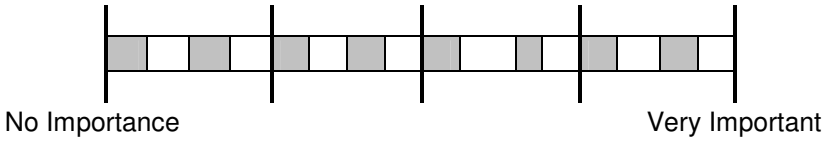
16. Mark the ratio of the biddings you enter results with architectural design contract.

- ☐ 0% - <20%
- ☐ 20% - <40%
- ☐ 40% - <60%
- ☐ 60% - <80%
- ☐ 80% - <100%

☐ 100%

Mark the importance of the above criteria for you.

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐



No Importance Very Important

VITA

Doğan Arda BESET was born in İzmir, on 23rd of June, 1973. He received his B.Sc. Degree from Yıldız Technical University İstanbul in 1996. During the B.Sc. Degree, he worked for Han TÜMERTEKİN and Lotus Mimarlık in İstanbul. He completed his master degree from Dokuz Eylul University between 1996-2000. During his master degree, he established his own architectural design office in İzmir. Since 1996, he has been carrying his architectural design works parallel to his doctorate programme.

Exhibitions:	UIA 2005 Istanbul Congress. Cities: "Grand Bazaar of Architectures." Personal architectural design works. July 3 – 10, 2005, Istanbul, Turkey.
	Personal architectural design works. Exhibition with Association of Turkish Independent Architects. Izmir Dokuz Eylul University. 2005, Izmir, Turkey.
	Personal architectural design works. Exhibition with Association of Turkish Independent Architects. Yapı Endüstri Merkezi - Yapı Fuarı. 2005, Izmir, Turkey
	Personal architectural design works. Exhibition with Association of Turkish Independent Architects. Izmir Economy University. 2006, Izmir, Turkey
	Personal architectural design works. Exhibition with Association of Turkish Independent Architects. Balıkesir University. 2007, Balıkesir, Turkey
Memberships:	Association of Turkish Independent Architects – Izmir – Board Member.
	Scandinavian – Turkish Business Association – Vice President
	Aegean Region Chamber of Industry – Young Industrian Union – Vice President.
	Turkish Chamber of Architects - Member