AN INVESTIGATION OF MACROERGONOMIC PERSON FACTOR EFFECT ON CONSULTING WORK SYSTEM PERFORMANCE

by

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ABSTRACT

AN INVESTIGATION OF MACROERGONOMIC PERSON FACTOR EFFECT ON CONSULTING WORK SYSTEM PERFORMANCE

Macroergonomics has been one of the significant approaches to contribute to design of the systems with human element for well being and system's performance. Previous macroergonomics studies concentrated exclusively on the design and analysis of the manufacturing work systems. On the other hand, the value of adding a macroergonomic approach with all its components to a service work system has received little consideration. This study addresses this gap in the existing literature and investigates the effects of person which is one of the macroergonomics factor on consulting work system performance. Specifically, study objectives are twofolds: (i) Developing a person factor-related hypothesis model representing consulting work system performance; and (ii) Determine the direct, indirect and total effects of the four person factor elements on the consulting work system performance using the developed hypothesis model. To reach the stated objectives, a person-factor hypothesis model for consulting work system performance was developed. A macroergonomics compatibility questionnaire (MCQ) was created for data gathering from the managerial staff of various consulting companies. To define key 'driver' constructs and estimate the direct, indirect, and total effects, the variance based PLS-SEM technique was performed. The findings indicated that for higher employee performance, the macroergonomic compatibility of cognitive skills, education and knowledge, psychological characteristics and motivation and needs are significant person related elements. Total effects in the hypothesis model revealed that employee performance significantly effects organizational performance and service process. In this regard, the developed model may help consulting companies to enhance service quality and stay competitive in today's business world.

ÖZET

MAKROERGONOMİK KİŞİ FAKTÖRÜNÜN DANIŞMANLIK İŞ SİSTEMİ PERFORMANSINA ETKİSİ ÜZERİNE BİR ARAŞTIRMA

Makroergonomi, insanlı sistemlerin tasarımında ve geliştirilmesinde sistem performansını ve insan esenliğini artırmak için kullanılan bir yaklaşımdır. Önceki makro ergonomi çalışmaları, daha çok imalat sektörü üzerindeki araştırmaları içerir. Öte yandan, makroergonomik yaklaşımın, danışmanlık iş sistemleri üzerine etkisi pek araştırılmamıştır. Bu çalışma, bu konuya eğilerek, makroergonomi faktörlerinden biri olan kişinin, yani işgücünün, danışmanlık iş sistemi performansına etkisini araştırdı. Bu çalışmanın amaçları şunlardır: (i) Danışmanlık iş sistemi performansını temsil eden kişi faktörüyle ilgili bir hipotez modeli geliştirmek; ve (ii) Geliştirilen hipotez modelini kullanarak, dört kişi faktör unsurunun danışmanlık çalışma sistemi performansı üzerindeki doğrudan, dolaylı ve toplam etkilerini belirlemek. Sözkonusu amaçlara ulaşmak için, kişi faktörüne bağlı bir danışmanlık iş sistemi performansı hipotez modeli geliştirilmiştir. Hipotezleri test etmede kullanmak üzere, çeşitli danışmanlık şirketlerinin yönetim kadrosundan veri toplamak için bir makroergonomik uyumluluk anketi (MUA) oluşturuldu. Temel 'etken' yapıları tanımlamak ve doğrudan, dolaylı ve toplam etkileri hesaplamak için, varyans bazlı PLS-YEM tekniği uygulandı. Bulgular, daha yüksek çalışan performansı için bilişsel becerilerin, eğitim ve bilginin, psikolojik özelliklerin ve motivasyon ve ihtiyaçların makro ergonomik uyumluluğunun kişiyle ilgili önemli unsurlar olduğunu gösterdi. Hipotez modelindeki toplam etkiler, çalışan performansının örgütsel performansı ve iş süreçlerini önemli ölçüde etkilediğini ortaya koydu. Bu bağlamda, geliştirilen model, danışmanlık şirketlerine, hizmet kalitesini artırma ve günümüz iş dünyasında rekabetçi kalmada yardımcı olabilir.

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LIST OF ACRONYMS/ABBREVIATIONS

AFA	Açımlayıcı Faktör Analizi
ANOVA	Analysis of Variance
APC	Average Path Coefficient
ARS	Average R-Squared
AVE	Average Variance Extracted
AVIF	Average Variance Inflation Factor
CA	Cronbach's Alpha
CB-SEM	Covariance Based Structural Equation Modelling
CFA	Confirmatory Factor Analysis
CR	Composite Reliability
DRC	Dual-Resource Constraint
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
GoF	Goodness of Fit
HFE	Human Factors and Ergonomics
HR	Human Resource
HRM	Human Resource Management
IEA	International Ergonomic Association
IT	Information Technology
KMO	Kaiser-Meyer-Olkin
MC	Macroergonomic Compatibility
MCI	Macroergonomic Compatibility Index
MCQ	Macroergonomic Compatibility Questionnaire
MUA	Macroergonomik Uyumluluk Anketi
PLS-SEM	Partial Least Squares – Structural Equation Modelling
PLS-YEM	Kısmi En Küçük Kareler Yapısal Eşitlik Modellemesi
SEIPS	Systems Engineering Initiative for Patient Safety
SEM	Structural Equation Modelling

SPSS	Statistical Package for the Social Sciences
STS	Socio-Technical Systems
VIF	Variance Inflation Factor
WS	Work Systems

1. INTRODUCTION

Ergonomics (human factors engineering) knowledge and principles are applied in both manufacturing and service industries. Ergonomics is defined by The International Ergonomic Association (IEA) as "the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design to optimize human well-being and overall system performance" [1].

The three main domains used frequently in ergonomics are physical, cognitive, and organizational ergonomics. These main domains can be further grouped into microergonomics and macroergonomics. A keyword to define ergonomics is "compatibility" between human and the other elements of the system. For example, "macroergonomic compatibility" can be defined as the ability of organizational constraints, technology, tasks, and the environment to integrate and work within a business system in an efficient, effective, appropriate, and orderly manner [2]. If the work system has compatible design and has been carried through from micro- to the macroergonomic design of jobs and human-machine interfaces, then the work system design is said to be harmonized. Harmonized work systems are productive, safe, have higher employee satisfaction and quality of working life, and fewer job hazards [3].

Macroergonomic compatibility, which is the primary domain of this thesis, can contribute to the performances of manufacturing and service systems [4]. Manufacturing work systems are composed of human participants or machines performing different tasks using information, technology and other resources to produce products; while service work systems comprise people and technologies that form both service providers and service clients who are working closely together to deliver value in complex systems and networks [5]. Providers and clients might be individuals, firms, government agencies, or any organization of people and technologies. Through the past half-century, service systems have become the most substantial part of most industrialized nations'

economies [6]. With the rising of service industries, "macroergonomic compatibility" have found its application in this area, and consequently the companies realized the importance to achieve sustainable competitive advantages [4].

In this study, the effects of "macroergonomic compatibility", more particularly, "macroergonomic compatibility of person factor elements" (*cognitive skills, education and knowledge, physical characteristics, psychological characteristics, and motivation and needs*) on consulting work system performance were investigated.

This thesis is organized as follows: Brief background about ergonomics, macroergonomics and its common implements are addressed in Section 1. Section 2 discusses related literatures on ergonomics, macroergonomics, macroergonomic compatibility and components of the critical work system design, components of the macroergonomic human factor, and review of the output components of the service consulting industry and consulting work system. Section 3 provides briey the rationale and aims of the thesis. The research methodology conducted for this study is explained in Section 4. The development of a person factor related hypothesis model representing consulting work system performance and analyzing of the model using the variance based PLS-SEM method and its direct, indirect and total impact on the performance elements of the consultancy work system of macroergonomic person factor elements is stated in Section 5. A brief discussion and general results of the data analysis complete this section. Finally, the research is concluded, and the main findings and suggestions for future work are presented in Section 6.

The summary of the steps taken to conduct this study is illustrated following flow chart of the study in Figure 1.1.

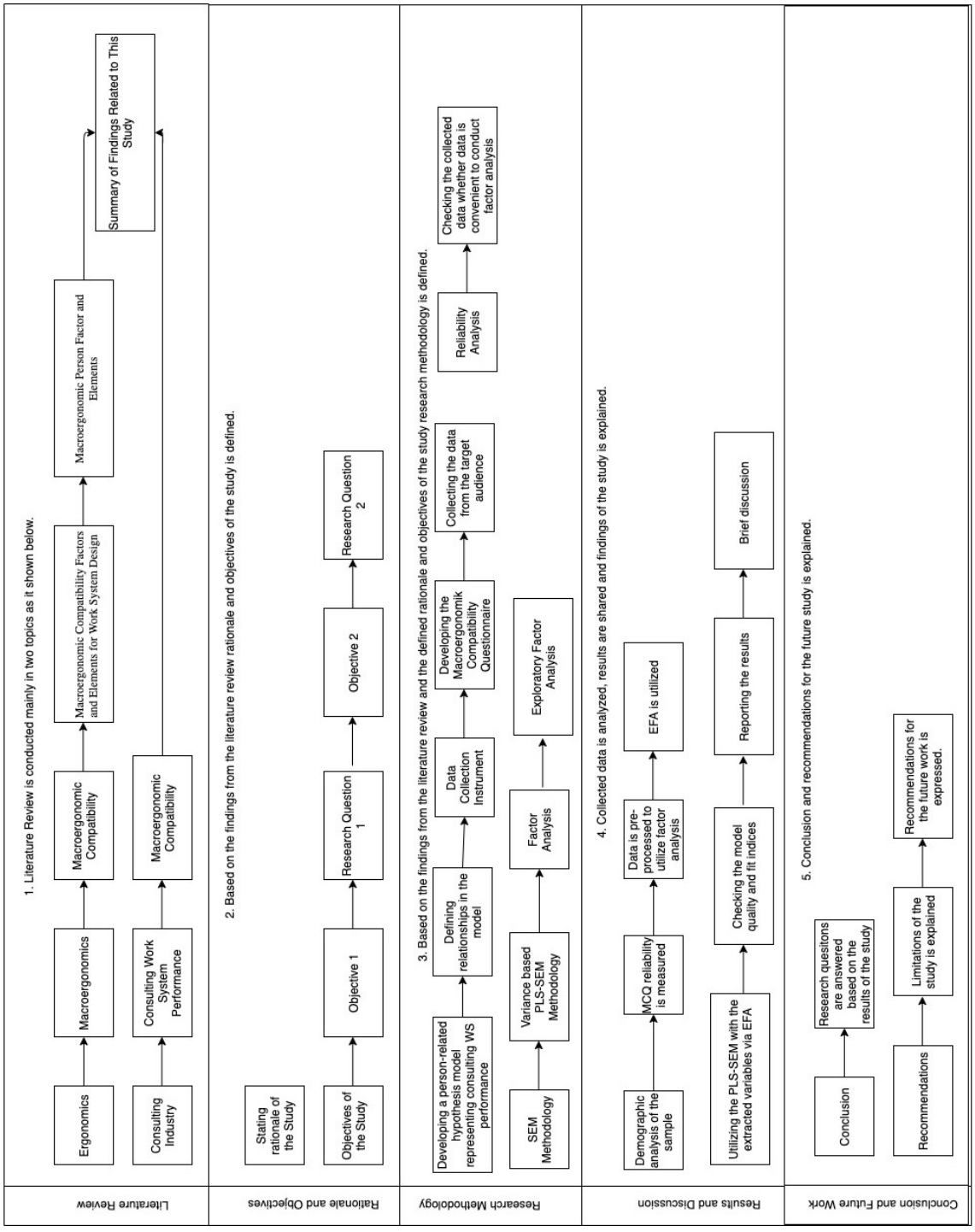

Figure 1.1. Flow chart of the study.

2. LITERATURE REVIEW

2.1. Macroergonomics

"Macroergonomics" is defined as the study and design of jobs, organizational structure, incentive systems, and training programs while researching, developing, and applying ergonomic and organizational design principles at a macro-level by Hendrick in 1987 [7] .Helander and Burri [8] and O'Neill and Evans stated that businesses can enhance the capabilities abilities, safety, and productivity of employees by incorporating ergonomic approaches at micro and macroergonomic levels (as cited by Realyvásquez *et al.* [9]). Microergonomic approaches are implemented to evaluate a particular function at an individual level. Macroergonomic approaches, on the contrary, are applied at the organizational level to increase the efficiency of the organization. Carayon [10] and Erensal and Albayrak [11] stated that macroergonomics is therefore aimed at helping the whole business enhance its competitive advantage in the worldwide (as cited by Realyvásquez *et al.* [9]). Although researchers say that human factors started when early humans first used simple tools and gadgets, the development of ergonomics had its beginning in the industrial revolution of late the 1800s and early 1900s with Frank and Lillian Gilbreth work. This also starts the oldest ergonomics research area; physical ergonomics [12]. Physical ergonomics mainly investigates how an individual interacts functionally with physical products, objects, and structures according to their anatomical, anthropometric, physiological and bio-mechanical characteristics as they relate to physical activity (i.e., adapting human to the system or other way around: fitting system to the human) [13]. While physical ergonomics has been concerned with guidelines for the correct design of the physical interaction between human and machine, work and environment; cognitive ergonomics, which is especially crucial for information intense systems, requiring decisions and problem-solving of time-sensitive actions, focuses its attention upon to understand how a range of mental constructs pertaining to memory, general reasoning, and motor response can potentially support or inhibit effective operational decisions within an individual's interactions among humans and other elements

of a system [13, 14]. From the 1950s to the present day, the first two primary domains of the ergonomics field have been responding to human-work system mismatches successfully. However, unprecedentedly improving technology, the increasingly saturated marketplace, the competitiveness of both service and manufacturing systems, and the higher complexity of systems have produced a new design and organization-system interaction issues, which suggest the need for an extensive system approach as offered by organizational ergonomics [15]. Micro-ergonomic interventions are starting to be inadequate to improve the efficiency of the whole system management as both the benefits of achieving potential successes in terms of system security, health, quality work life goals, and operation costs.

Organizational ergonomics, also known as Macroergonomics, is focused on the optimization of socio-technical systems (STS) with all of their aspects such as structures, environment, policies, and processes while putting humans in the center of macroergonomic approaches [16]. Macroergonomics generally includes related organizational development topics such as teamwork, participatory design, cooperative work, organizational culture, virtual organizations, communication, resource management, quality management, and telecommuting, which makes macroergonomics the Organizational and Design perspective of ergonomics [17]. With the realization that organizational elements of a work system are the most critical factors in gaining competitive advantage for today's rapidly changing, uncertain, and dynamic business world, macroergonomics has become one of the rising trends of human factor engineering both in the business world and the academic world.

2.2. Macroergonomic Compatibility

According to Karwowski [18], "macroergonomic compatibility refers to the ability to incorporate (adjust) and function with the human factor in an accurate, compatible, and organized manner within a work structure of technology components, structural requirements, functions, and the environment. Its aim is to explore universal concepts, to hypothesize person compatibility, and to construct a quantitative framework

to calculate this compatibility. Karwowski [18] first established the notion after integrating two Greek works: syvatotis (compatibility) and logos (study of something). Karwowski [18] stated that the necessity to establish strong ergonomic basis as a confirmatory discipline for symvatology.

System compatibility must be taken into account by the relation with system complexity. The artifact-human system achieves greater compatibility and small complexity rates in the most optimal level of system design. The change from largest to smallest stages of system complexity, however, does not always assure or leads to greater compatibility with the system. Indeed, system compatibility is increased in most artifact-human systems as system complexity rises [19]. Figure 2.1 illustrates the ergonomic compatibility complexity (ECC) needed to improve ergonomic compatibility at the micro- and macro-ergonomic levels.

The lack of complexity described as artifact-human system disintegration is expressed in the tangible ineffectiveness of the system and the related personal losses [21]. Karwowski *et al.* [21] suggested the concept of complexity- incompatibility, to express the inherent relation among system complexity and system compatibility. Authors stated that if the complexity of the artifact-human system rises the incompatibility within the elements of the system through its ergonomic relations at all system levels also raises, resulting in wider entropy of the system which cannot be eliminated and reducing the capacity for successful ergonomic approaches.

2.3. Macroergonomic Compatibility Factors and Elements for Work System Design

The primary aim of macroergonomic concepts is to evaluate firms on macroergonomic variables in order to enhance the design/redevelopment of work systems (e.g., manufacturing systems). This objective is accomplished when macroergonomic variables are improved mainly because of the fact that organizational efficiency, competitiveness, customer satisfaction, as well as workplace safety, security, and health are

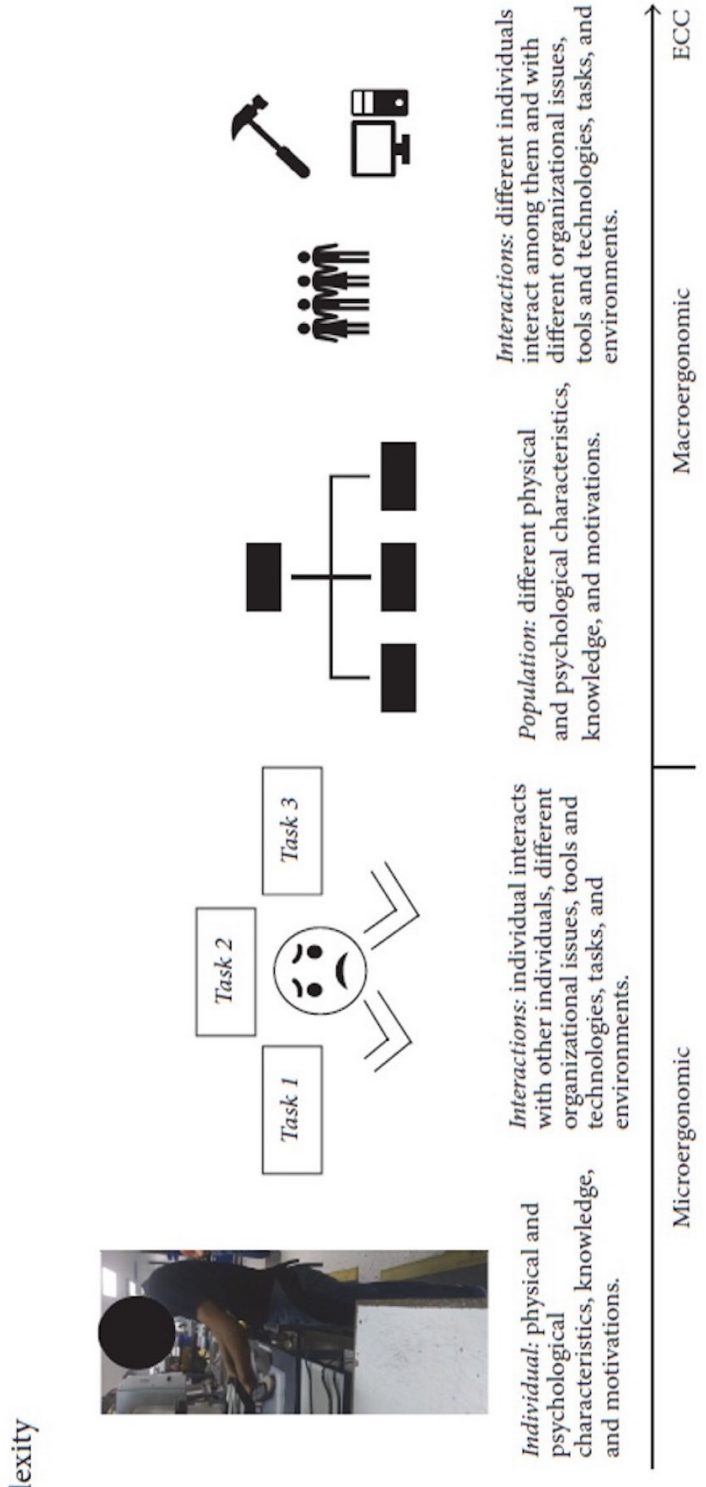

Figure 2.1. Ergonomic compatibility complexity at micro- and macroergonomic levels (Source adapted from Realyvásquez and Maldonado-Macías [20]).

enhanced.

Realyvásquez *et al.* [22] have the most elaborative research in the literature which contains the macroergonomic factors and elements and their direct, indirect, and total effects on three manufacturing system performance variables: Customers, production processes, and organizational performance. Realyvásquez *et al.* [22] outlined the main factors used to establish metrics of compatibility and to evaluate the dynamics and techniques commonly utilized for indices development, as well as their numerous positive gains. In their study they divided macroergonomics factors of the work system design mainly two categorizes: Carayon's model and Hyer's model.

Carayon and Smith [23] argued that the following five elements compose the organizational structure: (1) person, (2) tasks, (3) technology and equipment, (4) environment, and (5) organization. Those components were split into very primary types by the authors, named macroergonomic elements. They said that these five components of the balance framework work effectively to serve the loads and resources for individual and organizational objectives to be achieved. While in terms of motivation, success and job tension, there are some of the possible negative aspects of the elements, there are also upsides of each that can offset the adverse impacts.

A research was performed by Hyer *et al.* [24] to maximize both the technological and social aspects of system. To accomplish this purpose, their goals for the conceptual building stressed the development of a safe work atmosphere for workers while delivering high quality goods which always met rapidly consumer demands. As it shown in their study their first priority was the sustain a healthy workplace for their employees. Macroergonomic person elements such as employees' skills, coordination, and communication and supervision styles, performance assessment, and employee compensation were mentioned in their conceptual scheme for work cell structure. As for the task factor, Hyer *et al.* [24] proposed that macroergonomic elements such as task variation, capacity utilization, and participation of employees in decision-making be properly considered.

Koyuncu *et al.* [25] exclude a thorough extraction of the main indicators from a specific angle, so they discuss critical components to be included in the development and assessment of the organizational framework. Employee education, expertise, talents, physical characteristics, psychological characteristics, and variety of tasks are some of these elements. Likewise, the study suggests that we need to prioritize following components to improve the efficiency of the work system: individuals, technology, and the environment.

In their analysis, Realyvásquez *et al.* [22] reported that Carayon [26] model is coherent with majority of the macroergonomic elements in Carayon *et al.* [27] model. Carayon [26], nevertheless, differs primarily in some elements. For instance, for the macroergonomic person factor it differs for motivation and needs element. Similarly, Chui *et al.* [28] based the Carayon *et al.* [27] model to analyze factors and elements of the work system and research how customer service process are influenced by all of these factors and elements. According to recent studies and Realyvásquez *et al.* [29] study the most discussed macroergonomic factors are: (1) the Person factor, (2) the Organization factor, (3) the Technologies and Tools factor, (4) the Tasks factor, and (5) the physical Environment factor. Although the macroergonomics factors and elements are represented in Figure 2.2 separately, and macroergonomic compatibility factors are independent, we must consider that they have a double-sided effect on each other.

To sum up, a macroergonomic concept leads to enhanced performance, service efficacy work health and safety, and the job satisfaction within a business environment. Consequently, to do this, the following macroergonomic factors and their elements and interactions between those elements should be considered: (1) the Person factor, (2) the Organization factor, (3) the Technologies and Tools factor, (4) the Tasks factor, and (5) the physical Environment factor.

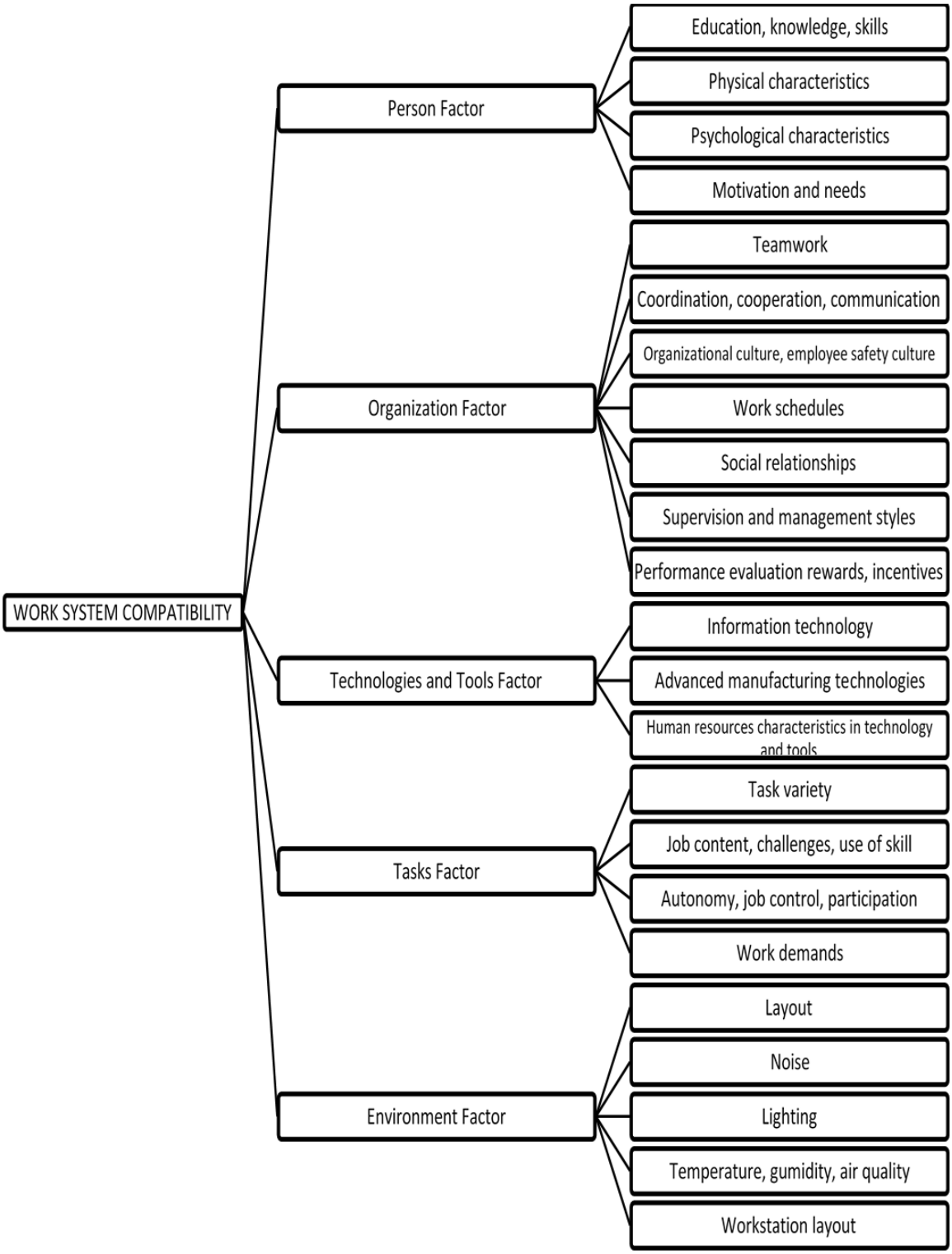

Figure 2.2. The five macroergonomic factors and their elements (Source adapted from Realyvásquez and Maldonado-Macías [20]).

2.4. Person Factor and Elements

According to the above literature, the person factor composed by four elements: (1) Cognitive skills, education and knowledge; (2) physical characteristics; (3) psychological characteristics; and (4) motivation and needs.

2.4.1. Cognitive Skills, Education, and Knowledge

Education is defined as "a process of teaching, training, and learning, especially in schools or colleges, to improve knowledge and develop skills" by the Oxford dictionary. As one of the first element recent studies showed that education factor is very important in order to performance of individuals and to reach the business' goals. Moreover, recent studies showed that there is a relation among education, skills and knowledge.

Hyer *et al.* [24] conducted a study to suggest a comprehensive model for cell system design. Their new model takes into account technical and social dimensions simultaneously. In these model decisions to create new model person factor also has included with its elements: education, skills and knowledge. In their study they made three stage: proposing model, making decisions, and implementing and evaluating and improving new model all the time. In second stage (making decisions stage) they established training activities. These training activities has started with team start-up training for each cell team. In this phase additional training activities are provided when in need. Job-rotation and cross-training activities also is supplied for the employees. With the help of the education, they aim to improve employees' skills and enhance the supportive coordination and collaboration in teams. Their efforts indicate the relation between education and training with psychological characteristics of the employee. After decision stage, the implementation stage, they proposed a role which is "The transition manager". This person's only responsibility was the assisting employee when they need and sustaining education processes all the time. This research showed the importance of training activities and applying these activities periodically is also crucial to sustain the developing skills.

Skill is described as "the ability to use one's knowledge effectively and readily in execution or performance" [30]. In the literature, skill as a one of the macroergonomic compatibility element is considered in different concepts. For the manufacturing industries employee skill considers the hand skills to perform the tasks. Although this thesis aim is to analyze the effects of the person factor in specifically consulting service industry, cognitive skills is the core skill to perform high performance for every employee. Cognitive skills are consisted of various elements such as: socio-cognitive variables for instance decision-making, response time to process the tasks, accuracy of the work outputs and so forth.

Individuals need a broad range of skills to contribute reach business's goals and reach their needs and sustain motivation for every industry. Hyer *et al.* [24] emphasized the importance of enhance the managing individuals' skills with training activities and raise individuals' knowledge and in case of inadequate skill of the employee providing cross-training, job rotation.

Knowledge is defined as "Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject." from Oxford dictionary. Hyer *et al.* [24] in their study they aim to enhance to employee's knowledge to be capable of the responsibilities and job tasks with the help of training activities. Similarly, Carayon and Smith [23] pointed out the importance of the skills and knowledge element and they emphasized the inadequate skill can be compensated with training activities. Smith and Carayon [31] focused on the effects of the inadequate skills, knowledge or education on the motivation, performance and psychological characteristics. They found that it is related to stress and poor performance.

Clegg [32] conducted a study to offer sociotechnical principles for work system design from a macroergonomic perspective. In their criteria job features is described and one of the macroergonomic person factors element which is knowledge, skills and training is accepted one of the vital elements for the macroergonomic compatibility. Similarly, Sittig and Singh [33] studied the same topic in a different industry. They

also for proposing a sociotechnical model in complex work systems they considered eight elements such as the Person, Organization and Technology. They examined the education, skills, and knowledge element of the macroergonomic person factor, and they claimed that in order to sustain safe, efficient systems employees need to have adequate proper knowledge, skills, and training. Also, in similar research area Holden *et al.* [13] conducted a study to derive 30 principles for successful change management. For the principles, they made recommendations for macroergonomic practices. In those study there are principles that mention the importance of person factors and elements such as knowledge, education, skills, and motivation. Supplying training activities in order to enhance skill is stated in their principles.

Azadeh *et al.* [34] in their study considered all macroergonomic person factor elements and needs were applied macroergonomic method. Their results demonstrated that training is necessary to achieve an integrated macroergonomics program and have a positive effect on the system productivity and reliability. More specifically, the recent studies showed that businesses utilize an approach to improve their organizational performances by enhancing the employee skills. Drucker [35] claimed that since tasks becomes knowledge-dependent, knowledge-based training gain importance as well as skills-based education.

Erensal and Albayrak [11] analyzed the macroergonomic person, organization, and environmental factors utilizing analytical hierarchical method. Authors stated that person factor should consider employee education, knowledge, and skills, employee motivation and needs, and employee psychological characteristics elements. They stated that the knowledge, skills, and training element have an impact on the worker performance. With respect to employee performance indicators, they considered the main abilities to perform tasks, behavioral requirements in teams, and change capacity.

Koyuncu *et al.* [25] conducted a study to determine critical elements which play critical role to sustain successful work system with macroergonomic approach. Rather than considering all macroergonomic elements they took into account 3 important char-

acteristics to achieve their research goal. According to the authors personnel subsystem should include the degree of professionalism, skills, knowledge, formal education, training and experience.

The concept mesoergonomics was presented and explained by Karsh *et al.* [36] as an open-system approach to ergonomic theory. The mesoergonomic method explores the relationships between variables in at least two distinct levels. The authors used the model proposed by Karsh *et al.* [37] to describe elements, which considers the macroergonomic elements of the personal factor examined in mainly three categories. One of them is employee education, knowledge, skills, and training.

To sum up, recent studies showed that education, skills and knowledge is crucial elements of the people factor and there are obvious relations between those elements, such as adequate training helps employee to enhance their skills and knowledge. Recent studies were generally focused on manufacturing industries. Since the author's aim is to conduct this study in consulting service work system cognitive skill is considered for this element. As it mentioned, this element has a direct effect on employee psychical characteristics, employee psychological characteristics, employee motivation and needs and employee performance.

2.4.2. Physical Characteristics

Physical characteristics of the individuals' is the one of the important elements of the macroergonomic person factor. Especially, in the manufacturing work systems tasks require physical efforts. Therefore, recent studies focused on the physical characteristics such as strength, health status, size, weight, fatigue, posture, age, gender and so forth. Recent studies showed that required physical characteristics depends on the work system and tasks. Therefore, it is important to understand the key physical characteristics and effects of them on performance metrics and other macroergonomic person factor elements.

Although this research's main scope the analyze the effect of the person factors on system performance recent studies also showed that not only work system productivity and reliability is affected by the employee physical characteristics but also work system has the considerable effect on the employee physical characteristics. Azadeh *et al.* [34] mentioned that the inadequate system designs cause the posture illnesses. Authors also the importance of anthropometry studies for employee and investigated the specific measurements: "working postures, height, weight, seating position, and standing position" since those studies are highly related to enhance of system performance with respect to productivity and reliability. Similarly, Carayon and Smith [23] argued the work system elements. According to authors all five macroergonomic factors and for the person factor all four elements mention in this thesis are required to create sustainable work systems. They pointed out the physical characteristics of the individual can be affected by the work design and jobs. For instance, they stated that the work pressure which has over burden on the employee may cause the poor work control or stress level of workers which is one of the major low performance indicators.

Thereafter previous study, Carayon *et al.* [27] developed the model consisted of all five macroergonomic factors. They stated the employee physical characteristics has an important impact on the employee performance which can affect significantly the customer satisfaction. Workers' physical condition is directly related with the work output and customers thus with the work processes. Similary, Fruggiero *et al.* [38] examined the relation between workers' fatigue levels and performance of the work system. Results of the study showed that process effectiveness is highly correlated with the fatigue of the employees.

Robertson *et al.* [39] also studied flexible workplace design with the macroergonomic approach, and they focused on the effects of macroergonomic implementetations on Psychological and social working atmosphere, employee physical status, and job efficacy at the workplaces such as the office of headquarters. The results indicated that Physical Characteristics are highly related to rise performance indicators specifically, organizational, employee, work output, work processes quality and so forth.

Karsh *et al.* [36] developed the term "mesoergonomics" which is described by authors as a new approach to ergonomic theory in which research is interested the relations between variables in at least two different levels. To obtain those elements they used the model which is constructed by Karsh *et al.* [37]. In this model, macroergonomic Person factor elements examined in mainly three categories as already mentioned in previous person element. Second element is physical characteristics of person which is analyzed basically these measures: size, weight, reach and strength. In their categorization third elements is the age, gender, ethnicity and language which are studied differently when individual's physical characteristics with regard to other studies in the literature on the macroergonomic person factor.

Realyvásquez *et al.* [40] analyzed the effects of macroergonomic person factor elements on the performance of the manufacturing work system. They took into account three elements respectively: Physical Characteristics, Psychological Characteristics, and Motivation and Needs and three performance elements respectively: Customers, Production Processes, and Organizational Performance. Their results showed the Physical Characteristics of the employee have an effect on the other person factor elements and the organizational performance.

To sum up, physical characteristics of the individuals' in the work system is both affected the by the work system environment and affect the work system performance and the work systems need to be designed to fulfill needs of employee to work in healthy work-place and does not cause any discomfort of the employee since the physical characteristics of the individual has an effect on performance indicators of the work systems and other two macroergonomic elements which are motivation and needs and psychological characteristics.

2.4.3. Psychological Characteristics

Psychological characteristics is one of the vital elements of macroergonomic person factor. Psychological characteristics in the literature was described with various

indicators. Self-esteem, emotion, perception, cognition, work attitudes, coping behaviors (stress management), ability to determine personal aims, intrinsic motivation and so forth. All these indicators were found related to perform high achievable performance of the individuals in the work systems.

Carayon and Smith [23] stated that personality is the determinant to react the circumstances in the workplaces since personality is formed by recent experiences and social status. also stated that psychological responses of the person are the product of personality, past experiences and the social situation. Therefore, psychological characteristics may affect the performance of the system and the motivations of individuals. For instance, Flynn *et al.* [41] stated that importance of the effects of the positive work attitudes on problem solving by individuals, raise of the supporting colleagues and decrease in postpone of tasks to managers.

Azadeh *et al.* [34] utilized the approach with examination of the traditional human factors engineering and macroergonomics simultaneously. When they took psychological characteristics of employee as a macroergonomic person factor element, they examined the effect of the stress symptoms. Results showed that employee psychological characteristics have positive effect on productivity of the work systems and reliability of the systems.

Carayon *et al.* [27] expanded the model for the patient safety considering all main five macroergonomic factors. For the person factor Carayon *et al.* [27] considered all four elements: education, skills, and knowledge, physical and psychological characteristics, and motivation and needs. Their study showed that psychological characteristics of employee effects the performance of work system.

Similarly, Chui *et al.* [28] conducted a study to characterize and define the characteristics of the workplace environment for patient safety. Since, in their model, individuals are the core of the work framework, they considered all macroergonomic person factor elements together. Authors stated that situation awareness which is being

able to follow consciously and with knowledge what is happening around as the crucial feature that each employee need to have. And their study showed that psychological characteristics is important element when analyze the person factor.

Holden *et al.* [13] in their study also analyzed psychological characteristics of individuals in work system and they mentioned in their principles. One of their principle is mentioned as the managing individuals' stress responses. With the help of the principle, they aimed to reduce individuals' psychological illnesses, distresses, and stresses. They believed that the key indicators of psychological characteristics were being transparent and fair, getting guidance, demonstrating respect and appreciation, and generally expressing a perception of psychological safety.

Erensal and Albayrak [11] emphasized the ability to evolve the positive work behaviors, having self-confidence, communicating with colleagues and managers are the core abilities that employee need to have in order to raise employee and system performances.

Realyvásquez *et al.* [40] examined the worker on the performance of the work processes, as described in previous pages, and the findings showed that psychological characteristics of the worker have a significant direct impact on the motivation and needs of the employee and the performance of the production system.

In conclusion, psychological characteristics of individuals are very important for all industries since its effects can be observed on employee motivation and organizational, individual performance and service and/or production processes. both are affected and affect the work system performance. Since literature review indicated that psychological characteristics of the individuals' in the work system is both affected the by the work system environment and affect the work system performance, carefully determining the employee characteristics and demands which are asked to perform from employee such as workload, pressure and so forth, is crucial to for both employee and organizations to sustain high work performance.

2.4.4. Motivation and Needs

Motivation is the term originated of the expression 'motive' that indicates the subject's needs expectations, demands or pushes. It is the method of encouraging people to take action to accomplish their goals. In the context of a career goal, motivation for income, achievement, appreciation, career progression, good communication, etc. may be the personal qualities that stimulate people's actions.

As it stated in previous pages, Erensal and Albayrak [11] considered three factors to examine the work systems with macroergonomic perspective. They stated that person factor should include all four elements. For the motivation and needs element, they inherent drive, system of individual worth, organizational loyalty, satisfaction in the job, a commitment on widely accepted business strategies stated as the core indicators to assess if an employee have the personal motivation and needs are fulfilled. They also indicated that by adopting strategies that foster motivation, business executives require should go further than theory and into practice.

As it stated in previous pages, Koyuncu *et al.* [25] conducted a study to determine critical elements which play critical role to sustain successful work system with macroergonomic approach. Rather than considering all macroergonomic elements they took into account 3 important characteristics to achieve their research goal. According to the authors personnel subsystem should include the values, perceptions, mores, and attitudes with regard to individuals' motivation and needs.

Similarly, Clegg [32] in their principles they explored the job features with respect to motivation and needs element of the macroergonomic person factor. In their criteria they stated the important work features as learning opportunities, a field of decision-making that can be owned by the employee, a degree of social assistance and encouragement, ability to relate what one does to a broader life, and a desired outcome. As authors stated in their principle, motivation and needs one of the vital elements for the macroergonomic compatibility and with the help of the principle, they aimed to

create macro ergonomically compatible work system.

Holden *et al.* [13] also in their study emphasized the importance of the motivation and fulfilling of the needs. They stated their purpose in one of the principles as creating control and competence of individuals' approach principle. With this principle their goal was to establish a degree of stability by enabling decision-making by manager and people involved and convincing individuals to be voluntary. Convincing people that they have the skill and knowledge required to take part effectively is also one of the benefits of the principles.

The concept mesoergonomics was presented and explained by Karsh *et al.* [36] as an open-system approach to ergonomic theory. The mesoergonomic method explores the relationships between variables in at least two distinct levels. The authors used the model proposed by Karsh *et al.* [37] to describe elements, which considers the macroergonomic elements of the personal factor examined in mainly three categories as already mentioned in previous recent pages. Third and last element is motivation and needs. They examined this factor mainly four areas such as: needs, biases, beliefs and mood of the individuals.

To examine human-system interaction, Marras and Hancock [42] conducted a study. They concluded that motivation, physical characteristics and social relationships of individuals are main dimensions of human–system interaction research. When analyzing the human motivation factor, the authors considered factors such as perceived work demands, tolerance and stability of decisions, work triggers, social support, career progression, psychological distress, potential psychological energy, willingness to perform the task, and risk perceptions related to job that influence human motivation.

Realyvásquez *et al.* [40] examined the worker on the performance of the work processes, as described in previous pages, and the findings showed that motivation and needs of the worker have a significant direct impact on the production system variables: customers, production processes, and organizational performance.

To sum up, motivation and needs of employee is one of the most important elements of people factor. Recent studies showed that motivation and fulfilled needs of individuals has positive effect on work system performance. Therefore, supporting motivation and determination and supplying needs is vital to organizations aim to enhance their organizations' performance. In Table 2.1 summary of literature that mention macroergonomic compatibility person factor elements are represented.

Table 2.1. Summary of literature that mention macroergonomic compatibility person factor elements.

Element	**Cognitive Skills, Education and Knowledge**	**Physical Characteristics**	**Psychological Characteristics**	**Motivation and Needs**
Reference	**[9, 11, 13, 20, 22–25, 27, 28, 33, 34, 37, 40, 43]**	**[9, 20, 22, 23, 27, 28, 34, 37, 38, 40, 42, 44]**	**[9, 11, 20, 22, 23, 25, 27, 28, 34, 40, 43]**	**[9, 11, 20, 22, 23, 27, 28, 34, 37, 40, 42, 43]**

2.5. Consulting Industry

Service industry, also known as the tertiary sector, produces immaterial goods more precisely services rather than goods, and contains numerous service industries, such as warehousing and transportation services, information sector services, commodities, specialist, technical and scientific services, health care and social support services and so forth. A service work system combines individuals and technologies that optimally evaluate and adapt to an evolving asset of information of a system. Services have become the most important part of the markets of most developed countries in past decades. Service can be described as the usage of resources to support other [45], that can be interpreted as service is a type of stimulation efficiency, or assurance that is generated through interacting operations for an interest between the service provider

and service customers. The main aim of engaging together in harmony is to create value in complicated business functions and structures [3].

Consulting is a type of professional service that has been rapidly evolving since the late nineteenth century. The primary goal of the consulting companies is to offer assistance with the guidance of their deep expertise to enhance the business strategy of customers regarding the strategic concepts. Popularity and growth of consulting services and business needs consulting services can be explained by the following two reasons: (1) Clients usually do not have the broad point of view required since management skills, techniques, and expertise are best learned through exposure, implementation, and participation with a broad range of sectors in different businesses and (2) Clients need an external and independent insight for problems that couldn't be detected due to work blindness (Drucker, 1979 as cited by Aguilar and Vallejo [46]). Consulting industry firms can be classified into five main segments [47], which are illustrated in Figure 2.3

Management Consulting

Management consulting, also known as business consulting, is described as consulting or deployment services to enhance the efficiency of the corporate plan, business outcomes and functional operations of customers for (senior) organizational management.

Strategy Consulting

The significant percentage of consultants perceive strategy consulting, also referred as strategy consulting, strategic consulting or boardroom consulting, as the most 'elevated' and respected segments of the qualified services industry [47]. The strategy consultancy area specializes on facilitating the implementation of business, organizational or operational objectives for private market clients and assisting public market companies and initiatives with financial strategy.

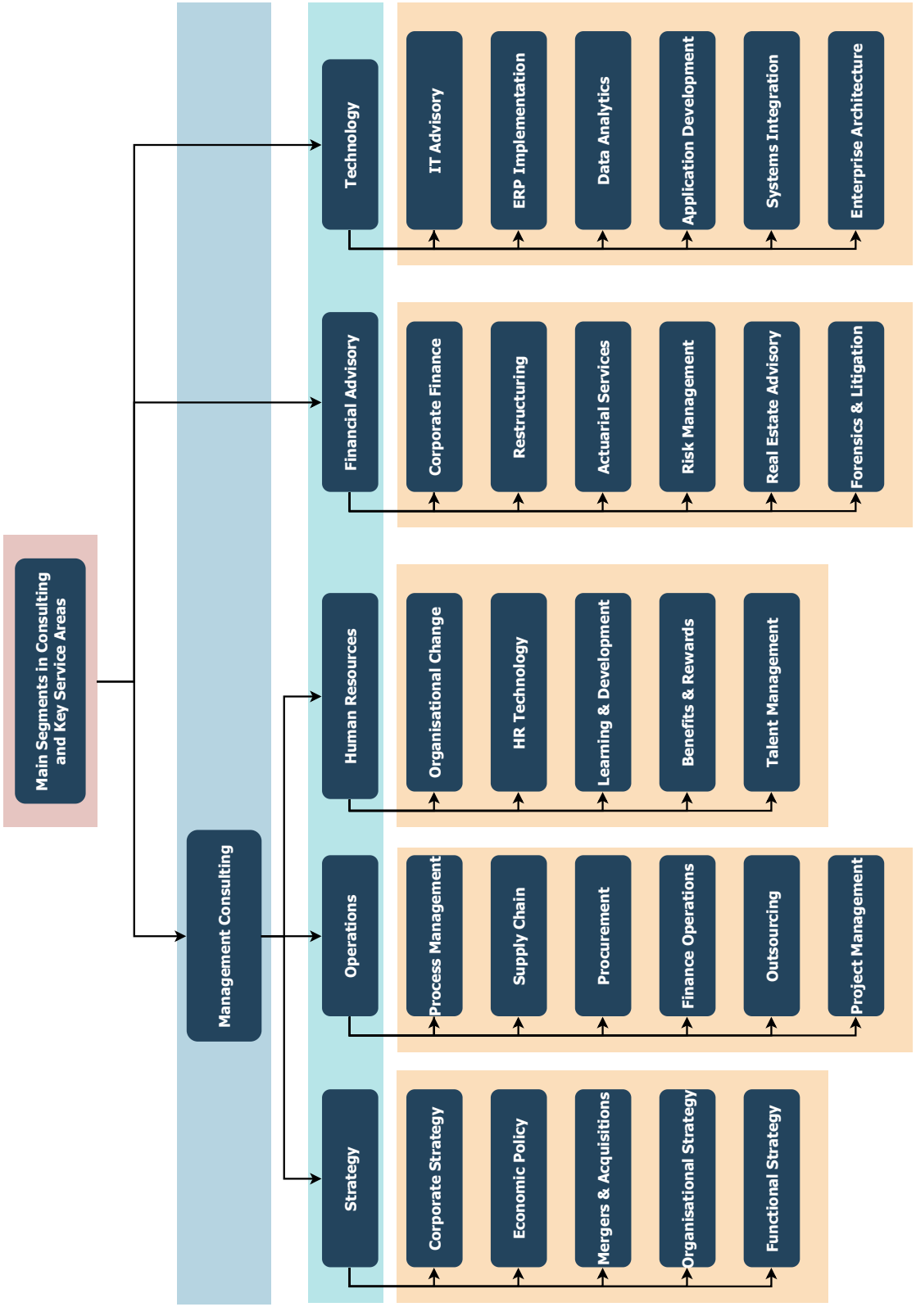

Figure 2.3. Main segments in consulting and key service areas (Source adopted from [47])

Operations Consulting

Operations consulting, also known as operations management, is described as outsourcing and/or implementation services that enhance the company processes and effectiveness of a business in the global marketplace [47]. Consulting projects for operations management yield more successful system utilization by guiding and facilitating adjustments to the desired business strategy, operational workflows, organizational strategies cultures and other elements of the value stream.

Human Resource Consulting

Human resource (HR) consulting, also known as human capital consulting or HRM consulting, covers guidance and execution practices associated with the administration of the personnel resource of an organization and the HR role. The range of work differ from overarching work on human resource strategic plan to the development and planning of a reward system approach down to the transformation of the organization [47].

Financial Advisory

The Financial Advisory (or financial consulting) category offers consulting services that operate on a decent financial analytical basis. Service solutions cover a broad scope of fields, such as transaction services, risk management, tax consulting, real estate consulting, regulation and litigation services however financial and accounting expertise seem to be at the center of the services provided [47].

Technology Consulting

Technology consulting companies help to establish a brand-new sense of shared purpose to take a major transition forward in the digital age since enterprises are looking forward to exploring the best solutions for technological innovations that can

resolve their existing problems with a revolutionary vision and renovate their business. In particular, IT consulting firms assist customers in these areas: designing and implementing IT solutions or establishing effective IT practices; training employees in IT disciplines such as setting up hardware/software architecture, network setup and maintenance, cyber security, and promoting for search engines; and offering strategic guidance on social networks and IT topics [47].

2.6. Consulting Work System Performance

In order to survive in highly competitive business systems, companies, regardless of the sector they work, strive to develop their business systems and improve their performance. For this purpose, in order to achieve their strategic short- and long-term objectives, it is very important for businesses to evaluate the key performance metrics for business system efficiency.

While there are bunch of system performance indicators, consulting firms need to recognize and prioritize performance metrics which can help them successfully handle this competitive environment with the industry evolving so rapidly. As highlighted by Bisogno *et al.* [48], the performance metrics of the operations of businesses should be incorporated with the mission and goals of organizations. Well-performing consulting companies tend to have a more comprehensive strategy regardless of their company size or type of organization, consisting of the proper tools and systematic processes to gather and evaluate information for measurement and inspecting.

To sum up, considering components of the consulting business system and the functions businesses operate, the performance of the consulting work system can be assessed accurately with four key metrics: employee performance, customer satisfaction, service process and organizational performance.

2.6.1. Employee Performance

Although systems and artificial intelligence have been started to carry out tasks with the help of rapidly evolving technology and digital transformation revolutions, human resources continue to be an essential resource for all business systems, especially the consulting industry. Employees are the most important element of the performance of service and company, as they provide services by accurately analyzing client demands (Lovelock, 1985 as cited by Kostopoulos *et al.* [49]). The degree of employee job satisfaction is closely linked to strong company's performance since job satisfaction increases the loyalty of employees to the organization by Jiang *et al.* [50].

To sum up, macroergonomic person factor elements strongly effect the employee performance and also employee performance is the key variable that affect all other performance indicators of consulting work systems, which are customer satisfaction, service process and organizational performance. Bakker *et al.* [51] stated that organizations will achieve more satisfied customers and, thus, excellent operational performance with well-dedicated and enthusiastic employees who are willing to devote their assets and passion to the organization.

2.6.2. Customer Satisfaction

The service system reflects the "value-in-use" concept. Therefore, without clients, any product or service system unable to last their existence. Customer satisfaction, unlike other industries, is even more critical since services are provided in the consulting industry. Cosier and Dalton [52] stated that there is an important need to satisfy the client as repeat business comprise up a substantial proportion of the portfolio of the consulting business, and this often produces a challenging balance.

Yau and Sun [53] collected indicators of service performance assessment and developed the framework of performance assessment based on four aspects of customer, economical, knowledge, productivity and business processes. Aydiner *et al.* [54] in-

dicated that the performance indicators of the satisfaction of consumer needs, competitiveness in the business functions of the business, and quantitative measures that reflect the profitability of the business to succeed in the market is often seen as service businesses' key success factors. Simon and Kumar [55] claimed that consultants should have five critical strengths to communicate to and acknowledge the client, service quality, client engagement, professionalism and fairness and practical skills in order to have remarkable service process quality and project outcomes from the consumer point of view. They explained that all those qualities are associated to consulting businesses' five major performance criteria: reaching targets customer satisfaction, timeliness of delivery of services, implemented suggestions, and ensuring successful outcomes.

2.6.3. Service process

Service process are the products of service industries organizations and have a vital effect on the overall performance of both the level of organization and customer satisfaction. Since consulting firms are project-based businesses that have a remarkable amount of time and budget, they continue to evaluate numerous project metrics as critical measures of company performance. Delivering services resulting in high projects refers to an impressive customer perception by the businesses. Organizations can gain extended customer loyalty, productivity, and, consequently, long-haul profitability by coordinating high levels of high-quality project activities.

I-Ming *et al.* [56] explored the relationship between quality of service, customer experience, and loyalty and revealed that customer satisfaction through regression model has a significant positive impact on customer loyalty. Kostopoulos *et al.* [49] advised that service providers should ensure that the service they provide to their customers is built up of high-quality service process and also projects in order to generate value for its customers. Consulting firms backed by more innovations, more projects, and more agreements that have been growing from the era of knowledge and technology, could reach rapidly increasing important financial success criteria such as revenues and profit. International Data Cooperation also claimed in this aspect that advanced

consulting firms concentrate primarily on performance indicators from clients, projects and employees.

2.6.4. Organization Performance

Ittner and Larcker, (1998) (as cited by Ryu and Lee [57]) suggested that there are different metrics of non-financial performance, such as operational efficiency employee performance, market growth, customer satisfaction, use of capacity, and innovation. With regard to financial organizational indicators, the growth of sales, net profit margin, and cash flow are included. Strategic objectives and management strategies should also serve the purpose of monitoring the performance of the work system and enhancing the performance of those actions in which their performance is measured.

In conclusion, there are four main categories of consulting work system performance indicators: customer satisfaction, employee performance, service process and organizational performance. Those all indicators will help to understand, assess and improve the system performance in the global competitive age especially for consulting industries. Although various performance assessment metrics have been proposed for service work systems in the past literature, in order to achieve sustainable work system with growing performance, those four indicators need to take into account comprehensively.

2.7. Macroergonomics studies on Consulting Work System

Although previous research efforts focused on the analysis of the macroergonomic factors and its elements on manufacturing industry and analysis the consulting work system with other approaches, there are only few studies which investigated the effects of macroergonomics factors on service sector such as consulting. First steps to examine consulting work system performance ergonomically have taken by Kaya [58]. He investigated the effects of "macroergonomic organization factor" on the consulting system performance. He emphasized the importance of the analyzing consulting work system

performance ergonomically in his master thesis, which is conducted by the author and thesis advisor Prof. Dr. Mahmut Ekşioğlu at Boğaziçi University. Kaya [58]focused on the specifically management consulting work system performance considering the macroergonomic organization factor elements. Kaya [58] considered three performance metrics to evaluate management consulting work system performance. These metrics are namely: employee performance, firm performance and client. In his study, covariance-based SEM was utilized to analyze the relations between independent variables (macroergonomic organization factor elements) and dependent variables (management consulting work system performance metrics). Results of the study revealed that Supervision and Management Styles have the most powerful effect on all the performance indicators that have been investigated. Therefore, this organizational macroergonomic element is found as the most significant contributor to the competitiveness of the management consulting companies operating in Turkey.

2.8. Summary of Findings Related to This Study

The findings from the literature can be summarized as follows:

- In the literature, the most discussed macroergonomic factors are: (1) the Person factor, (2) the Organization factor, (3) the Technologies and Tools factor, (4) the Tasks factor, and (5) the physical Environment factor. The person factor composed by four elements: (1) education, skills and knowledge; (2) physical characteristics; (3) psychological characteristics; and (4) motivation and needs. There are four main categories of consulting work system performance indicators: (1) customer satisfaction; (2) employee performance; (3) service process and (4) organizational performance.
- Macroergonomic compatibility can be defined as the ability of organizational constraints, technology elements, tasks, and the environment to integrate and work within a business system in an efficient, effective, appropriate, and orderly manner [2]. If the work system has compatible design and has been carried through from micro- to the macroergonomic design of jobs and human-machine

interfaces, then the work system design is said to be harmonized. Harmonized work systems are productive, safe, have higher employee satisfaction and quality of working life, and fewer job hazards [3]. Therefore, it is important to establish macroergonomically compatible working systems.

- The primary aim of macroergonomic concepts is to evaluate firms on macroergonomic variables in order to enhance the design/redevelopment of work systems (e.g., manufacturing systems).
- Recent studies mostly focused on the advantages of macroergonomics for the manufacturing industry, there are very few studies investigating the effects of macroergonomics factors on a system's performance. Although previous research efforts analyze the macroergonomic factors and its elements on manufacturing industry, there is still no study investigating the effects of all four macroergonomic person factor elements over the consulting work system's performance.
- A service work system combines individuals and technologies that optimally evaluate and adapt to an evolving asset of information of a system. Consulting is a type of professional service. The primary goal of the consulting companies is to offer assistance with the guidance of their deep expertise to enhance the business strategy of customers regarding the strategic concepts.
- Considering components of the consulting business system and the functions businesses operate, the performance metrics of the consulting work system are: (1) Employee Performance, (2) Customer Satisfaction, (3) Service Process and (4) Organizational Performance.
- Recent studies mostly focused on the organizational performance metrics to evaluate work system performances. In the literature, as it mentioned studies were focused specific metrics to assess work system performances e.g. employee performance, job satisfaction, productivity etc. Especially, for consulting work system, there is still no study integrating the all four performance metrics that are determined considering the consulting work system functions and operations.

Summary of the related research and papers are summarized in Table 2.2.

Table 2.2. Summary of the selected research and papers from the literature.

STUDY	PURPOSE	METHOD	MAIN FINDINGS
[59]	Examining the relationship between job satisfaction and organizational commitment through both personal and corporate concentrations.	They use a multilevel structural equation modelling.	Results showed that job satisfaction is a fundamental indicator in both worker and business unit stage corporate involvement.
[34]	Presenting an interactive macroergonomics model with the use of an overall framework method focused on the combination of traditional human factors engineering and macroergonomics concepts.	They implemented statistical tests, Kruskal-Wallis Test, on questionnaire survey data.	Study results showed that the importance of total human factors on job pressure. They also concluded employee motivation and needs, and physical characteristics increases system productivity and reliability.
[23]	Examining the impact of socio-technical and business trends on work organization and ergonomics.	Through the application of "Balance Theory" research is carried out.	Their study claimed that jobs and organizations are highly complex, could have many impacts on individuals (beneficial and harmful) and can also be restructured to satisfy both individual and corporate requirements.
[27]	Describing a work system model which is named "SEIPS" for patient safety.	In one specific healthcare system, which is outpatient surgery, the application of the SEIPS model is presented and some other theoretical and clinical implementations of the concept are defined.	The SEIPS model suggests a model for the interpretation of medical systems mechanisms and consequences and their relations that can be used for these functions.
[28]	Identifying and describing pharmacy work system characteristics (organization, tasks, tools/ technology, people, and environment).	To gather information, they used an analytical method and semi-structured interviews were utilized.	Collaboration, interaction, and organizing skills were found quite important.

Table 2.2. Summary of the selected research and papers from the literature (cont.).

STUDY	PURPOSE	METHOD	MAIN FINDINGS
[32]	Offering a collection of socio-technical concepts and several considerations of the function of concepts of such to drive design process.	Providing a viewpoint that is highly comprehensive than is evident in current modalities by including three broad types of principles: meta, content and process.	If the principles are essentially independent but reinforced by suitable techniques and instruments it is expected to be successful.
[11]	Improvement of the implementation of macroergonomics and increament of the efficiency of management decision-making in assessing the as total effects of three types of management focused on macroergonomic principles.	They utilized the Analytic Hierarchy Process as a decision-making technique with several parameters.	The analysis concluded that the better leadership style to boost the acceptance of macroergonomics is Management through Principles in terms of business cultural values, engagement, intellectual resources and behaviors.
[38]	Investigating the impact on results in a DRC framework of individual exhaustion.	A multi-agent system design was introduced combining system dynamics designing for each person. For interaction analysis, ANOVA was used.	Results showed that exhaustion is affected under not entirely occupied workplace practices by the functional concept applied by the framework. Exhaustion demonstrated a relation with the rest model in different circumstances.
[60]	Giving a summary of the person elements and ergonomics discipline and explaining its function in enhancing the safety of clients.	They provided five key suggestions to leverage human factors and ergonomics in patient safety improvement efforts and they used HFE principles, theories, tools and methods.	They found that to accelerate the rate of enhancing healthcare outcomes, human factors and ergonomics are needed to be applied in medical services.
[61]	Review of the systematic growth of ergonomics in the functional architecture and development.	Discussion of the fundamental principles of socio-technical structures and functional architecture.	The approaches and implementations of macroergonomics in the development of functional and task frameworks are summarized.

Table 2.2. Summary of the selected research and papers from the literature (cont.).

STUDY	PURPOSE	METHOD	MAIN FINDINGS
[13]	Investigating the conceptual or macroergonomic factors existing in healthcare systems.	Associated recommendations for macroergonomic research implementations are prepared for every principle.	They highlighted plenty of the different directions wherein efficient operational improvement concepts can be implemented.
[43]	Examining the impact of socio-technical and business trends on work organization and ergonomics.	A secondary context review of the outcomes of three analyses of the work of clients was implemented for health care system.	Their study demonstrated that how performance is influenced by macroergonomic variables converging through contexts and concentrations in expected and unexpected ways.
[24]	Proposing a broad cell system design framework that combines each technological and social aspects into account.	The author used a case-based method to evaluate the observation of the cell design phase of one entity.	They found that all significant changes were produced by a strategic direction, commitment to STS concepts of optimal allocation and worker engagement.
[37]	Proposing human factors engineering framework concerns the design of structures to maximize the efficiency of health care practitioners and minimize risk.	They developed a number of concepts, each proposing an original way to solve the issue, or at least a divergent one.	The study found that monitoring, review, and handling of incidents are significant tasks within a general health system.
[36]	The "mesoergonomics" term was presented and characterized as an open-system framework to ergonomic concept.	They used the model proposed by Karsh *et al.* [37]	In their study they used macroergonomic factors and elements to define the variables.

Table 2.2. Summary of the selected research and papers from the literature (cont.).

STUDY	PURPOSE	METHOD	MAIN FINDINGS
[18]	Proposing a new science of artifact-human system compatibility, symvatology.	Discussion of the core tenets of symvatology.	The significance of macroergonomic variables such as persons, organizations, and the environment must be understood by corporations. As for person factor elements the report states that the psychological and physical characteristics, education, experience, and skills of employees need to be taken into account.
[19]	Providing a theoretical perspective on human factors and ergonomics (HFE).	Proposing a theoretical perspective.	The results showed that he the design and management of systems that fit the criteria of human compatibility should be the key goal of the HFE.
[25]	Identification of factors that influence the performance of the design of the work system to minimize the incidence for macroergonomic incompatibility.	They used Fuzzy Analytic Network Process.	Authors stated that the developed model can recognize potential drawbacks of the work system design in starting phase.
[42]	Analyze the relationship between the person and system.	Review of person factors and ergonomics and proposing the new model in which physical and cognitive dimensions of workers are explored together.	Authors stated that human motivation, physical characteristics, and social relations are essential dimensions of human–system interaction analysis.
[62]	Evaluation and classification of the papers according to the macroergonomic factors and elements for work systems design.	Five primary groups, factors and their related subgroups, elements were classed from the studies.	The highest occurrence was shown by the macroergonomic organization factor, while the lowest occurrence was presented by the macroergonomic factor of Tools and Technology.

Table 2.2. Summary of the selected research and papers from the literature (cont.).

STUDY	PURPOSE	METHOD	MAIN FINDINGS
[20]	Assessment of macroergonomic compatibility grades in a production system.	They used the macroergonomic compatibility index (MCI) and the Macroergonomic Compatibility Questionnaire (MCQ).	Results showed that the person factor was the factor with the greatest rank of MC.
[40]	Analyzing the impact of macroergonomic person factor on the performance of the manufacturing work system.	SEM approach was utilized.	Results revealed that macroergonomic elements of the person factor have a considerable influence on the performance of the manufacturing systems.
[44]	Analyzing the impact of macroergonomic person factor on the performance of the manufacturing work system.	SEM approach utilized and data gathered with Macroergonomic Compatibility Questionnaire (MCQ).	Results showed that physical characteristics have considerable impact on the motivation and needs. They also found psychological characteristics and customers have considerable impact on the organizational performance.

3. RATIONALE AND OBJECTIVES OF THE STUDY

3.1. The rationale of the Study

Organizations need to follow the trends and most importantly adopt the change not only in technical aspects or production perspective but also human factors issues to stay competitive in today's business environment. Human factors issues are especially important in consulting sector, since its main asset is the workforce. While managing white-collar workforce, it is important to evaluate the person factor effects from ergonomical perspective.

Previous research mainly investigated the effects of the macroergonomic factors and its elements on the performance of manufacturing work systems, there are only few studies which investigated the effects of macroergonomics factors on service sector such as consulting. One of those studies performed by Kaya [58] investigated the effects of "macroergonomic organization factor" on the consulting system performance. However, there is no study that investigated the effects of "macroergonomic person factor elements" on the consulting work system performance such as employee performance, customer satisfaction, service process and company performance. Therefore, this study aims to achieve that.

3.2. Objectives

Based on the rationale, this research mainly focuses on the following two objectives:

(i) Developing a person factor-related hypothesis model representing consulting work system performance.
(ii) Determine the direct, indirect and total effects of the four person factor elements on the consulting work system performance metrics using the developed hypoth-

esis model.

Four person factor elements that are mentioned above are namely: 1. Employee Cognitive Skills, Education, and Knowledge, 2. Employee Physical Characteristic, 3. Employee Psychological Characteristics, 4. Employee Motivation and Needs. Similarly, consulting work system performance metrics are 1. Employee Performance, 2. Customer Satisfaction, 3. Service Process and 4. Organizational Performance.

In order to achieve the above objectives, the research questions are defined as follows:

RQ1: What are the effects of each macroergonomic person elements on the consulting work system performance and what are the relations between those elements?

RQ2: Which macroergonomic person elements are the most critical to sustain the high performing consulting work system and which relation between person elements have the important effect on the consulting work system performance?

4. RESEARCH METHODOLOGY

4.1. Hypothesis Model

This thesis aims to develope a person factor-related hypothesis model representing consulting work system performance. Four person factor elements that are namely: 1. Employee Cognitive Skills, Education, and Knowledge, 2. Employee Physical Characteristic, 3. Employee Psychological Characteristics, 4. Employee Motivation and Needs used to develope this model. Similarly, consulting work system performance metrics are determined and included as Employee Performance, Customer Satisfaction, Service Process and Organizational Performance. Related questionnaire items can be found in Table 4.1 for person factor elements and in Table 4.2 for consulting work system performance metrics.

The hypotheses were formulated based on the findings from the literature. As it explained in Section 2, studies are reviewed on ergonomics and consulting topics. Since the literature on these topics mainly focused on the manufacturing and work design areas, regarding the findings a new person factor-related hypothesis model is developed for consulting work system performance. Developed model is represented in Figure 4.1.

All hypotheses are represented with related hypothesis numbers in the Figure 4.1, for instance as H1. Developed hypotheses are listed in the below. Cognitive Skills, Education and Knowledge variable is represented as CS&E&K, Physical Characteristics is represented as PhC, Psychological Characteristics is represented as PC, Motivation and Needs is represented as MN, Employee Performance is represented as EP, Service process is represented as SP, Customer Satisfaction is represented as CS and Organizational Performance is represented as OP.

Hypothesis that are developed:

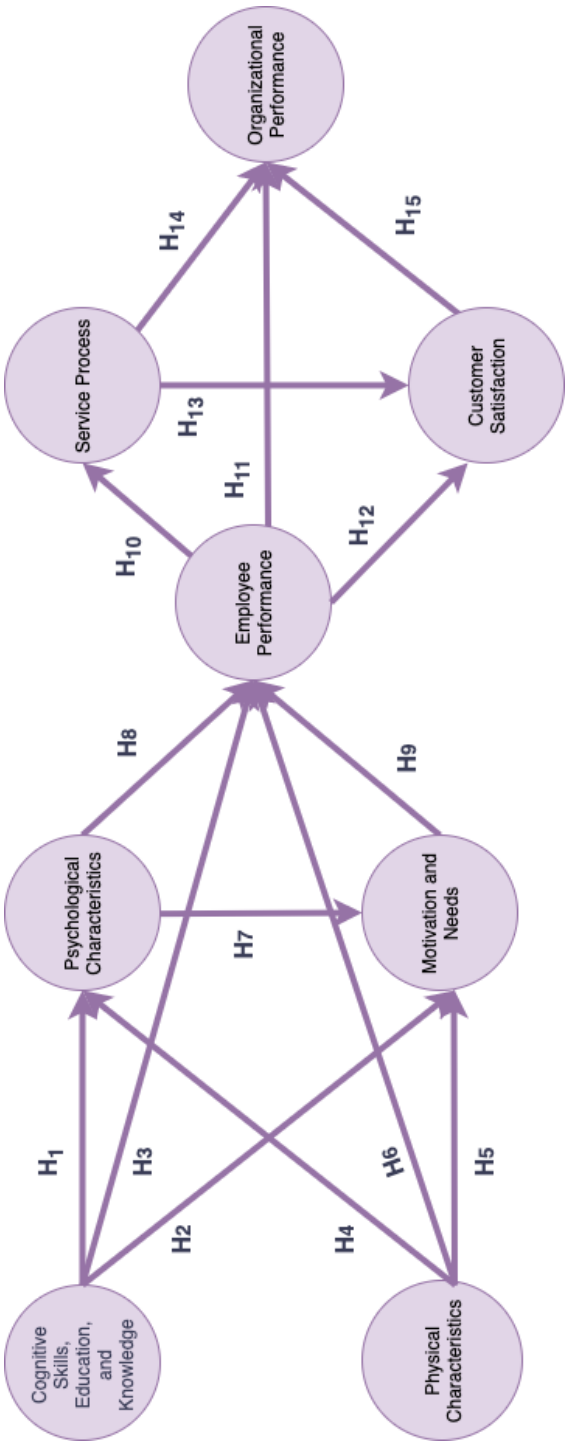

Figure 4.1. Developed person factor-related hypothesis model representing consulting work system performance

H_1: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on employee's Psychological Characteristics in consulting work systems.

H_2: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on employee's Motivation and Needs in consulting work systems.

H_3: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on Employee Performance in consulting work systems.

H_4: Employee's Physical Characteristics have a positive direct effect on employee's Psychological Characteristics in consulting work systems.

H_5: Employee's Physical Characteristics have a positive direct effect on employee's Motivation and Needs in consulting work systems.

H_6: Employee's Physical Characteristics have a positive direct effect on Employee Performance in consulting work systems.

H_7: Employee's Psychological Characteristics have a positive direct effect on employee's Motivation and Needs in consulting work systems.

H_8: Employee's Psychological Characteristics have a positive direct effect on Employee Performance in consulting work systems.

H_9: Employee's Motivation and Needs have a positive direct effect on Employee Performance in consulting work systems.

H_{10}: Employee Performance have a positive direct effect on Customer Satisfaction in consulting work systems.

H_{11}: Employee Performance have a positive direct effect on Service process in consulting work systems.

H_{12}: Employee Performance have a positive direct effect on Organizational Performance in consulting work systems.

H_{13}: Service process have a positive direct effect on Customer Satisfaction in consulting work systems.

H_{14}: Service process have a positive direct effect on Organizational Performance in consulting work systems.

H_{15}: Customer Satisfaction have a positive direct effect on Organizational Performance in consulting work systems.

Other objective of this thesis is to determine the direct, indirect and total effects of the four person factor elements on the consulting work system performance metrics using the developed hypothesis model. In order to measure these effects, developed

model is tested by utilizing variance based PLS-SEM method. In this model person factor elements are analyzed as independent latent variables and consulting work system performance metrics are analyzed as dependent latent variables. Latent variables are extracted via the Exploratory Factor Analysis method.

4.2. Data Collection Instrument

Statistical Society of London developed questionnaires in 1838. Since this time questionnaires are accepted and utilized as a research instrument. Questionnaires are mainly composed of questions to collect data from target audiences. Question types can contain close-ended questions, open-ended questions or both. Depending on the research aim, a questionnaire can measure qualitative or quantitative data. Questionnaires are relatively easy and cost effective to use as a data collection tool, that's why they are preferred by the researchers.

4.3. The Macroergonomic Compatibility Questionnaire (MCQ)

4.3.1. Developing the Macroergonomic Compatibility Questionnaire (MCQ)

For the purpose of this study, the MCQ was structured in accordance with the consulting industry dynamics and macroergonomic person factor elements for the consulting sector in order to analyze the macroergonomic compatibility of person factor and its elements on the consulting work system performance. As Realyvasquez *et al.* [40] mentioned, the MCQ can be administered to all types of employees. In order to collect largest exploratory information from respondents, the questionnaire can be applied to the people who work in higher organizational levels.

For the purpose of this study, the developed MCQ for the consulting service sector is mainly composed of three sections. First section gathers demographic information about participants and company that participants work for. This section includes

twelve questions to obtain demographic information from the participants. Demographic data includes information such as participant's gender, age, position, company name, highest education level, working experience, type of consulting company, etc.

The second section of the developed MCQ collects data to measure the degree of the consideration of the macroergonomic person factor elements in consulting companies. Person factor elements; namely, Cognitive Skills, Education and Knowledge; Physical Characteristics; Psychological Characteristics; and Motivation and Needs are considered to develop this section of the MCQ. This section includes 54 questions that are responded based on 5-point Likert scale.

The Likert scale is introduced by Rensis Likert in 1932. Likert scale is mostly utilized as a method in questionnaires in order to evaluate psychometric data. Since the Likert scale is useful to conduct, modify and easy to use by the respondents, it is preferred by the author to conduct the MCQ. The 5-point Likert scale rating scale is described as follows: (1) totally disagree, (2) disagree, (3) neutral, (4) agree, (5) totally agree.

Table 4.1 represents the sample of the second section questions. For this section, 12 questions for Cognitive Skills, Education and Knowledge element, 5 questions for Physical Characteristics element, 17 questions for Psychological Characteristics element and 20 questions for Motivation and Needs element are prepared. All the questions are presented in Appendix A in Turkish and English versions. Table 4.1 represents a sample of the questionnaire items in the left column and the rating scale in the right column. The third section of the MCQ consists of the questions for the purpose of the measuring the consulting work system performance in mainly four parts which are respectively: (1) Employee Performance, (2) Service process, (3) Customer Satisfaction and (4) Organizational Performance. This section includes 55 questions with 5-point Likert scale for ratings. Table 4.2 shows a sample of the third section questions. For this section, 16 questions for Employee Performance indicator, 10 questions for Customer Satisfaction indicator, 9 questions for Service process indicator and

Table 4.1. Section two of the MCQ.

	1	2	3	4	5
Cognitive Skills, Education and Knowledge					
Inadequate skill and knowledge of employee are compensated with employee training.					
Knowledge transfer between colleagues and knowledge transfer when the employee is recruited are adequate.					
Employees have adequate informal qualifications, such as experience, beyond formal education and training, to perform their tasks successfully.					
Physical Characteristics					
If possible, causes of employees' physical discomfort are analyzed and resolved.					
Physical fitness states of employees are considered for task allocation.					
Employees receive attention when they present a physical discomfort.					
Psychological Characteristics					
Employees have high self-esteem and confidence to tackle problems.					
Tasks are designed in order to avoid employees' psychological discomfort. E.g., Feeling (1) boredom, (2) emotionally bad way, (3) pressure such as job loss.					
Employees have positive work attitudes.					
Motivation and Needs					
When in need, help is provided to employees for the assigned job.					
Job positions are open to career and individual development.					
Tasks are interesting and challenging to employees.					

16 questions for Organizational Performance indicator are prepared. All the questions are shown in Appendix A in Turkish and versions. Table 4.2 presents a sample of the questionnaire items in the left column and the rating scale in the right column.

4.3.2. Administering the MCQ

In order to gather the data, target audience were gotten in contact by the LinkedIn and consulting firms web sites. Five major consulting firm types were determined and consultants from all hierarchical levels especially in managerial positions were added the network. Then, mail template was shared with them. In Appendix A related mail templates is shared in Turkish and English.

Information about the study and instructions about the questionnaire were given to the participants in the invitation e-mail and detailed information in the questionnaire. 148 consultants from consulting companies have responded to the MCQ.

4.4. Structural Equation Modelling (SEM)

Structural equation modeling (SEM) is a statistical method in order to analyze structural theory. Byrne [63] stated that SEM technique has two important advantages. First one is the ability to represent the causal processes of the theory by structural equations. Second pro is the relations can be graphically modellable for conceptualization the research. In order to evaluate causal relations between multiple dependent or independent variable, SEM is accepted the most convenient technique.

Proposed model in SEM analysis can be analyzed comprehensively from the data. In SEM analysis both dependent and independent variables can be observed data or latent factors. Latent variables are inferred from observed variables to create theoretical constructs. Since SEM consider the error terms for each factor, SEM has major advantage with respect to multivariate statistical methods. The relation between factors can be evaluated with the result of the goodness of fit of indices for the constructed

Table 4.2. Section three of the MCQ.

	1	2	3	4	5
Employee Performance					
On-time task completions by employees have been improved over the time.)					
Employees have adequate informal qualifications, such as experience, beyond formal education and training, to perform their tasks successfully.					
Employees' coordination, collaboration and communication have improved over the time.					
Customer Satisfaction					
Customers' needs and expectations are taken into account.					
The number of customers has increased over the time.					
Customer satisfaction has increased over time.					
Service process					
Time duration to complete the projects or services has reduced over the time.					
Service quality (without error) has increased over the time.					
Flexible services are provided to satisfy different types of customers over time.					
Organizational Performance					
The variety of services has increased over the time.					
Productivity has increased over the time.					
Investments in employee development and training has increased over the time.					

hypotheses model.

Another main difference of the SEM is the statistical is the exploratory logic. In this model causal effects are not measured by the latent or observed variables since SEMs search for the relations which is caused by the amplification of the conducted model [40]. There are two basic types of SEM: covariance-based structural equation modeling (CB-SEM) and partial least squares structural equation modeling (PLS-SEM).

The most important reason to select covariance-based CB-SEM or variance based PLS-SEM is the research goal. In other words, model preference depends on whether research objective is conducting structure or prediction. The main goal of the CB-SEM approach is to study the structure of the observables. The major focus of the PLS approach is to predict the indicators by means of the component expansion [64]. In line with this notion, Hair *et al.* [65] recommend:

- "If the goal is predicting key target constructs or identifying key 'driver' constructs, select PLS-SEM.
- If the goal is theory testing, theory confirmation, or comparison of alternative theories, select CB-SEM.
- If the research is exploratory or an extension of an existing structural theory, select PLS-SEM."

4.5. Measurement Models: The relation between observed and Latent Variables

Bollen [66] defined the measurement as "the process by which a concept is liked to one or more latent variables, and these are linked to observed variables". He stated that the concept is the first step of the measurement process [66]. For instance, we can define the positive work attitudes as one of the items of the psychological characteristics concept. In other words concept defines thing or things kept in common. Latent

variables are the representations of concepts in measurement models [66].

After selecting or devising a concept, main four steps in the measurement process are:

(1) Giving the meaning of the concept
(2) Identifying the dimensions and latent variables to represent it
(3) Forming measures
(4) Specifying the relation between the measures and the latent variables

First two steps should be taken while developing the model structure and developing measuring instrument, which is MCQ for this study.

Two important properties of measures are their reliability and validity.

4.5.1. Reliability Analysis

Consistency of responses of the questionnaires can be measured by the reliability analysis. Reliability is defined as "part of a measure that is free of purely random error" by Bollen [66]. Reliability is not same as validity since we can have consistent (reliable) but invalid measure [66]. Reliability analysis can be conducted on the ordinal data. Reliability analysis can be applied to a 5-point Likert scale questionnaire given to a question about any subject such as strongly disagree (1) and strongly agree (5). Although variety of method have been proposed to estimate the reliability of measures, such as test-retest, split-halves and Cronbach's alpha (CA). CA is the most popular reliability coefficient in social science research [66].

Reliability analysis can be verified utilizing Cronbach's Alpha value. CA can be estimated for each item or all items in a factor or for all items in the questionnaire. If the CA is estimated for all items in the questionnaire then the average CA value will be estimated. The average CA value which is measured for all items in questionnaire

shows the overall reliability of the questionnaire. On the other hand, CA value should be estimated for each dependent and independent variable separately to measure inter-item reliability. Internal-item reliability means that the items in the scale or test have a specific conceptual structure. That is, the scale items should measure the same structure with each other, and the measurement results are stable under the same and different conditions while they are not changing [67].

Cronbach Alpha (α) can be statistically calculated with

$$\alpha = \frac{N \times \bar{c}}{\bar{v} + (N-1) \times \bar{c}} \tag{4.1}$$

where N represents the number of items, $\bar{c}$ represents average covariance between item-pairs and $\bar{v}$ represents average variance.

In order to accept the questionnaire as reliable, CA value should be at least 0.7. Lower than this value indicates poor reliability of the questionnaire [68]. Higher than 0.8 α values indicate high reliability of the questionnaire. Recent studies suggest the 0.7 as the acceptable minimum values for unrestricted models. Some experts stated that in relaxed models critical CA value can be accepted as 0.6. However, for conduct this research 0.7 is accepted as a critical value.

4.5.2. Validity

Validity is concerned with whether a variable measure what is suppose to measure [66]. Traditionally, psychologists have distinguished four types of validity:

(1) Content validity: qualitative type of validity where the domain of a concept is made clear and the analyst judges whether the measures fully represent the domain.
(2) Criterion validity: degree of correspondence between measure and a criterion variable.

(3) Construct validty: Construct validity assess whether a measure relates to other observed variables in a way that is consistent with theoritically derived predictions.
(4) Discriminant validity:

Content validity is largely "Conceptual test" whereas others are empirically based [66].

4.5.2.1. Convergent and Discriminant Validity. Convergent validity, which is closely related to the idea of construct validity, is proposed by Campbell and Fiske [69]. Convergent validity is a measure of the quality of a measurement instrument. A measurement instrument has good convergent validity if the question-statements (or other measures) associated with each latent variable are understood by the respondents in the same way as they were intended by the designers of the question-statements [70]. In order to describe the convergent validity of their measurement instrument, the table of combined loadings and cross-loadings should be analyzed. There are mainly two criteria are recommended as the basis for concluding that a measurement model has acceptable convergent validity: that the P values associated with the loadings be equal to or lower than 0.05; and that the loadings be equal to or greater than 0.5 [70–73].

Discriminant validity is a measure of the quality of a measurement instrument; the instrument itself is typically a set of question-statements [74]. A measurement instrument has good discriminant validity if the question-statements (or other measures) associated with each latent variable are not confused by the respondents, in terms of their meaning, with the question-statements associated with other latent variables [69].

AVEs are normally used for discriminant validity assessment and, less commonly, for convergent validity assessment. For discriminant validity assessment, AVEs are used in conjunction with latent variable correlations. For convergent validity assessment, the AVE threshold frequently recommended for acceptable validity is 0.5 [70–73], and applies only to reflective latent variables. Other coefficients are correlations among

latent variables and square roots of AVEs, structure loadings and cross-loadings, and full collinearity VIFs. The VIF threshold of 3.3 has been recommended in the context of PLS-based SEM [70]. Two criteria, one more conservative and one more relaxed, are recommended by the multivariate analysis literature in connection with VIFs. More conservatively, it is recommended that VIFs be lower than 5; a more relaxed criterion is that they be lower than 10 [70, 72].

4.5.3. Factor Analysis

Factor analysis is an approach to explain the covariance and correlation relationship between observed multiple variables by means of relatively few underlying latent variables. In this aspect it is a factor reduction technique [75]. Although theory and methodology for exploratory factor analysis have been well developed for continuous variables, factor analysis is useful method in variable reduction for ordinal data [40, 76, 77]. Since in practice observed or measured variables are often ordinal, many approaches were developed to factor analysis of ordinal variables [76].

Since in the behavioral sciences, researchers are often interested in studying theoretical constructs that cannot be observed directly, these underlying structures which are named as latent variables do not measured directly [78]. As an example of latent variable can be given as that for the macroergonomic person factor element motivation and needs element is the latent variable as other variables in our conducted model.

Factor analysis is a combination of the techniques and its primary goal is to produce a small number of factors from a large number of variables which is capable of explaining the observed variance in the larger number of variables [75]. In order to achieve this aim, factor analyses use the correlation or covariance matrix [75, 78, 79]. Therefore, in order to explain structures with regard to covariance or correlations, factor analysis is very effective technique. In 1940 initial development of the factor analysis is conducted by Spearmen [75]. There are two basic types of factor analyses: Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) [75, 78].

Exploratory and confirmatory factor analyses are multivariate statistical methods that involve similar assumptions as well as specific processes [75].

4.5.3.1. Exploratory Factor Analysis (EFA). Exploratory factor analysis (EFA) aims to reveal and explore the underlying factor structure of expressions representing the variables of a newly created or translated language from one language to another. In EFA, researchers aim to determine the optimal number of factors and to determine whether the measured variables (items) are reasonable indicators of various latent dimensions [80].

The aim of using EFA in this study is to achieve a small number of explanatory factors that explains the maximum variance and reveal the real reasons behind the numerous features that can be measured and seen [78,79]. In order to analyze the variables with respect to covariance and exploratory variance in all variables and detect the variables that have no impact and remove them, factor analysis has been recognized as the most convenient technique [40]. Furthermore, this method is convenient when working with ordinal data to reduction of factors [40,77] and also can work with observed data [81].

EFA should be used in condition in which links between the observed and latent variables are unknown or uncertain [78]. The analysis thus proceeds in an exploratory mode to determine how and to what extent the observed variables are linked to their underly factors [74]. Since in this study a new macroergonomic compatibility questionnaire instrument is developed, EFA is conducted to determine the extent to which the observed variables are related to latent variables. In factor analysis, these relations are called as factor loadings [79].

Since EFA is data-driven approach, no specifications are made in regard to the number of common factors (initially) or the pattern of relationships between the common factors and the indicators (i.e., the factor loadings) [82]. Therefore, exploratory factor analysis has utilized in many statistical analyses and research. In general use,

the factors provided from the original data set, regression, correlation, discriminant analysis, difference tests, etc. provides benefits many analyzes [83].

There are two types of measurement of variables: reflective and formative [82]. Independent and dependent variables can be reflective and formative or both. Reflective variables are influenced by latent variables [74]. In other words, changes in the underlying latent construct are reflected by changes in the indicators. In the reflective model for each variable error term is calculated. In a model that consists of reflective variables are expected to be correlated [74, 82]. Since the variables have high correlations, the indicators can interchangeable or can be removed from the model without any lack of conceptual meaning of the construct [84]. Figure 4.2 represents the example of reflective variable.

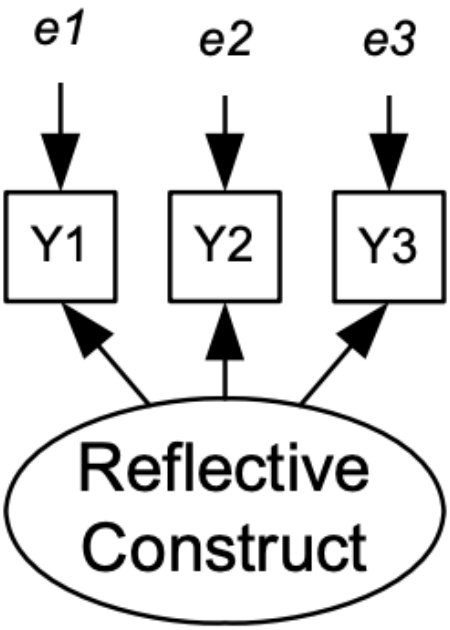

Figure 4.2. Reflective Latent Variable (Source adopted from Freeze and Raschke [85]).

Formative variables are influenced by the indicators [74, 82]. Measures cause the construct which means the construct is fully extracted from its measurement [74, 82]. Since in the formative structure error of the measurement error is at the construct level, measures do not explain part of the structure [82]. Therefore, removal of any

items means the lack of part of the construct [84]. Figure 4.3 represents the example of formative variable.

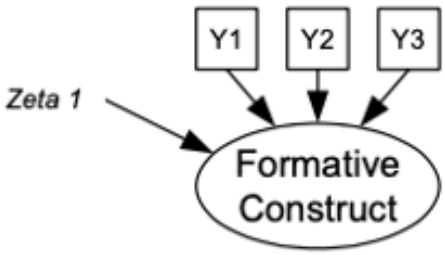

Figure 4.3. Formative Latent Variable (Source adopted from Freeze and Raschke [85]).

An exemplary model for EFA is described in Figure 4.4. This model has two latent variables which are extracted from observed variables. The arrow linking factors between these latent variables illustrate variance or covariance between latent variables. X symbolizes every variable (item) in the data. In this model these two variables are defined as reflective variables.

One-way arrows from factors to indicators show the direct effects of that indicator on that factor. It shows the factor load value in the direct effect exploratory factor analysis. In the Figure 4.4 measurement errors represented by E term for each measurement. These errors are spontaneous and there is no description of the cause of these errors. In other words, these are distinctive differences that cannot be clarified by variables. As a consequence, EFA is used to assess whether the extracted factor is appropriate for the hypothesis model and to determine the number of factors will be extracted [86].

Not all variables and data collections may be appropriate for factor analysis. Therefore, in order to conduct satisfactory exploratory factor analysis major steps should be carried out carefully. These steps are respectively:

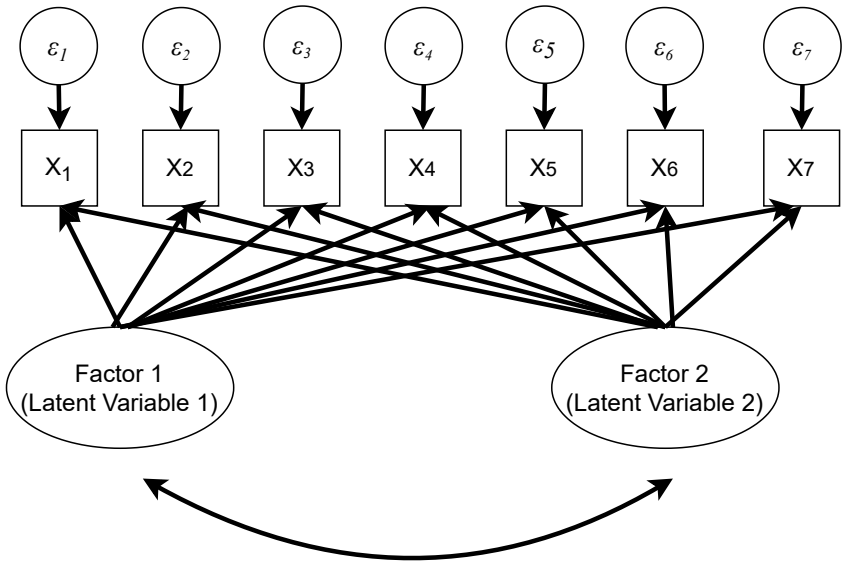

Figure 4.4. The exemplary model of EFA.

(1) Suitability of data for factor analysis should be checked.
   (1.1) Sample size (number of samples) must be controlled whether the sample size is sufficient to apply the exploratory factor analysis.
   (1.2) The adequacy of sampling should be examined through KMO [87, 88], and the strength of the relationship among variables should be examined through Bartlett's test of sphericity [89].
(2) Factor loadings should be examined.
(3) Factor extraction method used should be selected.
(4) Factor rotation method should be selected.
(5) Communality values and factor loadings for each item should be examined.
(6) Factors should be named.
(7) Total variance explained should be reported.

Suitability of data for factor analysis

Sample size

Sample size Required minimum sample size to perform PLS-SEM depends on three factors [90]. These factors are respectively:

(1) The number of variables or constructs that are intended to explain the dependent variable.
(2) The estimated effect size (R^2).
(3) Defined significance level.

KMO and Bartlett's test of sphericity

Kaiser–Meyer–Olkin (KMO) test are used for to measure sampling adequacy is a test to assess the appropriateness of using factor analysis on the data set [92]. KMO test is a test that measures the correlations between variables and the suitability of factor analysis. KMO test shows whether the sample sufficient items for each factor.The KMO value is expected between 0 and 1. 1 KMO value indicates that extracted factor is estimated without error. In order to carry out factor analysis KMO value between 1 and 0.8 is suggested (Ferrando and Anguiano-Carrasco, 2010 as stated by Realyvásquez *et al.* [40]. KMO value between 0.5 and 0 is not accepted for to evaluate dimensionality of the data [93]. Kaiser also states that the value found is excellent as it approaches 1, and below 0.50 is unacceptable, in 0.90s is excellent, in 0.80s is very good, in 0.70s and 0.60s is mediocre.

"Bartlett test of sphericity test are used to check that the original variables are sufficiently correlated. This test should come out significant ($p < 0.05$). If not, factor analysis will not be appropriate." [94]

Factor extraction method

Choosing an appropriate factorization method in the analysis is extremely important for the validity of the factor structure obtained. Although there are variety of methods for factor extraction such as principal component analysis, principal factorization

Table 4.3. Sample size recommendation in PLS-SEM for a statistical power of 80 % (Source adopted from Cohen [91]).

Maximum Number of Arrows Pointing at a Construct	**Significance Level**											
	1%				**5%**				**10%**			
	Minimum R^2				**Minimum R^2**				**Minimum R^2**			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	63	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

analysis, maximum likelihood, image factorization, and alpha factorization, the most commonly used methods are principal component analysis and principal factorization analysis [95]. Decision of the choosing right method is depends on the research purpose. Since in this study we test to conducted hypothesis model and we believe that there are hidden measurements that cannot be observed directly; Principal Axis Factoring method is utilized as factor extraction method. Also, PCA is an analysis, which is not a factor analysis [96]. Moreover, PCA only looks for a set of factors which can account for the total variability in the original variables. On the other hand, Principal Axis Factoring method tries to find the lowest number of factors which can account for the variability in the original variables that is associated with these factors [96].

Factor rotation method

In order to extract exploratory latent variables, factor rotation is crucial. In an EFA, factor rotation is used to maximize a load of each item on a given factor and to provide a better interpretation of the factor structure [97]. The variance that extracted associated with a single factor is greater in the varimax rotation [98]. With the aim of conducted a model with the most convenient number of factors with high exploratory information as possible, the orthogonal method of varimax rotation is the generally accepted method.

Examining Communality values and Factor Loadings

Communality value shows the proportion of each variable's variance that can be explained by the factors. For variable reduction, since the sample size is 148 in this study 0.5 value is accepted as a cut-off value. As it mentioned in Section 4.5.3.1 since the variables in this study are reflective, the indicators can interchangeable or can be removed from the model without any lack of conceptual meaning of the construct. Therefore, items with communality value lower than 0.5 should be removed.

Factor analysis output supply the "rotated factor matrix". This matrix contains "the rotated factor loadings". Factor loadings represent both "how the variables are

weighted for each factor but also the correlation between the variables and the factor" [96].

Factor Naming

Based on the factor loadings latent variables should be estimated and labeled. For instance, if the first component (latent variable) of one factor have two items with loadings 0.2 and 0.4, first latent label should be estimated via product of the loadings and items value for each sample.

Reporting the total variance explained

Finally, the total variance explained should be reported as a final step of the factor analysis.

5. RESULTS AND DISCUSSION

5.1. Demographic Analyses

Distribution of demographic information such as gender, age, position, company name, highest education level, working experience, type of consultancy company of 148 people participating in the survey conducted during the quantitative data collection phase and working in companies operating in the consultancy sector are as follows. Demographic information from participants is gathered by twelve questions that were used in this thesis to conduct a descriptive analysis of the sample.

36.5% of 148 people who participated in the survey were women, and 63.5% were men and related data are represented in Table 5.1.

Table 5.1. Distribution of the participants' gender.

	Frequency	**Percent**
Female	54	36.5
Male	94	63.5
Total	148	100

From the sample consisting of the 148 respondents, 54.8% were aged from 25 to 30, 22.3% were aged from 31 to 40, 15.5% were aged from 51 to 50, and 7.4% were aged 51 or older and related data are represented in Table 5.2.

From the sample consisting of the 148 respondents, 58.1% have a bachelor's degree, 38.5% have a master's degree, and 3.4% have a Doctorate degree and related data are represented in Table 5.3.

Table 5.2. Distribution of the participants' age.

	Frequency	**Percent**
25-30 years old	81	54.8
31-40 years old	33	22.3
41-50 years old	23	15.5
51+	11	7.4
Total	148	100

From the sample consisting of the 148 respondents, 68.2% have a total of 6 to 10 years of working life, 17.6% total of 11 to 20 years of working life, and 14.2% have a total of over 20 years of working life and related data are represented in Table 5.4.

Table 5.3. Distribution of the participants' education.

	Frequency	**Percent**
Bachelor's degree	86	58.1
Master's degree	57	38.5
Doctorate	5	3.4
Total	148	100

From the sample consisting of the 148 respondents, 63.5% are senior associate or senior consultant, 16.2% are managers, 2.1% are senior manager or associate partner, 13.5% are partners, and 4.7% are a director and related data are represented in Table 5.5.

From the sample consisting of the 148 respondents, 60.1% have a total of 0 to 2 years of working life, 11.5% total of 2 to 5 years of working life, 10.8% total of 5 to 10 years of working life, 17.6% total of 10 to 20 years of working life and 14.2% have a total of over 20 years of working life and related data are represented in Table 5.6.

Table 5.4. Distribution of the participants' total professional experience.

	Frequency	**Percent**
6 to 10 Years	101	68.2
11 to 20 Years	26	17.6
Over 20 Years	21	14.2
Total	148	100

Table 5.5. Distribution of the participants' position.

	Frequency	**Percent**
Senior Associate/Senior Consultant	94	63.5
Manager	24	16.2
Senior Manager/Associate Partner	3	2.1
Partner	20	13.5
Director	7	4.7
Total	148	100

Table 5.6. Distribution of the participants' total managerial experience.

	Frequency	**Percent**
0 – 2 Years	89	60.1
2 – 5 Years	17	11.5
5 – 10 Years	16	10.8
10 – 20 Years	18	12.2
20 + Years	8	5.4
Total	148	100

From the sample consisting of the 148 respondents, 75% are not managing other managers in their current position, and 25% are managing other managers in their current position and related data are represented in Table 5.7.

Table 5.7. Distribution of the participants that manage other managers.

	Frequency	**Percent**
No	111	75.0
Yes	37	25.0
Total	148	100

From the sample consisting of the 148 respondents, 64.9 % have been in their current position for 1 to 2 years, 31.0 % have been in their current position for 2 to 5 years, and 4.1 % have been in their current position for 5 to 10 years and related data are represented in Table 5.8.

Table 5.8. Distribution of participants' total experience in the current position.

	Frequency	**Percent**
1 to 2 Years	96	64.9
2 to 5 Years	46	31.0
5 to 10 Years	6	4.1
Total	148	100

83.8% have been in their current company for 1 to 5 years from the survey of the 148 respondents, 7.4% have been in their current company for 5 to 10 years, 6.8% have been in their current company for 10 to 20 years, and 2.0% have been in their current company for over 20 years and related data are represented in Table 5.9.

From the sample consisting of the 148 respondents, 32.4 % have been in working in Strategy (Corporate strategy, Organizational strategy, Functional strategy, Economic

Table 5.9. Distribution of participants' total experience in the current company.

	Frequency	**Percent**
1 to 5 Years	124	83.8
5 to 10 Years	11	7.4
10 to 20 Years	10	6.8
Over 20 Years	3	2.0
Total	148	100

policy, Mergers & Acquisitions) Consulting firms, 15.5 % have been in working in Operations (Process Management, Supply Chain, Procurement, Finance Operations, Outsourcing, Project Management) Consulting firms, 16.2 % have been in working in Human Resources (Organizational Change, HR Technology, Learning & Development, Benefits & Rewards, Talent Management) Consulting firms, 4.1 % have been in working in Financial Advisory (Actuarial Services, Risk Management, Real Estate Advisory, Forensics & Litigation) Consulting firms, 31.8 % have been in working in Technology (IT Advisory, ERP Implementation, Data Analytics, Application Development, System Integration, Enterprise Architecture) Consulting firms and related data are represented in Table 5.10.

From the sample consisting of the 148 respondents, 37.2 % have been in working in Strategy (Corporate Strategy, Economic Policy, Mergers & Acquisitions; Organizational Strategy, Functional Strategy) service area, 12.8 % have been in working in Operations (Process Management, Supply Chain, Procurement, Finance Operations, Outsourcing, Project Management) service area, 14.9 % have been in working in Human Resources (Organizational Change, HR Technology, Learning & Development, Benefits & Rewards, Talent Management) service area, 5.4 % have been in working in Financial Advisory (Actuarial Services, Risk Management, Real Estate Advisory, Forensics & Litigation) service area, 29.7 % have been in working in Technology (IT Advisory, ERP Implementation, Data Analytics, Application Development, System

Integration, Enterprise Architecture) service area and related data are represented in Table 5.11.

5.2. Reliability Analysis

In order to measure consistency of the MCQ reliability analysis should be performed. As it was mentioned Section 4.5.1 this approach is convenient to conduct ordinal data. Statistical software IBM® SPSS® Statistics v24.0 is used to perform the reliability analysis.

Since answering to each question in the survey is obligatory, I had no missing values. Therefore, I did not need to apply any preprocess. If data had missing value, this item needs to replace with the related item's median value. In order to perform PLS-SEM this implementation is convenient for ordinal values in a Likert scale.

Reliability analysis of the MCQ was verified utilizing Cronbach's Alpha (CA) value. Cronbach Alpha (α) is statistically estimated as

$$\alpha = \frac{N \times \bar{c}}{\bar{v} + (N-1) \times \bar{c}} \tag{5.1}$$

where N represents the number of items, $\bar{c}$ represents average covariance between item-pairs and $\bar{v}$ represents average variance.

CA coefficient of the questionnaire as a whole has been found as 0.968. In order to accept the questionnaire as reliable, essential CA value is accepted at least 0.7. Higher than 0.8 α values indicate high reliability of the questionnaire. CA analysis reveals that the items have an adequate level of inter-item reliability. CA coefficient values of elements and performance indicators are represented in Table 5.12.

Since the Physical Characteristics variable show the CA value lower than 0.7, Physical Characteristics were excluded. After removing process, other elements Cron-

Table 5.10. Distribution of the types of consulting services of the company that participants work for.

	Frequency	**Percent**
Strategy (Corporate Strategy, Economic Policy, Mergers & Acquisitions; Organizational Strategy, Functional Strategy)	48	32.4
Operations (Process Management, Supply Chain, Procurement, Finance Operations, Outsourcing, Project Management)	23	15.5
Human Resources (Organizational Change, HR Technology, Learning & Development, Benefits & Rewards, Talent Management)	24	16.2
Financial Advisory (Actuarial Services, Risk Management, Real Estate Advisory, Forensics & Litigation)	6	4.1
Technology (IT Advisory, ERP Implementation, Data Analytics, Application Development, System Integration, Enterprise Architecture)	47	31.8
Total	148	100

Table 5.11. Distribution of the types of consulting service that participants provide.

	Frequency	**Percent**
Strategy (Corporate Strategy, Economic Policy, Mergers & Acquisitions; Organizational Strategy, Functional Strategy)	55	37.2
Operations (Process Management, Supply Chain, Procurement, Finance Operations, Outsourcing, Project Management)	19	12.8
Human Resources (Organizational Change, HR Technology, Learning & Development, Benefits & Rewards, Talent Management)	22	14.9
Financial Advisory (Actuarial Services, Risk Management, Real Estate Advisory, Forensics & Litigation)	8	5.4
Technology (IT Advisory, ERP Implementation, Data Analytics, Application Development, System Integration, Enterprise Architecture)	44	29.7
Total	148	100

Table 5.12. Cronbach's Alpha coefficient values related to the scales used.

Elements	Cronbach's Alpha (α)
Cognitive Skills, Education and Knowledge	0.830
Physical Characteristics	0.633
Psychological Characteristics	0.859
Motivation and Needs	0.884
Employee Performance	0.912
Service process	0.877
Customer Satisfaction	0.836
Organizational Performance	0.921

bach's Alpha coefficients ranged from 0.830 to 0.921. Therefore, we can conclude that the scales and the questionnaire is reliable [68].

5.3. Factor Analysis

5.3.1. Results of EFA

Validation of the MCQ was also performed by a factor analysis. As it was mentioned in chapter 4, the aim of using EFA in this study is to achieve a small number of explanatory factors that explains the maximum variance and reveal the real reasons behind the numerous features that can be measured and seen. In order to analyze the variables with respect to covariance and exploratory variance in all variables and detect the variables that have no impact and remove them, factor analysis has been recognized as the most convenient technique. Furthermore, this method is convenient when working with ordinal data to reduction of factors (Castañeda *et al.*, [77] as cited by Realyvásquez *et al.* [40] and also can work with observed measurements [81].

5.3.1.1. Compliance with Factor Analysis. Bartlett's sphericity test and the Kaiser-Meyer-Olkin (KMO) test were utilized trough a factor analysis with the aim of analyze of the each macroergonomic person factor elements' viability [92].

KMO test is a test that measures the correlations between variables and the suitability of factor analysis. Kaiser states that the value found is excellent as it approaches 1, and below 0.50 is unacceptable, in 0.90s is excellent, in 0.80s is very good, in 0.70s and 0.60s is mediocre.

As for the rotation, varimax rotation is used. In order to perform variable reduction process, communality values were examined. Variable elements indicating community values lower than 0.5 were excluded [99]. In order to perform factor analysis, high adequacy is achieved with KMO test results. Since the Physical characteristics are excluded from the model due to low CA value, KMO test is applied rest of the elements. Therefore, number of total variables (number of questions) is 104 after this step. 33 of the 104 elements indicated lower than 0.5 communality values. This result indicates that the questionnaire was statistically validated by the 68.3 % of MCQ's items. Related questions that are excluded from questionnaire due to low communality are respectively, SEK5, SEK6, SEK12, PC4, PC7, PC11, PC15, PC16, PC17, MN1, MN2, MN3, MN7, MN8, MN9, MN10, MN11, MN12, MN13, MN15, MN17, MN19, MN20, EP10, EP11, CS5, CS6, SP4, SP5, SP6, SP7, SP8, SP9, OP2, OP7, OP9, OP13 and OP15. In Table 5.13. those questions are not included. After this step, factors are extracted. Extracted factors showed a high value of total variance explained. This implies that the structure developed represents the overall data and has a power for representation.

Table 5.13 represents the EFA results which are the number of factors extracted, total variance explained, KMO value, and Bartlett Test. Total variance explained values are higher than 50 % (range of 49.577 % and 60.467 %) for all macroergonomic elements and performance indicators, KMO values are above 0.50, and acceptable (range of 0.696 and 0.903). Bartlett tests were shown powerful results at 99 % confidence level

with p <0.001 value.

Table 5.14 represents the factor loadings of each factor that extracted and the CA, Average Variance Extracted (AVE), and Composite Reliability (CR) values of each macroergonomic element and performance indicators. In order to define the significance of the variables under the factors, a load of each variable to the factors are considered. Here, the most critical indicator of how many values is significant for the relevant factor is the number of samples. The higher the number of samples, the lower the acceptable load value. In samples of less than 50, factor analysis is not recommended [68]. Factor loading minus or plus is related to the direction of the effect so that these values should be considered as the absolute value. Since the sample size is 148 in this study, the factor loadings higher than 0.4 are considered significant.

Reliability criteria are represented in Table5.15. As for the reliability of the new construct, internal reliability has achieved. CA values of each factor are higher than 0.6. Since CA is a statistic that tends to give high values when there are many variables, the CR value is used as an alternative to CA or as a control tool. CR is the measure of reliability and internal consistency of the measured variables representing a latent construct. The CR value is expected to be higher than 0.7. Thus, construct reliability is achieved. In order to conclude, all reliability criteria were achieved, and it can be said that the new construct is reliable.

5.3.1.2. Validity. Construct validity is evaluated with convergent validity and divergent validity. The AVE is an indicator of discriminant validity and convergent validity. Convergent validity states that expressions of variables are related to each other and the factor they create. Discriminant validity (divergent validity) is that expressions of variables should be less correlated with factors other than their own.

Average Variance Extracted (AVE) and the cross-loading factors for each variable is estimated to test validity of construct. In order to achieve convergent validity, experts recommend critical minimum AVE value as 0.5 and a significant P value as P

Table 5.13. EFA results for each macroergonomic element and performance indicators.

Element	**Number of Questions**	**Number of Factors Extracted**	**Total Variance Explained**	**KMO**	**Bartlett Test**
Cognitive Skills, Education and Knowledge	9	2	49.577 %	0.829	<0.001
Psychological Characteristics	15	4	60.459 %	0.785	<0.001
Motivation and Needs	6	2	53.757 %	0.770	<0.001
Employee Performance	15	3	56.884 %	0.895	<0.001
Customer Satisfaction	8	2	57.341 %	0.847	<0.001
Service process	3	1	60.467 %	0.696	<0.001
Organizational Performance	11	2	58.570 %	0.903	<0.001

Table 5.14. Factor loadings and associated CA, AVE, and CR values of each macroergonomic element and performance indicators.

Element	**Factor**	**Factor Loading**	**Cronbach Alpha**	**AVE**	**Composite Reliability**
Cognitive Skills, Education and Knowledge	1	0.829	0.546	0.688	0.815
	2	0.829			
Psychological Characteristics	1	0.678	0.659	0.496	0.796
	2	0.637			
	3	0.721			
	4	0.723			
Motivation and Needs	1	0.857	0.638	0.734	0.847
	2	0.857			
Employee Performance	1	0.903	0.753	0.673	0.860
	2	0.823			
	3	0.727			
Customer Satisfaction	1	0.862	0.654	0.743	0.853
	2	0.862			
Service Process	1	1.000	1.000	1.000	1.000
Organizational Performance	1	0.903	0.774	0.816	0.899
	2	0.903			

Table 5.15. Reliability measures and associated criteria.

Reliability Measures	**Interpretation**
Internal Reliability	**In order to ensure the internal reliability, a value of Cronbach's Alpha value should be 0.6 or greater.**
Composite Reliability	**In order to ensure the composite reliability, a value of CR should be 0.7 or greater.**

<0.05 for each item [71–73]. As AVE and factor loadings values can be seen in Table 5.14, convergent and discriminant validity is achieved. Although for Psychological Characteristics element's AVE value (0.496) is slightly lower than 0.5, this value is acceptable since those elements have reliable CA and CR values. Also, for Cognitive Skills, Education & Knowledge element CA value is (0.546) is slightly lower than 0.6, this value is acceptable since this element have reliable AVE and CR values.

With respect to collinearity between latent variables, variance inflation factors (VIFs) are calculated. GarcAlcaraz *et al.,* [73] stated that to eliminate collinearity issues, a latent variable's VIF value had to be lower than 3.3. Table 5.16 represents the VIF values of latent variables.

As a final step, nonparametric predictive validity is checked. Since the data were collected as ordinal, Q-squared (Q^2) coefficient is estimated to measure nonparametric predictive validity. García-Alcaraz *et al.,* [73] stated that values above zero should be accepted. Although for Organizational Performance variables VIF value is 3.377 since this variable have reliable CR, CA and Q^2 coefficient of this value is acceptable. Since all validation and reliability tests are performed successfully, latent variables are calculated using rotated component matrix coefficients. For instance, for Employee Performance indicator, 3 factors are extracted. Third latent variable is composed

Table 5.16. VIF values of each latent variable.

Elements	VIF
Cognitive Skills, Education and Knowledge	1.548
Psychological Characteristics	2.318
Motivation and Needs	2.283
Employee Performance	3.192
Service process	2.131
Customer Satisfaction	2.148
Organizational Performance	3.377

of EP13 and EP14 questions and their coefficients are respectively 0.823 and 0.782. Therefore, third component of Employee Performance is calculated for each item by firstly multiplying coefficients with related observed values and then average value is calculated.

5.4. Structural Equation Modelling

Variance based PLS-SEM technique is used to define key 'driver' constructs and estimate the direct, indirect, and total effects of macroergonomic Person factor elements on consulting work system performance. Each relationship in the hypothesis model is evaluated. Hypotheses were considered statistically significant at a 95% confidence level only if its P value was lower than 0.5. Also, explained variance of a dependent variable are measured in order to decide whether the variable has enough predictive validity. R-squared (R^2) value was higher than 0.02 is accepted as sufficient criteria [40]. All the hypothesis and R^2 values were statistically significant. Therefore, any relation or any variable is not removed from the model.

5.4.1. Hypothesis Model

Macroergonomic person factor elements' effects are tested on the consulting work system performance. Twelve hypotheses are conducted and statistically tested by utilizing the SEM. Macroergonomic person factor elements that are Cognitive Skills, Education and Knowledge, Psychological Characteristics, and Motivation and Needs are formulated as reflective independent latent variables. Consulting work system performance indicators that are Employee Performance, Service Process, Customer Satisfaction and Organizational Performance are formulated as reflective dependent variables.

The following hypothesis were tested in this study:

H_1: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on employee's Psychological Characteristics in consulting work systems.

H_2: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on employee's Motivation and Needs in consulting work systems.

H_3: Employee's Cognitive Skills, Education and Knowledge have a positive direct effect on Employee Performance in consulting work systems.

H_4: Employee's Psychological Characteristics have a positive direct effect on Employee Performance in consulting work systems.

H_5: Employee's Psychological Characteristics have a positive direct effect on employee's Motivation and Needs in consulting work systems.

H_6: Employee's Motivation and Needs have a positive direct effect on Employee Performance in consulting work systems.

H_7: Employee Performance have a positive direct effect on Customer Satisfaction in consulting work systems.

H_8: Employee Performance have a positive direct effect on Service process in consulting work systems.

H_9: Employee Performance have a positive direct effect on Organizational Performance in consulting work systems.

H_{10}: Service process have a positive direct effect on Customer Satisfaction in consulting work systems.

H_{11}: Service process have a positive direct effect on Organizational Performance in consulting work systems.

H_{12}: Customer Satisfaction have a positive direct effect on Organizational Performance in consulting work systems.

Figure 5.1 illustrates the hypothesis model. All hypotheses are represented with

related hypothesis numbers in the related figure, for instance as H1. Cognitive Skills, Education and Knowledge variable is represented as CS&E&K, Psychological Characteristics is represented as PC, Motivation and Needs is represented as MN, Employee Performance is represented as EP, Service process is represented as SP, Customer Satisfaction is represented as CS and Organizational Performance is represented as OP. In the Figure 5.1 R symbol represents the reflective variable and related numbers in parenthesis show the latent variable numbers.

5.4.2. Model Fit and Quality Indices

Examination of the model of the hypothesis was performed by utilization of WarpPLS7® software., which is downloaded from the link [100] for 3 months free trial. For small sample sizes, this program is extensively suggested [73, 101]. WarpPLS7® software utilize the partial least squares (PLS) SEM method for analysis. PLS algorithms are suggested especially for nonlinear models' analysis [101, 102].

Three model fit and quality indices were computed to assess the PLS-SEM model: Average Path Coefficient (APC), Average R-Squared (ARS), and Average Variance Inflation Factor (AVIF). P values were estimated for APC and ARS. If the related P values are lower than 0.05, it indicates that relation is statistically significant at the 95% confidence level. If the P value does not provide this criteria, related hypothesis is rejected. In this model, all relationships were significant. Therefore, any relationship was not removed. Factor loadings values was inspected. All items showed higher loading wherein they belonged than other items. Therefore, any item was not discarded. After this step, three types of effects are estimated: direct effect, indirect effect and total effect.

As it can be seen in Table 5.17, Since the APC and ARS values are respectively 0.387 and 0.523 with $P \leq 0.001$ values, all the model relationships were validated statistically as significant. Also, for the exploratory power Tenenhaus GoF was examined. The value of the Tenenhaus GoF index is 0.582 which is higher than 0.36, conducted

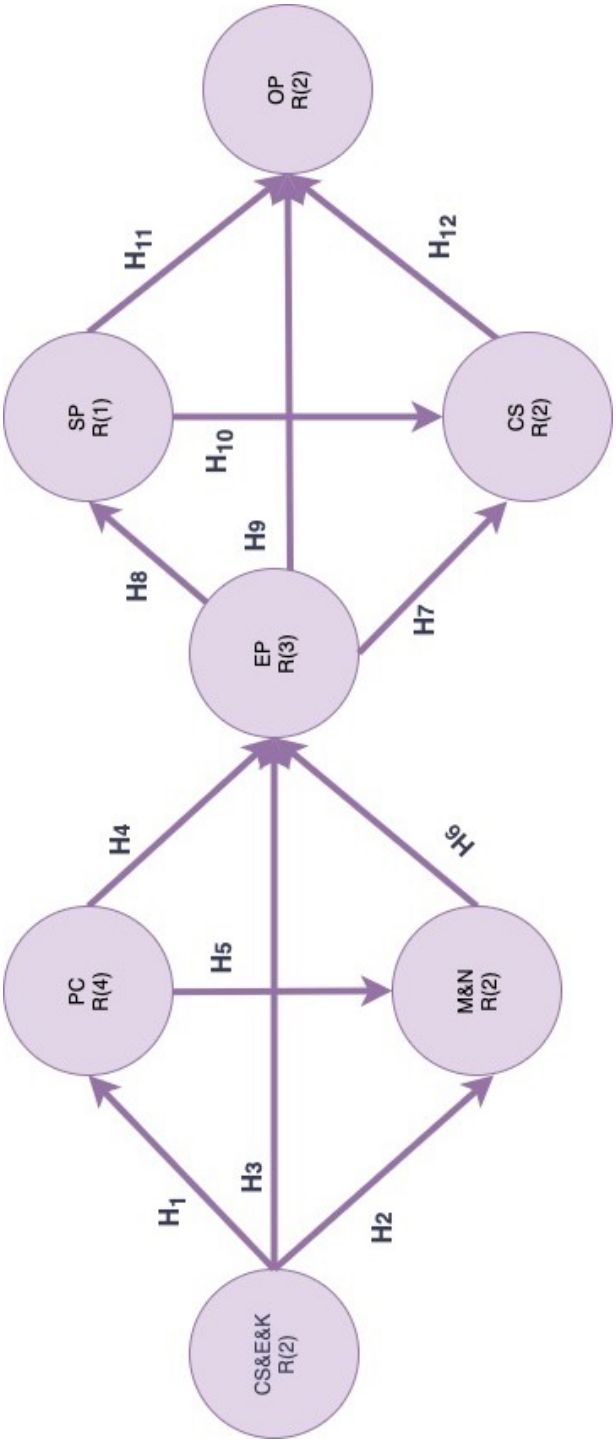

Figure 5.1. Hypothesis Model.

model's predictive capability and model exploratory power is defined as large [101].

Table 5.17. Model fit and quality indices.

Model Fit and Quality Indices:	**Index Value**	**Criteria**
Average path coefficient (APC)	0.376	**P <0.001**
Average R-Squared (ARS)	0.475	**P <0.001**
Average Variance Inflation Factor (AVIF)	1.702	**Acceptable if≤5, ideally≤3.3**
Tenenhaus GoF (GoF)	0.591	**Small ≥0.1, medium≥0.25, large≥ 0.36**

To sum up, in Table 5.18 structural validation of the model as summarized. Validation of the MCQ is achieved since the factor elements' and performance indicators' Cronbach's alpha values were higher than 0.6. Convergent and discriminant validity of the questionnaire is achieved with CA and AVE values since AVE values were above 0.5 in for the factor elements and performance indicators. High nonparametric predictive validity for the factor elements and performance indicators is achieved since the R-Squared coefficient is analyzed. R^2 values which is higher than 0.02 and all the Q^2 values were above zero.

5.4.3. Direct Effects

The direct effects between the explored variables are represented in Figure 5.2. Direct effects calculate the sensitivity to changes produced by one independent latent construct from a dependent latent construct, while all the measurement items remain the same in the study [103]. Each direct effect is generally associated with a value of beta (β) and a value of P. Realyvásquez *et al.* [40] described β values as "β values are standardized dependence measurement values.". In other words, the relationship between two variables with β value means that the independent variable increases by one standard deviation rise in independent variable cause the 1 X β standard deviations rise in the related dependent variable. For example, employee Cognitive Skills, Education and Knowledge and employee Psychological Characteristics shows $\beta = 0.51$. If the employee Cognitive Skills, Education and Knowledge variable increases by one stan-

Table 5.18. Structural Validation of the MCQ-Person Factor.

Element	**R-Squared (R^2)**	**Cronbach Alpha**	**Average Variance Extracted (AVE)**	**Q-Squared (Q^2)**
Cognitive Skills, Education and Knowledge		0.546	0.688	
Psychological Characteristics	0.257	0.659	0.496	0.259
Motivation and Needs	0.525	0.638	0.734	0.526
Employee Performance	0.504	0.753	0.673	0.509
Customer Satisfaction	0446	0.654	0.743	0.451
Service process	0.411	1.000	1.000	0.414
Organizational Performance	0.707	0.774	0.816	0.710

dard deviation, the employee Psychological Characteristics increases by 0.51 standard deviations.

Each relationship in the model is analyzed with P values. In order to accept the hypothesis as significantly important P values must be lower than 0.01 at 99% confidence level. In this conducted model, as it can be seen in Figure 5.2 all relationships were accepted statistically significant considering all P values which were below 0.01. Table 5.19 shows the results for the tested hypotheses.

Table 5.19. Results for the tested hypotheses.

Hypothesis	**Independent Variable**	**Dependent Variable**	**Decision**
H_1	**Cognitive Skills, Education and Knowledge**	**Psychological Characteristics**	**Accepted**
H_2	**Cognitive Skills, Education and Knowledge**	**Motivation and Needs**	**Accepted**
H_3	**Cognitive Skills, Education and Knowledge**	**Employee Performance**	**Accepted**
H_4	**Psychological Characteristics**	**Motivation and Needs**	**Accepted**
H_5	**Psychological Characteristics**	**Employee Performance**	**Accepted**
H_6	**Motivation and Needs**	**Employee Performance**	**Accepted**
H_7	**Employee Performance**	**Service process**	**Accepted**
H_8	**Employee Performance**	**Customer Satisfaction**	**Accepted**
H_9	**Employee Performance**	**Organizational Performance**	**Accepted**
H_{10}	**Service process**	**Customer Satisfaction**	**Accepted**
H_{11}	**Service process**	**Organizational Performance**	**Accepted**
H_{12}	**Customer Satisfaction**	**Organizational Performance**	**Accepted**

Highest three direct effects in the relationship are caused respectively (1) by Employee Performance on Service Performance, (2) by employee Psychological Characteristics on employee Motivation and Needs, (3) by employee Cognitive Skills, Education and Knowledge on employee Psychological Characteristics. The structural equations for the dependent latent variables are estimated with the related β values as follows:

Psychological Characteristics = 0.51 X Cognitive Skills, Education and Knowledge + Error

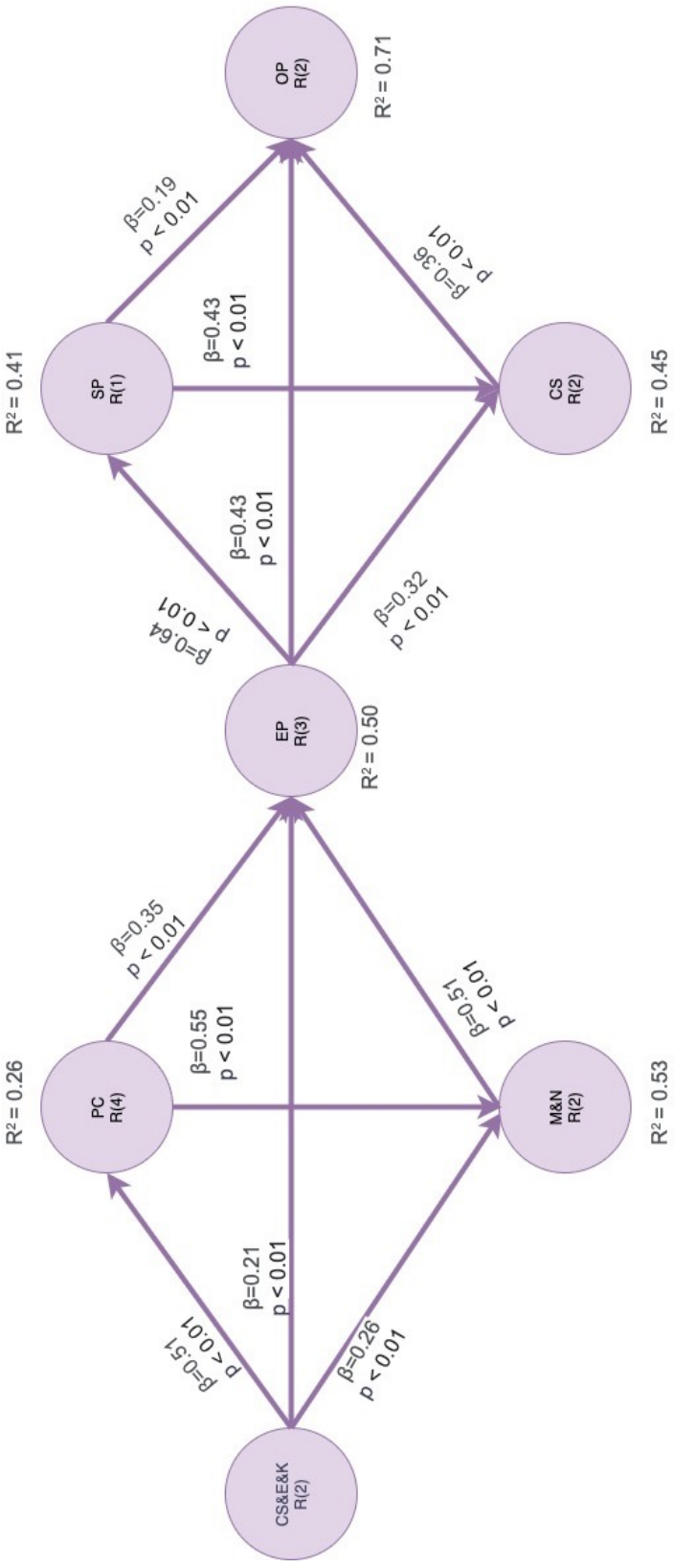

Figure 5.2. Direct effects between the analyzed variables.

Motivation and Needs = 0.26 X Cognitive Skills, Education and Knowledge + 0.55 X Psychological Characteristics + Error

Employee Performance = 0.21 X Cognitive Skills, Education and Knowledge + 0.35 X Psychological Characteristics + 0.27 X Motivation and Needs + Error

Service process = 0.64 X Employee Performance + Error

Customer Satisfaction = 0.32 X Employee Performance + 0.43 X Service process + Error

Organizational Performance = 0.43 X Employee Performance + 0.19 X Service process + 0.36 X Customer Satisfaction + Error

5.4.4. Indirect Effects

Realyvásquez *et al.* [40] stated that when the other dimensions acting as intermediaries, between two variables the indirect effects occur. In order to follow indirect effects visually, at least two or more model paths can be gone with. Table 5.20 represents the indirect effects in the model.

In this conducted model, all relationships were accepted statistically significant considering all P values which were below 0.007. Highest three indirect effects in the relationship are caused respectively (1) by employee Cognitive Skills, Education and Knowledge on Organizational Performance, (2) by Psychological Characteristics on Organizational Performance, (3) by employee Cognitive Skills, Education and Knowledge on Service process.

Indirect effects also can be explained with similar manner as direct effects. In other words, if the employee Cognitive Skills, Education and Knowledge variable increases by one standard deviation, the employee Service process increases by 0.341

standard deviations, since the indirect relationship between Cognitive Skills, Education and Knowledge and Service process has 0.341 β value.

Indirect effects are calculated by the paths. For measurement for each indirect relationship between variables for each number of paths indirect effects are estimated. Each path indirect effect is estimated by the multiplication of the direct effects. Then summation of all indirect effects reported. For instance, Cognitive Skills, Education and Knowledge have an indirect effect on Motivation and Needs via one 2 segment path because Cognitive Skills, Education and Knowledge effects indirectly Motivation and Needs via Psychological Characteristics element. Therefore, in order to estimate these effect direct effects in this path model can be estimated following equation:

Direct effect between Cognitive Skills, Education and Knowledge and Psychological Characteristics X Direct effect between Psychological Characteristics and Motivation and Needs = Indirect effect between Cognitive Skills, Education and Knowledge and Motivation and Needs

0.51X 0.55 = 0.2805

Since in the model results WarpPLS reports direct effects in two decimals, indirect effect is estimated 0.2805. To understand deeply, indirect effect between Employee Performance and Organizational Performance is estimated. In this relationship, there are 3 paths. Two of them is 2 segment path and other one is 3 segment path. Therefore, in order to estimate these effect direct effects in this path model can be estimated following equation:

Indirect effects for paths with two segments:

There are two paths with two segments. Firstly,

Direct effect between Employee Performance and Service process X Direct effect

between Service process and Organizational Performance = Indirect effect between Employee Performance and Organizational Performance

0.64 X 0.19 = 0.1216

Secondly,

Direct effect between Employee Performance and Customer Satisfaction X Direct effect between Customer Satisfaction and Organizational Performance = Indirect effect between Employee Performance and Organizational Performance

0.32X 0.356 = 0.1152

Indirect effect for paths with three segments:

Direct effect between Employee Performance and Service process X Direct effect between Service process and Customer Satisfaction X Direct effect between Customer Satisfaction and Organizational Performance = Indirect effect between Employee Performance and Organizational Performance

0.641 X 0.428 X 0.356 = 0.09766

Total indirect effect is between Employee Performance and Organizational Performance:

Indirect effects for paths with two segments + Indirect effect for paths with three segments = Total indirect effect

0.1216 + 0.1152 + 0.099072 = 0.335872

As it stated in previous, those rounding differences emerge from the direct effects

are reported in two decimals. The calculation method is as shown above with two separate examples.

Table 5.20. Sum of indirect effects.

To	From				
	Cognitive Skills, Education and Knowledge	**Psychological Characteristics**	**Motivation and Needs**	**Employee Performance**	**Service process**
Motivation and Needs	0.279				
Employee Performance	0.326	0.151			
Service process	0.341	0.322	0.176		
Customer Satisfaction	0.316	0.298	0.163	0.240	
Organizational Performance	0.403	0.380	0.208	0.331	0.152

5.4.5. Total Effects

The total effects of a relationship were estimated by summation of related relationship's direct and indirect effects [40, 73]. Table 5.21 represents the total effects in the model. Largest three total effects in the model are respectively caused (1) by Employee Performance on Organizational Performance, (2) by Employee Performance on Service process, (3) by Employee Performance on Service process.

5.5. Discussion

This study aimed to explore the influence of macroergonomic person compatibility elements in consulting organizations on the success of consulting work systems. First, the MCQ was constructed regarding consulting industry dynamics and macroergonomic person factor elements.

Table 5.21. Total effects.

To	From					
	Cognitive Skills, Education and Knowledge	**Psychological Characteristics**	**Motivation and Needs**	**Employee Performance**	**Service process**	**Customer Satisfaction**
Psychological Characteristics	0.507					
Motivation and Needs	0.539	0.550				
Employee Performance	0.531	0.502	0.274			
Service process	0.341	0.322	0.176	0.641		
Customer Satisfaction	0.316	0.298	0.163	0.594	0.428	
Organizational Performance	0.403	0.380	0.208	0.758	0.339	0.356

The statistical analysis results are summarized below with discussion.

5.5.1. Findings of the Data Analysis

- The direct effects were found significant at all relationships in conducted hypothesis model since all p-values were lower than 0.01 at the confidence level 99 %, the indirect effects were found significant at all relationships in conducted hypothesis model since all P-values were lower than 0.04 at the confidence level 96 %, the total effects were found significant at all relationships in conducted hypothesis model since all P-values were lower than 0.02 at the confidence level 98 %.
- The macroergonomic compatibility of cognitive skills, education and knowledge is necessary for the macroergonomic compatibility of remaining person elements, psychological characteristics and motivation and needs, to reach the high performance of the consulting work system. The macroergonomic compatibility of cognitive skills, education and knowledge is also necessary for the performance

indicators especially for the employee performance to reach the high performance of the consulting work system. Direct effects in the hypothesis model showed that employee cognitive skills, education and knowledge significantly effect the employee psychological characteristics (β=0.51). Indirect effects in the hypothesis model showed that employee cognitive skills, education and knowledge has the highest effect on the organizational performance (β=0.403), followed by service process (β=0.341) and motivation and needs (β=0.326). As a result, total effects indicated that employee cognitive skills, education and knowledge have a considerable effect on the performance indicators and other person factor elements. It should be pointed out that this element was not investigated in other similar studies (e.g.; manufacturing industry). Hence, this study is the first study to shed light to future studies.

- The macroergonomic compatibility of psychological characteristics is necessary for the macroergonomic compatibility of motivation and needs, to reach the high performance of the consulting work system. The macroergonomic compatibility of psychological characteristics is also necessary for the performance indicators especially for the employee performance to reach the high performance of the consulting work system. Direct effects in the hypothesis model showed that employee psychological characteristics significantly effect the employee motivation and needs (β=0.55). Indirect effects in the hypothesis model showed that employee psychological characteristics has the highest effect on the organizational performance (β=0.380), followed by service process (β=0.322) and performance (β=0.151), respectively. As a result, total effects indicated that employee psychological characteristics have a considerable effect on the performance indicators and employee motivation and needs. Although this study with respect to performance indicators and the elements that are included in the model is different from the Realyvásquez *et al.* [40] study, they are in agreement: employee psychological characteristics have a considerable effect on the employee motivation and needs. In their study they found the total relation as β=0.41, however we found stronger relation between these elements (β=0.55). They also found that the overall effects of employees' psychological characteristics on performance indicators for

the manufacturing industry were on the customer, organizational performance, and production processes, from the largest to the smallest, respectively. In this study, results revealed that the total effect of the psychological characteristics of employees on performance indicators for the consulting industry is employee performance, organizational performance, service process and customer satisfaction, respectively, from the largest to the smallest.

- The macroergonomic compatibility of motivation and needs is necessary for the employee performance to reach the high performance of the consulting work system. Direct effects in the hypothesis model showed that employee motivation and needs have a considerable significant effect on the employee performance (β=0.27). Indirect effects in the hypothesis model showed that employee motivation and needs effects was the highest one on the organizational performance (β=0.208) followed by the service process (β=0.176). Total effects in the hypothesis model showed that the employye performance was effected by the employee motivation and needs (β=0.274) compared to the other person factor elements.
- Developed hypothesis model showed the important relationships not only between macroergonomic person factor elements and consulting work system performance metrics; but also relationships among macroergonomic person factor elements and relationships among consulting work system performance metrics were revealed. With this aspect this study differs from the Kaya's study [58]. Not only the developed model structure and examined its relations but also the examined performance metrics and examined macroergonomic factor is also different. Kaya [58] investigated the macroergonomic organization factor, however in this study macroergonomic person factor was analyzed. Moreover, Kaya [58]considered three performance metrics to evaluate consulting work system performance.These metrics are namely: employee performance, firm performance and client. However, in this study, four performance metrics as it mentioned previous were analyzed. In addition, Kaya [58] focused on the specific area of consulting industry which is management consulting industry. However, this study all types of consulting companies was analyzed. Besides these differences, this study differs from the Kaya's study [58] regarding utilized method. In his study, covariance-

based SEM was utilized. In contrast to his study, in this study variance-based PLS-SEM is used to evaluate the developed hypothesis model.

- Employee performance is necessary for the service process, customer satisfaction and organizational performance to reach the high performance of the consulting work system. Total effects in the hypothesis model showed that employee performance effect was higher for the organizational performance (β=0.758) followed by the service process (β=0.641) and customer satisfaction (β=0.594). Since all the macroergonomic person factor elements directly affect employee performance, we can conclude that macroergonomic person factor elements are vital for the consulting work system performance. Indirect effects in the hypothesis model showed that employee performance effects the organizational performance (β=0.331) and customer satisfaction (β=0.24) indirectly also. Direct effects in the hypothesis model showed that employee performance has significant effect on the service process (β=0.64).
- Total effects in the hypothesis model showed that employee cognitive skills, education and knowledge (β=0.531), and psychological characteristics (β=0.502) have approximately the same effect, and motivation and needs elements has relatively lower effect (β=0.274) on the employee performance. This indicates that employee cognitive skills, education and knowledge, and psychological characteristics are more important than motivation and needs of employee for the employee performance.
- Service process are necessary for the customer satisfaction and organizational performance to reach the high performance of the consulting work system. Direct effects in the hypothesis model showed that service process has a significant effect on the customer satisfaction (β=0.43). Direct and total effects in the hypothesis model also showed that service process has a significant effect on the organizational performance (β=0.19 and β=0.339).
- Although all macroergonomic elements included in this study and performance indicators are important and necessary for the organizational performance, the most critical element is the employee performance to reach the high performance of the consulting work system because total effects indicated that total effect from

employee performance to organizational performance is β=0.758, which is higher than two times the closest value to this value.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusion

This study focuses primarily on analyzes of the relationship between the macroergonomic person factor elements and the benefits that these elements may generate on consulting work systems performance using a structural equation modeling approach. Specifically, this study is an attempt to shed light on the "macroergonomic person factor" effect on the consulting work system performance. The results obtained through this study should encourage the companies to incorporate macroergonomics practice and principles into their strategic endeavors. This study has several significant contributions to the existing knowledgebase in the area. Firstly, the study explored all the elements of the "macroergonomic person factor" on consulting work system performance through a hypothesis model developed for the purpose. Secondly, although the effects of several macroergonomic factors on the manufacturing work systems were examined by previous research, this study is the first to investigate the effects of all four macroergonomic person factor elements over the consulting work system's performance. Thirdly, the performance variables of the consulting industry were analyzed and identified to obtain a comprehensive understanding of all parts of the system. Finally, the use of the MCQ, and other analysis methods (namely, factor analysis and PLS-SEM) makes this study unique in this topic which brings new insights.

Although employee physical characteristics was excluded from the model due to present inadequate reliability, all relationships between rest of the macroergonomic person factor elements and performance indicators in the hypothesis model are found statistically significant at 99 % significance level. In conclusion employee cognitive skills, education and knowledge, psychological characteristics and motivation and needs are vital to reach high employee performance which is the most important element that effects other consulting work system components, in other words employee performance is very critical to achieve high service process performance, customer satisfaction and

organizational performance.

The developed model based on variance based PLS-SEM solution can be used to prioritize which elements are essential while creating high performing work system in the consulting sector. By using the suggested approach, managers that lead strategically companies in consulting industry may get benefit from the findings since until this time they generally do not have enough resource (time, cost, expertise, and motivation constraints) to setting priorities.

Based on the results of the study in relation to the objectives and research questions, the following can be concluded:

(1) A person factor-related hypothesis model representing consulting work system performance was developed.
(2) Employee Performance is the most influential element for the consulting work system performance. Results indicated that employee performance has the highest significant effect on other performance indicators, especially on the organizational performance.
(3) The macroergonomic person factor and its elements have a significant effect on the performance measures, especially on employee performance. Results indicate that employee cognitive skills, education and knowledge and psychological characteristics are more important than the employee motivation and needs for the employee performance.
(4) Results indicated that not only relations between person factor elements and performance indicators but also relations among person factor elements are also very important. Regarding the analysis results, employee cognitive skills, education and knowledge have a positive significant effect on the employee psychological characteristics and motivation and needs. Results also showed that employee psychological characteristics have a positive significant effect on the employee motivation and needs. With this aspect of the results, consulting companies should pay attention also to the relationships between macroergonomic person

elements.

(5) Consulting work systems must be open to change and improve by adopting ergonomic practices at all levels (micro- and macroergonomic) and improving those already implemented in order to gain competitive advantage.

(6) To increase long-term business benefits, organizations working in the consulting industry, as well as any other type of company, should design their work systems without neglecting macroergonomic factors.

(7) It is important that consulting firms establish an ongoing process able to guarantee that the initiatives and practices that move work system compatibility one step forward are useful not only in theory but in practice.

To sum up, this study was performed to achieve two main objectives and to answer two main research questions. Both of these objectives were achieved, and questions were answered. More specifically, the objectives can be summarized as all effects of the macroergonomic person elements on the consulting work system performance indicators and relations between those elements. Briefly, the results found regarding the first question: employee cognitive skills, education and knowledge and psychological characteristics are more important than the employee motivation and needs for the employee performance although all elements have a significant effect on employee performance. On the other hand, the results found regarding then second question can be explained as: Employee cognitive skills, education and knowledge have a positive significant effect on the employee psychological characteristics and motivation and needs. Similarly, according to the results employee psychological characteristics have a positive significant effect on the employee motivation and needs.

6.2. Recommendations for Future Research

This research has an important quality with regard to bringing new aspects in consulting service work system understanding with the methodology and macroergonomic compatibility approach. Although recent studies have conducted in macroergonomic compatibility research area, this thesis is unique regarding the specific area which is

consulting work system elements and analyzing the macroergonomic person factor. Through the conducted hypothesis model and relations between input variables and performance indicators and the utilized SEM analysis, not only academia but also businesses will get benefit from the results of the study.

As it mentioned, one of the novelties in this study is that hypothesis model. In this hypothesis model, relationships between inputs and the performance indicators are carefully structured. In other words, in this study, relations between variables were analyzed with theoretical approach. Another novelty is the determination of the consulting service work system elements. In this study, employee performance, customer satisfaction, service process and organizational performance are considered as the critical indicators of consulting work structure.

Although these results are only valid to the consulting companies having participated in the research, to gather more comprehensive understanding, similar research needs to be explored to broad target audience in which the participants' that in high hierarchical levels such as director level or higher. Not only increase of target participants but also research area can be explored to the other service companies which are operating in the service sector, such as banks, insurance, and so on.

This approach can be considered in future work with extended assessment indicators, different or additional macroergonomic variables for new or ongoing design processes of the work system. In addition, the direct relationships established in the hypothesis model can be formed since this does not indicate that all direct relationships between elements are restricted to the relationships examined. Future work may consider other direct interrelationships not examined by assessing them utilizing another methodology. The scope of this research would inevitably be enhanced by that one.

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APPENDIX A: MACROERGONOMIC COMPATIBILITY QUESTIONNAIRE

Table A.1. Questionnaire questions and associated identification code and section in English.

ID	SECTION	QUESTION
Deg1	**Demographic**	**What is the highest level of formal education you have completed?**
Deg2	**Demographic**	**How long have you been employed in your current company?**
Deg3	**Demographic**	**How long have you been in your current position?**
Deg4	**Demographic**	**How many years do you have work experience?**
Deg5	**Demographic**	**How many years of executive experience do you have?**
Deg6	**Demographic**	**What is the name of the company you currently work for?**
Deg7	**Demographic**	**Which of the following options best represents the type of consulting services does your company provide?**
Deg8	**Demographic**	**Which of the following options best represents the area of expertise you provide consultancy service?**
Deg9	**Demographic**	**Which of the following options better represent your position in the company?**
Deg10	**Demographic**	**In your current position, do you manage other managers?**
Deg11	**Demographic**	**Gender**
Deg12	**Demographic**	**Age**
CS, E & K1	**Cognitive Skills, Education and Knowledge**	**Training activities are available for every employee.**
CS, E & K2	**Cognitive Skills, Education and Knowledge**	**There are training activities in case of job rotation.**
CS, E & K3	**Cognitive Skills, Education and Knowledge**	**Training activities are periodically updated.**
CS, E & K4	**Cognitive Skills, Education and Knowledge**	**Training activities are increasing the skills and competency of employee, and employee knowledge.**
CS, E & K5	**Cognitive Skills, Education and Knowledge**	**Inadequate skill and knowledge of employee are compensated with employee training.**
CS, E & K6	**Cognitive Skills, Education and Knowledge**	**Qualifications such as education, training and experience required for the position are taken into account when recruiting employees.**
CS, E & K7	**Cognitive Skills, Education and Knowledge**	**Managers are able to recognize employees' needs of training and knowledge.**

Table A.1. Questionnaire questions and associated identification code and section in English. (cont.)

ID	SECTION	QUESTION
CS, E & K8	**Cognitive Skills, Education and Knowledge**	**Employees have adequate formal education and knowledge to perform their tasks successfully.**
CS, E & K9	**Cognitive Skills, Education and Knowledge**	**Employees have adequate training and competency development, beyond formal training, to perform their tasks successfully. (E.g. Courses, certificates about their studies)**
CS, E & K10	**Cognitive Skills, Education and Knowledge**	**Employees have adequate informal qualifications, such as experience, beyond formal education and training, to perform their tasks successfully.**
CS, E & K11	**Cognitive Skills, Education and Knowledge**	**Employees have key skills to perform their tasks successfully. Key skills: (1) the ability to communicate and build rapport with both clients and managers, (2) analytical thinking, (3)time management, (4)communication etc.**
CS, E & K12	**Cognitive Skills, Education and Knowledge**	**Knowledge transfer between colleagues and knowledge transfer when the employee are recruited are adequate.**
PhyC1	**Physical Characteristics**	**Physical fitness states of employees are considered for task allocation.**
PhyC2	**Physical Characteristics**	**Employees receive attention when they present a physical discomfort.**
PhyC3	**Physical Characteristics**	**If possible, causes of employees' physical discomfort are analysed and resolved.**
PhyC4	**Physical Characteristics**	**Employees' age are considered for task allocation.**
PhyC5	**Physical Characteristics**	**Employees' gender are considered for task allocation.**
PC1	**Psychological Characteristics**	**Employees' psychological well-beings (distress, stress, depression, and satisfaction) are considered for task allocation.**
PC2	**Psychological Characteristics**	**Employees receive attention when they present a psychological discomfort such as mental stress, depression, etc.**
PC3	**Psychological Characteristics**	**If possible, causes of employees' psychological discomfort are analysed and resolved.**
PC4	**Psychological Characteristics**	**Tasks are designed in order to avoid employees' psychological discomfort. E.g., Feeling (1) boredom, (2) emotionally bad way, (3) pressure such as job loss.**
PC5	**Psychological Characteristics**	**Tasks do not put time pressure on employees.**
PC6	**Psychological Characteristics**	**Tasks are designed not to overload employees.**
PC7	**Psychological Characteristics**	**Employees receive stress management training.**
PC8	**Psychological Characteristics**	**Employees successfully manage their stress.**

Table A.1. Questionnaire questions and associated identification code and section in English. (cont.)

ID	SECTION	QUESTION
PC9	**Psychological Characteristics**	**Employees have satisfactory communication abilities**
PC10	**Psychological Characteristics**	**Employees have high self-esteem and confidence to tackle problems.**
PC11	**Psychological Characteristics**	**Employees have personal goal-setting.**
PC12	**Psychological Characteristics**	**Employees' personal values match up with the company's values.**
PC13	**Psychological Characteristics**	**Employees have positive work attitudes.**
PC14	**Psychological Characteristics**	**Employees are open and honest.**
PC15	**Psychological Characteristics**	**Employees show gratitude.**
PC16	**Psychological Characteristics**	**Employees are emotionally stable and predictable.**
PC17	**Psychological Characteristics**	**Employees have high self-awareness and social awareness. Social awareness: Employees are aware of what is going on around them.**
M&N1	**Motivation and Needs**	**Employee motivation are considered for tasks allocation.**
M&N2	**Motivation and Needs**	**Employees are motivated to work through problem-solving approaches.**
M&N3	**Motivation and Needs**	**Employees have perseverance.**
M&N4	**Motivation and Needs**	**Employees are encouraged to express their ideas.**
M&N5	**Motivation and Needs**	**Employees have instrict motivation.**
M&N6	**Motivation and Needs**	**When in need, help is provided to employees for the assigned job.**
M&N7	**Motivation and Needs**	**Employees are satisfied with levels of pay.**
M&N8	**Motivation and Needs**	**Employees work in flexible schedules.**
M&N9	**Motivation and Needs**	**Employees perform tasks in self paced manner.**
M&N10	**Motivation and Needs**	**Employees have adequate daily breaks. (E.g. One hour lunch break and 2X15 min breaks daily.)**
M&N11	**Motivation and Needs**	**Employees have adequate annual vacation time.**
M&N12	**Motivation and Needs**	**Employees are satisfied with their tasks that they perform.**
M&N13	**Motivation and Needs**	**Tasks are interesting and challenging to employees.**
M&N14	**Motivation and Needs**	**Job positions are open to career and individual development**
M&N15	**Motivation and Needs**	**Employees are recognized / rewarded for their achievements.**
M&N16	**Motivation and Needs**	**Employees are loyal to company.**
M&N17	**Motivation and Needs**	**Employees are involved in the decision-making process.**

Table A.1. Questionnaire questions and associated identification code and section in English. (cont.)

ID	SECTION	QUESTION
M&N18	Motivation and Needs	Employees are convinced that they have self-efficacy. Self-efficacy: The ability and information necessary to make decisions successfully.
M&N19	Motivation and Needs	Employees are eager to take responsibilities.
M&N20	Motivation and Needs	Employees are motivated by the greater good. E.g. the reduction of air pollution by the work they do or the service they provide.
EP1	Employee Performance	Employee morale is higher than the last years
EP2	Employee Performance	Employee turnover rate (ETR) has decreased over the time.
EP3	Employee Performance	Employees' absenteeism has decreased over the time.
EP4	Employee Performance	Employee well-being at work has increased over the time.
EP5	Employee Performance	Employee based errors has minimized the least level over the time. (tasks, making-decisions, taking responsibilities)
EP6	Employee Performance	Employee knowledge and skills have improved over the time.
EP7	Employee Performance	On-time task completions by employees have been improved over the time.
EP8	Employee Performance	Employees' coordination, collaboration and communication have improved over the time.
EP9	Employee Performance	Employee relationship within company and with customers have improved over the time.
EP10	Employee Performance	Employees' adaptation to flexible working has increased over time.
EP11	Employee Performance	Reprocess due to inadequate worker efficiency has decreased over time.
EP12	Employee Performance	Employee productivity has increased over the time.
EP13	Employee Performance	Employees work in team projects successfully.
EP14	Employee Performance	Employees are ready to help coworkers.
EP15	Employee Performance	Sense of community in the company has increased over the time.
EP16	Employee Performance	Employee problem solving skills has increased over the time.
CS1	Customer Satisfaction	Customers' needs and expectations are taken into account.
CS2	Customer Satisfaction	Customer satisfaction has increased over time.
CS3	Customer Satisfaction	Customers remain loyal to the company.
CS4	Customer Satisfaction	The number of customers has increased over the time.
CS5	Customer Satisfaction	Customer engagement has been increased over the time.
CS6	Customer Satisfaction	Capacity utilization in client projects has increased over the time.

Table A.1. Questionnaire questions and associated identification code and section in English. (cont.)

ID	SECTION	QUESTION
CS7	**Customer Satisfaction**	**Number of projects has increased over the time.**
CS8	**Customer Satisfaction**	**Average project size has increased over the time.**
CS9	**Customer Satisfaction**	**Repeat business has increased over the time.**
CS10	**Customer Satisfaction**	**Size of customers has increased over the time.**
SP1	**Service Process**	**Service quality (without error) has increased over the time.**
SP2	**Service Process**	**Service productivity has increased over time.**
SP3	**Service Process**	**Number of projects completed on time has increased.**
SP4	**Service Process**	**Time duration to complete the projects or services has reduced over the time.**
SP5	**Service Process**	**Quality delivery is provided with respect to customer satisfaction.**
SP6	**Service Process**	**Flexible services are provided to satisfy different types of customers over time.**
SP7	**Service Process**	**Post-service customer supports are provided.**
SP8	**Service Process**	**Service development processes are implemented successfully over the time.**
SP9	**Service Process**	**Service development processes are updated over the time.**
OP1	**Organizational Performance**	**Productivity has increased over the time.**
OP2	**Organizational Performance**	**The number of employees has increased.**
OP3	**Organizational Performance**	**The variety of services has increased over the time.**
OP4	**Organizational Performance**	**The business has improved.**
OP5	**Organizational Performance**	**The company's sales has increased over the time.**
OP6	**Organizational Performance**	**The company's reputation has increased over the time.**
OP7	**Organizational Performance**	**The company's innovation capacity has increased over the time.**
OP8	**Organizational Performance**	**Net profit has increased over the time.**
OP9	**Organizational Performance**	**coordination for its regional, national and global activities than recent years.**
OP10	**Organizational Performance**	**Employee satisfaction has increased over the time.**
OP11	**Organizational Performance**	**Retaining talent has become easier over the time.**
OP12	**Organizational Performance**	**Employee engagement has increased over the time.**
OP13	**Organizational Performance**	**Percentage of responses to open positions has increased over the time.**

Table A.1. Questionnaire questions and associated identification code and section in English. (cont.)

ID	SECTION	QUESTION
OP14	**Organizational Performance**	**Investments in employees development and training has increased over the time.**
OP15	**Organizational Performance**	**Safety and health at work has improved over the time.**
OP16	**Organizational Performance**	**Work control and is improved over the time.**

Table A.2. Questionnaire questions and associated identification code and section in Turkish.

ID	SECTION	QUESTION
Deg1	**Demografik**	**Tamamladığınız son eğitim seviyesi nedir?**
Deg2	**Demografik**	**Şirketinizde ne kadar süredir çalışıyorsunuz?**
Deg3	**Demografik**	**Şu anki pozisyonunuzda ne kadar zamandır bulunuyorsunuz?**
Deg4	**Demografik**	**Kaç yıllık iş tecrübeniz var?**
Deg5	**Demografik**	**Kaç yıllık yöneticilik deneyiminiz var?**
Deg6	**Demografik**	**Şu anda çalıştığınız şirketin adı nedir?**
Deg7	**Demografik**	**Aşağıdaki seçeneklerden hangisi, şirketinizin sunduğu danışmanlık hizmetlerinin türünü en iyi temsil etmektedir?**
Deg8	**Demografik**	**Aşağıdaki seçeneklerden hangisi, danışmanlık hizmeti verdiğiniz uzmanlık alanını en iyi temsil etmektedir?**
Deg9	**Demografik**	**Aşağıdaki seçeneklerden hangisi şirketteki konumunuzu en iyi temsil ediyor?**
Deg10	**Demografik**	**Şu anki pozisyonunuzda, diğer yöneticileri yönetiyor musunuz?**
Deg11	**Demografik**	**Cinsiyet**
Deg12	**Demografik**	**Yaş**
BY, E & B1	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Her çalışan için eğitim faaliyetleri bulunmaktadır.**
BY, E & B2	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**İş rotasyonu durumunda eğitim faaliyetleri vardır.**
BY, E & B3	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Eğitim faaliyetleri periyodik olarak güncellenmektedir.**
BY, E & B4	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Eğitim faaliyetleri çalışanın beceri ve yetkinliğini ve çalışan bilgisini artırmaktadır.**
BY, E & B5	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışanın beceri ve bilgi yetersizliği, eğitim ile telafi edilir.**
BY, E & B6	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**İşe alımlarda, pozisyon için gerekli olan eğitim, öğretim ve deneyim gibi nitelikler dikkate alınır.**
BY, E & B7	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Yöneticiler, çalışanların eğitim ve bilgi ihtiyaçlarının farkındadırlar.**

Table A.2. Questionnaire questions and associated identification code and section in Turkish. (cont.)

ID	SECTION	QUESTION
BY, E & B8	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışanlar, görevlerini başarıyla yerine getirmek için yeterli örgün eğitim ve bilgiye sahiptir.**
BY, E & B9	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışanlar, görevlerini başarıyla yerine getirmek için örgün eğitimin ötesinde yeterli eğitim ve yeterliliğe sahiptir. (Örn. kurslar, çalışmaları ile ilgili sertifikalar)**
BY, E & B10	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışanlar, görevlerini başarıyla yerine getirmek için örgün eğitim ve öğretimin haricinde deneyim gibi yeterli niteliklere sahiptir.**
BY, E & B11	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışanlar, görevlerini başarıyla yerine getirmek için temel becerilere sahiptir. Temel beceriler: (1) müşteriler ve yöneticilerle iletişim kurma, (2) analitik düşünme, (3) zaman yönetimi vb.**
BY, E & B12	**Bilişsel Yetenekler, Eğitim ve Bilgi**	**Çalışan işe alındığında gerekli bilgi aktarımı yapılır. Meslektaşlar arası bilgi aktarımı yeterli seviyededir.**
FÖ1	**Fiziksel Özellikler**	**Görev dağılımı için çalışanların fiziksel uygunluk durumları dikkate alınır.**
FÖ2	**Fiziksel Özellikler**	**Çalışanlar fiziksel bir rahatsızlık hissettiklerinde bu duruma gerekli ilgi gösterilir.**
FÖ3	**Fiziksel Özellikler**	**Mümkünse, çalışanların fiziksel rahatsızlıklarının nedenleri analiz edilir ve çözülür.**
FÖ4	**Fiziksel Özellikler**	**Görev dağılımı için çalışanların yaşı dikkate alınır.**
FÖ5	**Fiziksel Özellikler**	**Görev dağılımı için çalışanların cinsiyeti dikkate alınır.**
PÖ1	**Psikolojik Özellikler**	**Çalışanların psikolojik durumları (sıkıntı, stres, depresyon ve memnuniyet) görev dağılımı için dikkate alınır.**
PÖ2	**Psikolojik Özellikler**	**Çalışanlar stres, depresyon vb. psikolojik bir rahatsızlık hissettiklerinde bu duruma gerekli ilgi gösterilir.**
PÖ3	**Psikolojik Özellikler**	**Mümkünse, çalışanların psikolojik rahatsızlıklarının nedenleri analiz edilir ve çözülür.**
PÖ4	**Psikolojik Özellikler**	**Görevler, çalışanların psikolojik rahatsızlıklara maruz kalmaması esas alınarak tasarlanmıştır. Örneğin. (1) Can sıkıntısı hissetme, (2) duygusal olarak kötü etkilenme, (3) iş kaybı gibi baskı hissetme.**
PÖ5	**Psikolojik Özellikler**	**Görevler, çalışanlar üzerinde zaman baskısı oluşturmaz.**
PÖ6	**Psikolojik Özellikler**	**Görevler, çalışanlara aşırı iş yükü getirmeyecek şekilde tasarlanmıştır.**
PÖ7	**Psikolojik Özellikler**	Çalışanlara stres yönetimi eğitimi verilir.
PÖ8	**Psikolojik Özellikler**	**Çalışanlar streslerini başarıyla yönetirler.**
PÖ9	**Psikolojik Özellikler**	**Çalışanların tatmin edici iletişim yetenekleri vardır.**

Table A.2. Questionnaire questions and associated identification code and section in Turkish. (cont.)

ID	SECTION	QUESTION
PÖ10	**Psikolojik Özellikler**	**Çalışanlar sorunların üstesinden gelmek için yeterli özgüvene sahiptir.**
PÖ11	**Psikolojik Özellikler**	**Çalışanlar kişisel hedeflere sahiptir.**
PÖ12	**Psikolojik Özellikler**	**Çalışanların kişisel değerleri şirketin değerleriyle örtüşür.**
PÖ13	**Psikolojik Özellikler**	**Çalışanlar olumlu iş tutumları sergiler.**
PÖ14	**Psikolojik Özellikler**	**Çalışanlar açık ve dürüsttür.**
PÖ15	**Psikolojik Özellikler**	**Çalışanlar minnettarlık gösterir.**
PÖ16	**Psikolojik Özellikler**	**Çalışanlar duygusal olarak istikrarlı ve öngörülebilirdir.**
PÖ17	**Psikolojik Özellikler**	**Çalışanlar yüksek öz farkındalığa ve sosyal farkındalığa sahiptir. (Sosyal farkındalık: Çalışanlar çevrelerinde olup bitenlerin farkındadır.)**
M&İ1	**Motivasyon ve İhtiyaçlar**	**Görev dağılımı için çalışan motivasyonu dikkate alınır.**
M&İ2	**Motivasyon ve İhtiyaçlar**	**Çalışanlar, problem çözme yaklaşımı ile çalışarak motive olurlar**
M&İ3	**Motivasyon ve İhtiyaçlar**	**Çalışanlar azimlidir.**
M&İ4	**Motivasyon ve İhtiyaçlar**	**Çalışanların fikirlerini ifade etmeleri teşvik edilir.**
M&İ5	**Motivasyon ve İhtiyaçlar**	**Çalışanların motivasyonu yüksektir.**
M&İ6	**Motivasyon ve İhtiyaçlar**	**İhtiyaç duyulduğunda, görevlendirilen iş için çalışanlara destek sağlanır.**
M&İ7	**Motivasyon ve İhtiyaçlar**	**Çalışanlar, maaş seviyelerinden memnundurlar.**
M&İ8	**Motivasyon ve İhtiyaçlar**	**Çalışanlar esnek programlarla çalışır.**
M&İ9	**Motivasyon ve İhtiyaçlar**	**Çalışanlar, görevleri kendi hızlarında gerçekleştirirler.**
M&İ10	**Motivasyon ve İhtiyaçlar**	**Çalışanların yeterli günlük molaları vardır. (Örn. Bir saat öğle yemeği arası ve her gün 2X15 dakikalık molalar.)**
M&İ11	**Motivasyon ve İhtiyaçlar**	**Çalışanların yeterli yıllık tatil süresi vardır.**
M&İ12	**Motivasyon ve İhtiyaçlar**	**Çalışanlar, gerçekleştirdikleri görevlerinden memnundurlar.**
M&İ13	**Motivasyon ve İhtiyaçlar**	**Görevler, çalışanlar için ilgi çekici ve geliştiricidir.**
M&İ14	**Motivasyon ve İhtiyaçlar**	**İş pozisyonları kariyer ve bireysel gelişime açıktır.**
M&İ15	**Motivasyon ve İhtiyaçlar**	**Çalışanlar başarıları için takdir edilir / ödüllendirilir.**
M&İ16	**Motivasyon ve İhtiyaçlar**	**Çalışanlar şirkete sadıktır.**
M&İ17	**Motivasyon ve İhtiyaçlar**	**Çalışanlar karar verme sürecine dahil olur.**
M&İ18	**Motivasyon ve İhtiyaçlar**	**Çalışanlar, öz yeterliliğe sahip olduklarına inanırlar. (Öz yeterlilik: başarılı kararlar vermek için gerekli yetenek ve bilgi.)**
M&İ19	**Motivasyon ve İhtiyaçlar**	**Çalışanlar sorumluluk almaya isteklidir.**
M&İ20	**Motivasyon ve İhtiyaçlar**	**Çalışanlar yaptıkları işin topluma da katkı sağlamasından motive olur. Örneğin, yaptıkları iş veya verdikleri hizmet ile hava kirliliğinin azaltılması.**

Table A.2. Questionnaire questions and associated identification code and section in Turkish. (cont.)

ID	SECTION	QUESTION
ÇP1	Çalışan Performansı	Çalışanların morali geçen yıllara göre artmıştır.
ÇP2	Çalışan Performansı	Çalışanların istifa oranı zamanla azalmıştır.
ÇP3	Çalışan Performansı	Çalışanların devamsızlığı zamanla azalmıştır.
ÇP4	Çalışan Performansı	Çalışanların işyerindeki refahı zamanla artmıştır.
ÇP5	Çalışan Performansı	Çalışan kaynaklı hatalar zaman içinde en az seviyeye inmiştir. (Görevler, kararlar alma, sorumluluk alma)
ÇP6	Çalışan Performansı	Çalışanların bilgi ve becerileri zamanla artmıştır.
ÇP7	Çalışan Performansı	İş teslimlerinin zamanında yapılma oranı artmıştır.
ÇP8	Çalışan Performansı	Çalışanların koordinasyonu, iş birliği ve iletişimi zamanla artmıştır.
ÇP9	Çalışan Performansı	Çalışanların şirket içi ve müşterilerle iletişimi gelişmiştir.
ÇP10	Çalışan Performansı	Çalışanların esnek çalışmaya uyumu zamanla artmıştır.
ÇP11	Çalışan Performansı	Çalışan performansı eksikliğinden dolayı ortaya çıkan gereksiz iş tekrarları azalmıştır.
ÇP12	Çalışan Performansı	Çalışan verimliliği zamanla artmıştır.
ÇP13	Çalışan Performansı	Çalışanlar ekip projelerinde başarıyla çalışır.
ÇP14	Çalışan Performansı	Çalışanlar, iş arkadaşlarına yardım etmeye isteklidirler.
ÇP15	Çalışan Performansı	Çalışanların şirkete aidiyeti zamanla artmıştır.
ÇP16	Çalışan Performansı	Çalışanların problem çözme becerileri zamanla artmıştır.
MM1	Müşteri Memnuniyeti	Müşterilerin ihtiyaç ve beklentileri dikkate alınır.
MM2	Müşteri Memnuniyeti	Müşteri memnuniyeti zamanla artmıştır.
MM3	Müşteri Memnuniyeti	Müşteriler şirkete sadıktır.
MM4	Müşteri Memnuniyeti	Müşteri sayısı zamanla artmıştır.
MM5	Müşteri Memnuniyeti	Müşteriler ile etkileşim zamanla artmıştır.
MM6	Müşteri Memnuniyeti	Projelerde kapasite kullanım oranı artmıştır.
MM7	Müşteri Memnuniyeti	Proje sayısı zamanla artmıştır.
MM8	Müşteri Memnuniyeti	Ortalama proje boyutu zamanla artmıştır.
MM9	Müşteri Memnuniyeti	Aynı müşterilerle proje yapma sayısında artış oldu.
MM10	Müşteri Memnuniyeti	Zamanla daha büyük şirketlerle proje yapma sayımız artmıştır.
HS1	Hizmet Süreci	Hizmet kalitesi (hatasız) zamanla artmıştır.
HS2	Hizmet Süreci	Hizmet sunma verimliliği zamanla artmıştır.
HS3	Hizmet Süreci	Zamanında tamamlanan proje sayısı artmıştır.
HS4	Hizmet Süreci	Proje veya hizmetleri tamamlama süresi zamanla kısalmıştır.
HS5	Hizmet Süreci	İş teslimatı, müşteri memnuniyetini karşılayacak şekilde yapılır.
HS6	Hizmet Süreci	Farklı müşteri isteklerini yerine getirmek üzere esnek hizmetler sunulmaktadır.

Table A.2. Questionnaire questions and associated identification code and section in Turkish. (cont.)

ID	SECTION	QUESTION
HS7	**Hizmet Süreci**	**Hizmet sonrası müşteri desteği sağlanmaktadır.**
HS8	**Hizmet Süreci**	**Hizmet geliştirme süreçlerindeki başarımız zamanla arttı.**
HS9	**Hizmet Süreci**	**Hizmet geliştirme süreçleri zamanla güncellenir.**
OP1	**Organizasyonel Performans**	**Zamanla verimlilik artmıştır.**
OP2	**Organizasyonel Performans**	**Çalışan sayısı artmıştır.**
OP3	**Organizasyonel Performans**	**Zamanla hizmetlerin çeşitliliği artmıştır.**
OP4	**Organizasyonel Performans**	**Şirket performansı zamanla artmıştır.**
OP5	**Organizasyonel Performans**	**Şirketin satışları zamanla artmıştır.**
OP6	**Organizasyonel Performans**	**Şirketin itibarı zamanla artmıştır.**
OP7	**Organizasyonel Performans**	**Şirketin inovasyon kapasitesi zamanla artmıştır.**
OP8	**Organizasyonel Performans**	**Şirketin net karı zamanla artmıştır.**
OP9	**Organizasyonel Performans**	**Şirket, bölgesel, ulusal ve küresel faaliyetleri için son yıllara göre daha hızlı ve etkin iç ve dış koordinasyona sahiptir.**
OP10	**Organizasyonel Performans**	**Çalışan memnuniyeti zamanla artmıştır.**
OP11	**Organizasyonel Performans**	**Yetenekli çalışanların şirket bünyesinde uzun süreli devamlılığı sağlanmıştır.**
OP12	**Organizasyonel Performans**	**Çalışanların şirkete bağlılığı zamanla artmıştır.**
OP13	**Organizasyonel Performans**	**Şirketin açık pozisyonlarına verilen olumlu yanıtların yüzdesi zamanla artmıştır.**
OP14	**Organizasyonel Performans**	**Çalışanların gelişimine ve eğitimine yapılan yatırımlar zamanla artmıştır.**
OP15	**Organizasyonel Performans**	**İşyerinde güvenlik ve sağlık zamanla artmıştır.**
OP16	**Organizasyonel Performans**	**İş takibi ve kontrolü zamanla gelişmiştir.**

Dear Mr. ……,

My name is Zehra Çetin. I am a graduate student in the industrial engineering department at Boğaziçi University. I have successfully completed my courses and I am currently in the thesis period. I am doing a research for my thesis on the effects of macro ergonomics "person" factor on consulting business system performance. The main purpose of this thesis is to determine the direct and indirect effects of personal characteristics such as cognitive skills, knowledge, experience, physical and psychological characteristics, motivation and need on the performance of the consulting sector within the scope of the "person" factor. The target audience of this study is white-collar employees in consulting companies.

This master thesis has a unique value in terms of both the scope and the factor it researched. I believe that the output of this thesis will not only benefit the academy, but also the consultancy industry. As white-collar workers are one of the vital elements of the consulting industry, this study will create a roadmap for future work in the field of macro ergonomics in the consulting industry. Based on the results of this thesis, companies can adopt macro ergonomics practices that best suit their future goals. In light of this information, I ask you to answer the questions in the questionnaire below to assist me in conducting this research. All information about the survey is available in the survey content. The survey will take approximately 15 to 20 minutes. You can complete the questionnaire in the language of your choice.

You can forward this survey to your colleagues and acquaintances who are of interest to you and whom you consider to be included in the target audience. Thank you in advance for your interest and efforts.

You can use the link below to complete the questionnaire in English:

https://forms.gle/CVy2XQTgC6aUL7Js6

Best regards,

Zehra Cetin

Figure A.1. English mail template for the questionnaire.

.... Bey / Hanım,

İsmim Zehra Çetin. Boğaziçi Üniversitesi endüstri mühendisliği bölümünde yüksek Lisans öğrencisiyim. Derslerimi başarı ile tamamlamış olup şu an tez döneminde bulunmaktayım. Makro ergonomi "kişi" faktörünün danışmanlık iş sistemi performansına etkileri üzerine tezim için bir araştırma yapıyorum. Bu tezin temel amacı, "kişi" faktörü kapsamında, bilişsel beceriler, bilgi, deneyim, fiziksel ve psikolojik özellikler, motivasyon ve ihtiyaç gibi kişisel özelliklerin, danışmanlık sektörü performansı üzerindeki doğrudan ve dolaylı etkilerini belirlemektir.

Bu yüksek lisans tezi, hem kapsam hem de araştırdığı faktör açısından özgün bir değer taşımaktadır. Bu tezin çıktısının sadece akademinin değil, aynı zamanda danışmanlık sektörünün de yararına olacağına inanıyorum. Beyaz yakalı çalışanlar, danışmanlık sektörünün hayati unsurlarından biri olduğundan, bu çalışma, danışmanlık sektöründe, makro ergonomi alanında gelecekteki çalışmalar için bir yol haritası oluşturacaktır. Bu tezin üreteceği sonuçlara dayanarak, şirketler gelecekteki hedeflerine en iyi uyan makro ergonomi uygulamalarını benimseyebilirler. Bu bilgiler ışığında, bu araştırmayı yürütmeme yardımcı olmanız için, aşağıdaki anketteki soruları yanıtlamanızı rica ediyorum. Anket ile ilgili detay tüm bilgi anket içeriğinde mevcuttur. Anket yaklaşık olarak 15 - 20 dakikanızı alacaktır. Arzu ettiğiniz soru dilinde anketi tamamlayabilirsiniz.

Bu anketi kendisini ilgilendiren ve hedef kitlesine dahil olarak gördüğünüz iş arkadaşlarınıza ve tanıdıklarınıza iletebilirsiniz. Şimdiden ilginiz ve emekleriniz için teşekkür ederim.

İngilizce soru dilinde anketi tamamlamak için aşağıdaki linki kullanabilirsiniz:

https://forms.gle/CVy2XQTgC6aUL7Js6

Türkçe soru dilinde anketi tamamlamak için aşağıdaki linki kullanabilirsiniz:

https://forms.gle/K4dkgdKuXkjKauBg6

Saygılarımla,

Zehra Çetin

Figure A.2. Turkish mail template for the questionnaire.

Macroergonomic Compatibility Questionnaire

Name of the Master Thesis: Effects of Macroergonomics Person Factor on Consulting Work System Performance

Dear Participant,

I am a graduate student at Boğaziçi University. I also have experience in the consulting sector. I am conducting a research for my thesis on the effects of macro ergonomics "person" factor on consulting business system performance. The main purpose of this thesis is to determine the direct and indirect effects of personal characteristics such as cognitive skills, knowledge, experience, physical and psychological characteristics, motivation and need on the performance of the consulting sector within the scope of the "person" factor.

Macro ergonomics has the potential to improve organizations by ensuring that work system designs are compatible with critical socio-technical characteristics. I believe that the output of this thesis will not only benefit the academy, but also the consultancy industry. As white-collar workers are one of the vital elements of the consulting industry, this study will create a roadmap for future work in the field of macro ergonomics in the consulting industry. Based on the results of this thesis, companies can adopt macroergonomy practices that best suit their future goals. In light of this information, I ask you to answer the questions in the questionnaire below to assist me in conducting this research. Please contribute to our work by answering the questions in the best way you think.

If you have any questions or concerns about this research, please feel free to contact me or my advisor. All personal information will be kept confidential and only statistical results will be shared. If you want, I would like to remind you that I can share my updated CV to inform you.

Thank you in advance for your contribution to this scientific study.

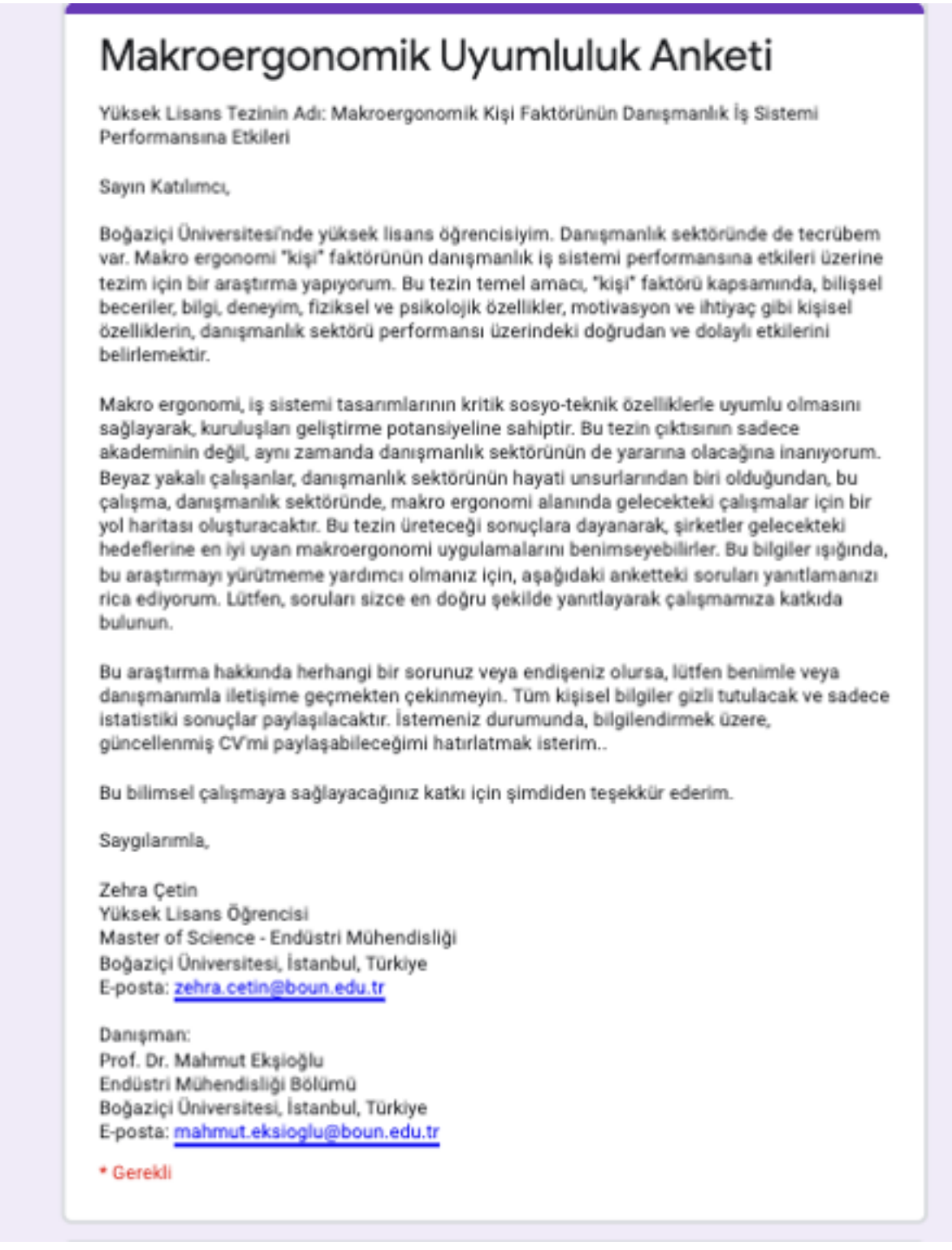
Yours sincerely,

Zehra Cetin
Graduate Student
Master of Science - Industrial Engineering
Bogazici University, Istanbul, Turkey
E-mail: zehra.cetin@boun.edu.tr

Advisor:
Ph.D. Professor
Department of Industrial Engineering
Bogazici University, Istanbul, Turkey
E-mail: mahmut.eksioglu@boun.edu.tr

* Gerekli

Figure A.3. Questionnaire information page in English.



Makroergonomik Uyumluluk Anketi

Yüksek Lisans Tezinin Adı: Makroergonomik Kişi Faktörünün Danışmanlık İş Sistemi Performansına Etkileri

Sayın Katılımcı,

Boğaziçi Üniversitesi'nde yüksek lisans öğrencisiyim. Danışmanlık sektöründe de tecrübem var. Makro ergonomi "kişi" faktörünün danışmanlık iş sistemi performansına etkileri üzerine tezim için bir araştırma yapıyorum. Bu tezin temel amacı, "kişi" faktörü kapsamında, bilişsel beceriler, bilgi, deneyim, fiziksel ve psikolojik özellikler, motivasyon ve ihtiyaç gibi kişisel özelliklerin, danışmanlık sektörü performansı üzerindeki doğrudan ve dolaylı etkilerini belirlemektir.

Makro ergonomi, iş sistemi tasarımlarının kritik sosyo-teknik özelliklerle uyumlu olmasını sağlayarak, kuruluşları geliştirme potansiyeline sahiptir. Bu tezin çıktısının sadece akademinin değil, aynı zamanda danışmanlık sektörünün de yararına olacağına inanıyorum. Beyaz yakalı çalışanlar, danışmanlık sektörünün hayati unsurlarından biri olduğundan, bu çalışma, danışmanlık sektöründe, makro ergonomi alanında gelecekteki çalışmalar için bir yol haritası oluşturacaktır. Bu tezin üreteceği sonuçlara dayanarak, şirketler gelecekteki hedeflerine en iyi uyan makroergonomi uygulamalarını benimseyebilirler. Bu bilgiler ışığında, bu araştırmayı yürütmeme yardımcı olmanız için, aşağıdaki anketteki soruları yanıtlamanızı rica ediyorum. Lütfen, soruları sizce en doğru şekilde yanıtlayarak çalışmamıza katkıda bulunun.

Bu araştırma hakkında herhangi bir sorunuz veya endişeniz olursa, lütfen benimle veya danışmanımla iletişime geçmekten çekinmeyin. Tüm kişisel bilgiler gizli tutulacak ve sadece istatistiki sonuçlar paylaşılacaktır. İstemeniz durumunda, bilgilendirmek üzere, güncellenmiş CV'mi paylaşabileceğimi hatırlatmak isterim..

Bu bilimsel çalışmaya sağlayacağınız katkı için şimdiden teşekkür ederim.

Saygılarımla,

Zehra Çetin
Yüksek Lisans Öğrencisi
Master of Science - Endüstri Mühendisliği
Boğaziçi Üniversitesi, İstanbul, Türkiye
E-posta: zehra.cetin@boun.edu.tr

Danışman:
Prof. Dr. Mahmut Ekşioğlu
Endüstri Mühendisliği Bölümü
Boğaziçi Üniversitesi, İstanbul, Türkiye
E-posta: mahmut.eksioglu@boun.edu.tr

* Gerekli

Figure A.4. Questionnaire information page in Turkish.

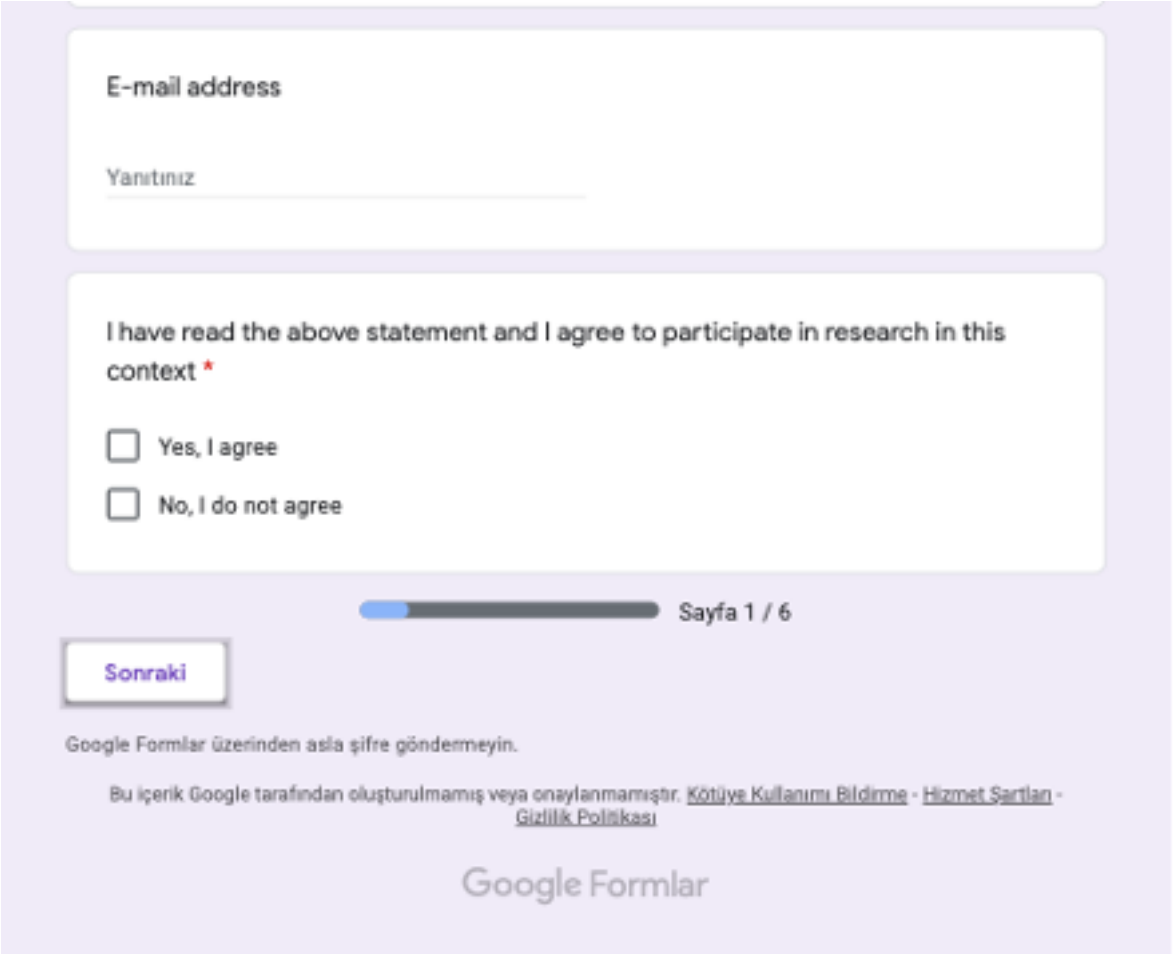


Figure A.5. Participation agreement page in English.

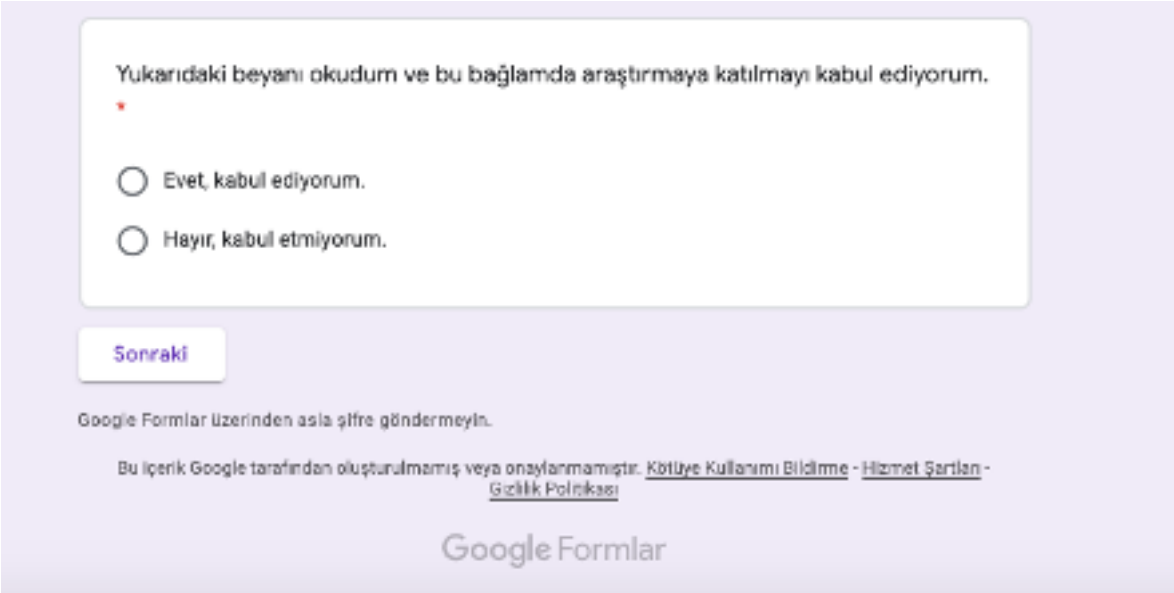


Figure A.6. Participation agreement page in Turkish.

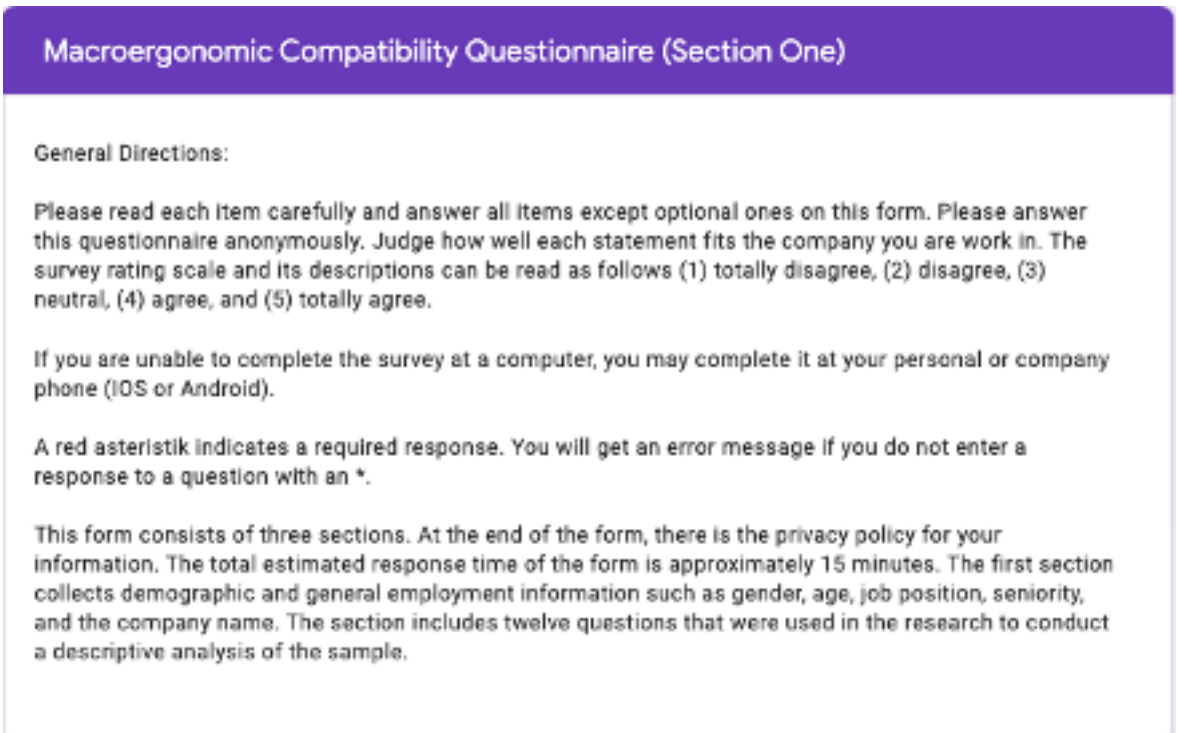


Figure A.7. Instruction page for the first section of the MCQ in English.

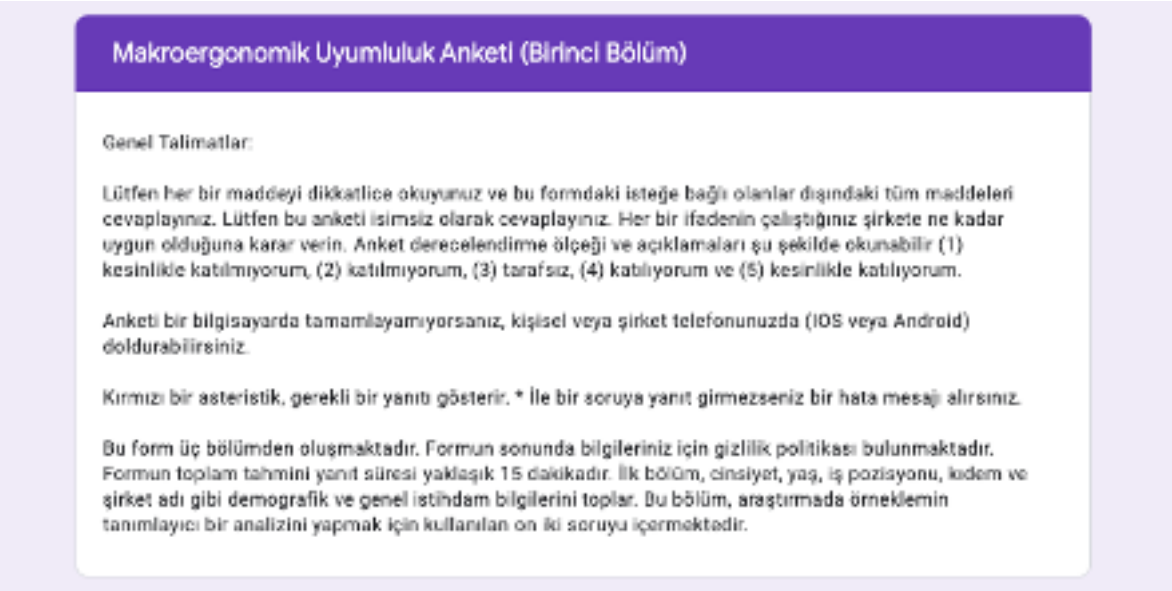


Figure A.8. Instruction page for the first section of the MCQ in Turkish.

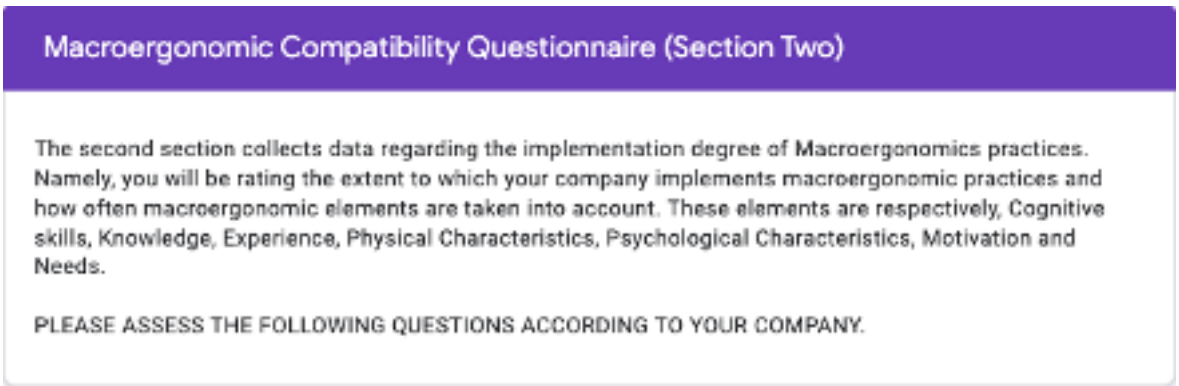


Figure A.9. Instruction page for the second section of the MCQ in English.

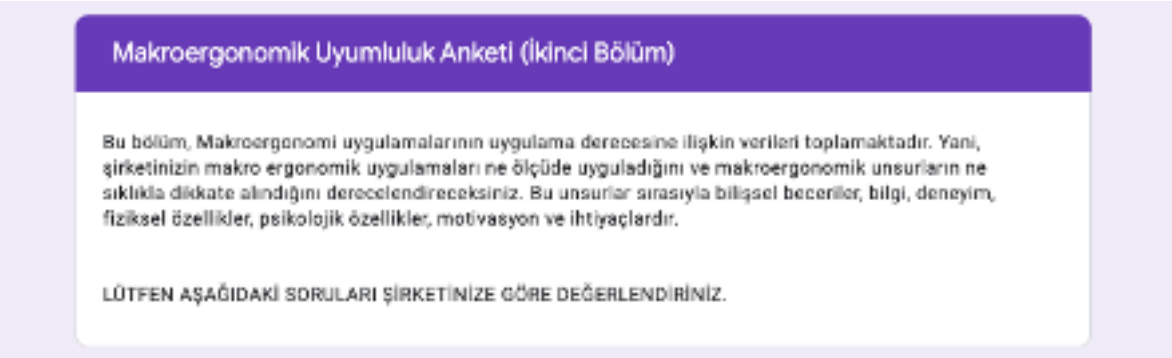


Figure A.10. Instruction page for the second section of the MCQ in Turkish.

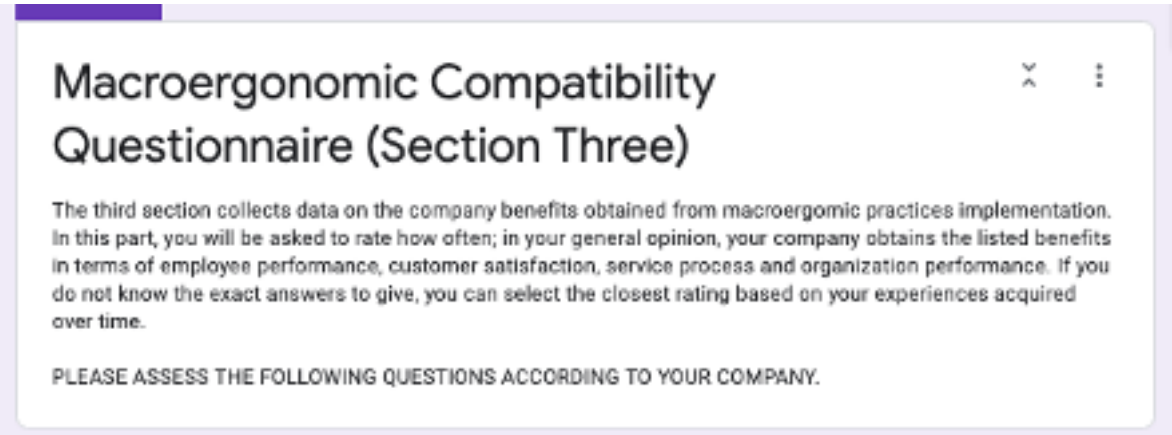


Figure A.11. Instruction page for the third section of the MCQ in English.

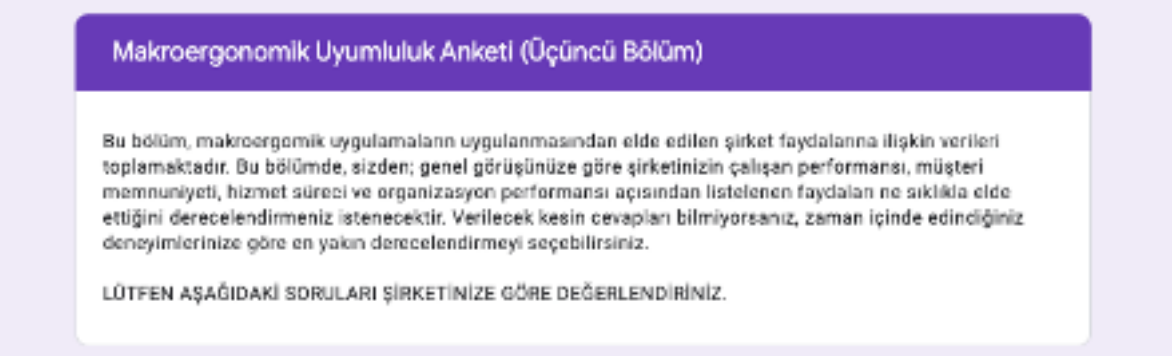


Figure A.12. Instruction page for the third section of the MCQ in Turkish.

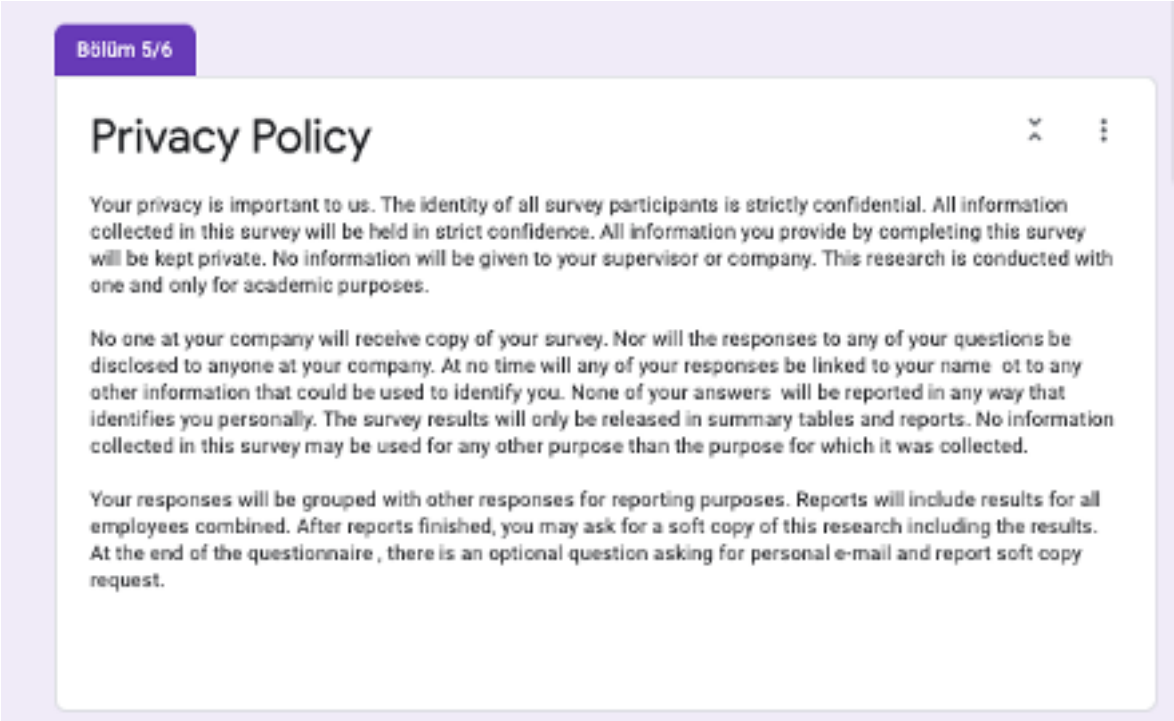


Figure A.13. Privacy policy declaration page in English.

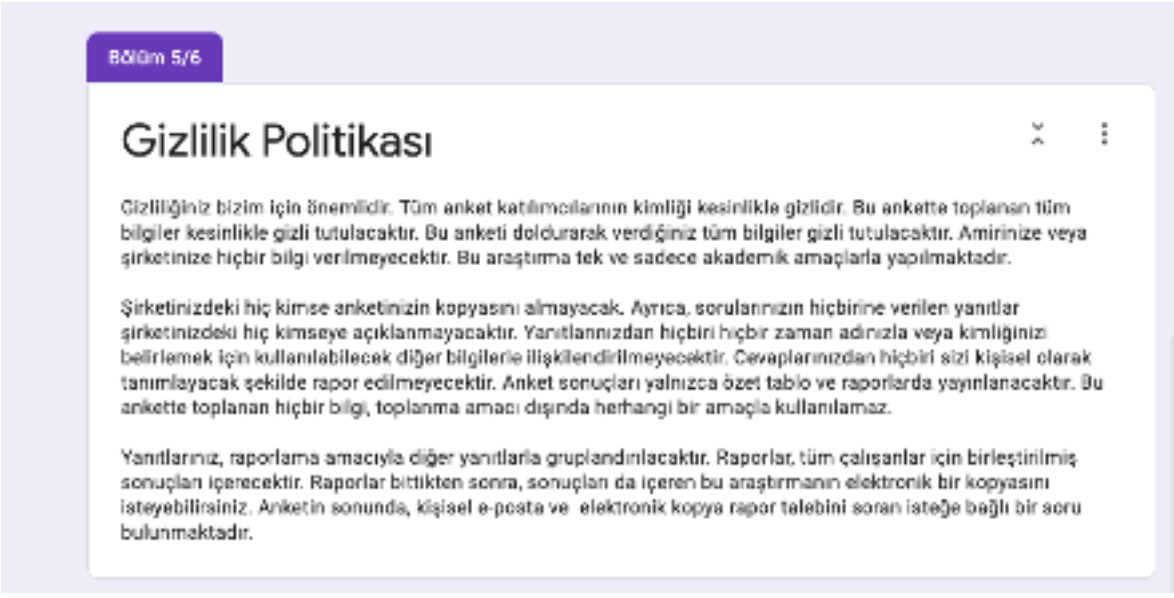


Figure A.14. Privacy policy declaration page in Turkish.