

Sosyal Bilimler Enstitüsü

T.C.
MARMARA ÜNİVERSİTESİ
SOSYAL BİLİMLER ENSTİTÜSÜ
İŞLETME (İNGİLİZCE) ANABİLİM DALI
YÖNETİM VE ORGANİZAYON (İNGİLİZCE) BİLİM DALI

THE MODERATING EFFECT OF TECHNO-STRESS ON CRITICAL SUCCESS FACTORS AND END USER ERP (ENTERPRISE RESOURCE PLANNING) SATISFACTION RELATIONSHIP

Yüksek Lisans Tezi

BİLGE YILDIZ

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DANIŞMAN: DOÇ. DR. HÜSEYİN EKİZLER

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TEZ ONAY BELGESİ

İşletme (İngilizce) Anabilim Dalı Yönetim ve Organizasyon (İngilizce) Bilim Dalı Yüksek Lisans öğrencisi Bilge Yıldız'ın The Moderating Effect of Techno-Stress on Critical Success Factors and End User ERP Satisfaction Relationship adlı tez çalışması, Enstitümüz Yönetim Kurulunun 03.08.2022 tarih ve 2022-29/12 sayılı kararıyla oluşturulan jüri tarafından oy birliği / oy çokluğu ile Yüksek Lisans Tezi olarak kabul edilmiştir.

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ÖZET

KRİTİK BAŞARI FAKTÖRLERİ VE SON KULLANICI ERP (KURUMSAL KAYNAK PLANLAMASI) MEMNUNİYETİ ARASINDAKİ İLİŞKİDE TEKNOSTRESİN DÜZENLEYİCİ ETKİSİ

Kurumsal Kaynak Planlaması Sistemlerinin (ERP) verimli kullanımını işletme kaynaklarının verimli kullanılması ve şirketlerin daha iyi rekabet edebilmesi için önemlidir. Bu sebeple, ERP'nin randımanlı bir şekilde kullanılmasında belirleyici etken olan bireylerin (çalışanların) memnuniyetini etkileyen faktörleri anlamak önemlidir.

Bu çalışmanın ana amacı kritik ERP başarı faktörleri ve son kullanıcı ERP memnuniyeti arasındaki ilişkiyi tekno-stress moderatörlüğünde incelemektir. İlave olarak, ERP literatüründeki nicel araştırma sayısının arttırılmasına katkıda bulunmak ve kullanıcıların tekno-stres olarak tanımladığımız yeni teknolojilere ve yazılımlara karşı olan içgüdüsel yaklaşımlarını çalışma kapsamına alarak, organizasyonel faktörleri ve çalışan (kullanıcı) faktörlerini biraraya getirmek suretiyle son kullanıcı ERP memnuniyeti hakkında kapsamlı bir görüşe sahip olmaktır.

Türkiye genelinde farklı sektörlerde çalışan ve ERP kullanan 392 katılımcı ile yapılan nicel araştırma ile ERP başarı faktörlerinin son kullanıcı ERP memnuniyeti arasındaki ilişki ve bu ilişkiye teknostresin etkisi incelenmiştir.

Araştırmanın sonuçlarına göre proje yönetimi ve değerlendirme, iş süreçlerinin yeniden dizaynı, üst yönetimin desteği ve iletişim ve danışmanlık hizmetleri faktörlerinin iyi yönetilmesinin, son kullanıcı ERP memnuniyeti üzerinde olumlu etkisi olmaktadır. Tekno-aşırı yükün proje yönetimi ve değerlendirme ile doğruluk ve iş süreçlerinin yeniden düzenlenmesi ile doğruluk arasındaki ilişkiye negatif etkisi olduğu tespit edilmiştir. Ayrıca, tekno-belirsizliğin proje yönetimi ve değerlendirme ile format ve güncellik arasındaki ilişkiye, iş süreçlerinin yeniden dizaynı ile içerik, format, kullanım kolaylığı ve güncellik arasındaki ilişkiye, son olarak üst yönetimin desteği ve iletişim ile içerik ve güncellik arasındaki ilişkiye olumsuz etkisi olduğu bulunmuştur.

Anahtar kelimeler: Kurumsal Kaynak Planlama (ERP), ERP Başarı Faktörleri, Teknostres, Son Kullanıcı ERP Memnuniyeti

ABSTRACT

THE MODERATING EFFECT OF TECHNO-STRESS ON CRITICAL SUCCESS FACTORS AND END USER ERP (ENTERPRISE RESOURCE PLANNING) SATISFACTION RELATIONSHIP

Enterprise resource planning (ERP) system effectiveness has a big impact on how well a firm uses its resources and how well it competes. Understanding the variables that affect people's (workers') satisfaction is crucial because it is what motivates effective ERP adoption.

This study's objective is to examine the relationship between critical ERP Success Factors and End User ERP Satisfaction under Techno-stress moderation. In addition, contributing to the number of empirical researches in literature and having a comprehensive view on End User ERP Satisfaction by bringing together organizational factors and employee (user) factors by including users' instinctive approach to new technologies and software, which we define as Techno-stress.

The association between ERP Success Factors and End User ERP Satisfaction and the effect of Techno-stress on this relationship was examined through a quantitative study conducted with 392 ERP using participants working in different sectors throughout Turkey.

The study's findings indicate that, effective Project Management and Evaluation, Business Processes Re-engineering, Top management Support and Communication and Consulting Services all contribute to end-user ERP satisfaction. Techno-overload has been found to have a negative impact on the relationship between Project Management and Evaluation and Accuracy, and Business Process Re-engineering and Accuracy. In addition, Techno-uncertainty has been found to have a negative impact on the association between Project Management and Evaluation and Format and Timeliness, the relationship between Business Process Re-engineering and Content, Format, Ease of Use and Timeliness, and finally the relationship between Top management Support and Communication and Content and Timeliness.

Keywords: Enterprise Resource Planning (ERP), ERP Success Factors, Techno-Stress, End User ERP Satisfaction.

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ABBREVIATIONS

APICS : The Association for Operations Management

APS : Advanced planning and scheduling

BOM : Bill of material

BPR : Business process re-engineering

CAGR : Compound annual growth rate

CRM : Customer relations management

CSFs : Critical success factors

EDP : Electronic data processing

ERP : Enterprise resource planning

EUCS : End-user computing satisfaction

EUES : End-user ERP satisfaction

ICT : Information and communication technologies

IS : Informationsystems

JIT : Just in time

MRP : Material requirements planning

MRP II : Manufacturing resource planning

SCM : Supply chain management

TUIK : Turkish Statistical Institute

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INTRODUCTION

Rapid developments in technology have affected our lives deeply. Specially ICTs made our lives easier by allowing us to process and distribute information more accurately and fast. Among these ICTs, ERP systems are one of the most important developments in the IT use of organizations (Davenport, 1998, p. 122).

All parties such as top management, end-users, consultants, project teams, and vendors of the process should be aware that ERP implementation is a part of re-designing the business processes which would lead to major changes regarding how the organization works and even its structure.

ERP systems are sophisticated solutions and implementing these systems takes time and high amounts of money. Therefore, it is crucial that businesses think about and act on the factors that affect their success or failure. In addition, ERP implementation cost is only a small part of the overall cost. Therefore, companies should work on assessing their business processes and have a good level of knowledge of critical factors that would support an implementation without problem (Ehie& Madsen, 2005, p. 547).

Apart from organizational factors, end users' perspectives about the ERP system are important for its efficient usage of it. When their opinions are overlooked, they may avoid using it and the expensive ERP system may fail to fulfill the expected results (Kwak et al., 2011, s. 267).

Another factor that should be considered is end-users' techno-stress levels. When employees feel stressed due to the extra workload that would ERP causes, or feel incompetent to learn it, this would affect their satisfaction with the ERP system itself.

1.1. Subject and the Purpose of Study

The subject of this study is examining the relationship between Critical ERP Success Factors (Project Management Principles, Feasibility/Evaluation of ERP Project, Business Process Re-engineering, Top Management Support, Human Resource Development, and Consulting Services) and End User ERP Satisfaction (Accuracy, Content, Format, Ease of Use, and Timeliness) under Techno-stress (Techno-overload, Techno-insecurity, Techno-Complexity, and Techno-uncertainty) moderation.

The purposes of the study can be explained as follows. Firstly, quantitative research in the ERP literature is limited as most of them are either articles that explain the author's opinions or case studies.

Therefore, it is important to increase empirical studies in order to have a better understanding of end users' approaches and avoid ERP implementation failures. Secondly, most of the empirical research especially in Turkey is made on a particular sector, therefore; research that contains a variety of industries will be more comprehensive. For last, the previous studies focus on what organizational success factors should be considered and leave out users' fundamental approach to the new technologies and software which we identify as techno-stress. On the other hand, this study brings organizational factors and employee (user) factors together to have a comprehensive view of end-user ERP satisfaction level as it is the main indicator of ERP successes and failures.

1.2. Evaluation of Information Resources

This study is based on three main research and their articles. The first one is Ehie and Madsen's article called "Identifying Critical Issues in Enterprise Resource Planning (ERP) Implementation" (2005). The significance of this study is that they conducted empirical research and created a survey instrument for future researchers. Although, the number of the answered surveys was very low (36 responses), it helped future empirical research as it is quite limited. The researchers stated that the survey instrument should be re-tested with a higher number of participants and one of the contributions of this study fulfill this need. The items of the survey were used for measuring independent variables of this study and proved to be efficient according to the data analysis.

The second research that contributed to this thesis greatly is reported in Doll and Torkzadeh's article titled "The Measurement of End-User Computing Satisfaction" (1988). In this dissertation, the satisfaction of end-users is considered as an indicator of a successful ERP implementation. In order to measure user satisfaction, Doll and Torkzadeh carried out research to develop a survey instrument that is easy to apply and reliable. They repeated their initial research to re-test the reliability of their survey and proved that it can be used as a standard measure. The significance of their survey is that it can be adapted to any application. Therefore, it was adapted into End User ERP Satisfaction in this study and used for the measurement of dependent variables.

The third most important article for this dissertation is Tarafdar, Tu, Ragu-Nathan, and Ragu-Nathan's article called "The Impact of Technostress on Role Stress and Productivity" (2007). Within this article, they identified dimensions of techno-stress and created a techno-stress scale which was used for measuring the moderator variable of this study. Their survey has been used by many researchers since it was developed and proved to be reliable.

1.3. Method of The Dissertation

This dissertation has been written within around one year of work. After the main question of the thesis was identified, a systematic and comprehensive assessment of the relevant literature was done in accordance with the major subjects and the research model and scales were generated. The literature review was made via online databases through Google Scholar, Marmara University Online Library, YÖK Thesis Center, and international online thesis databases. In the following, an online survey instrument was developed and shared with potential participants and data collection continued from September 2021 until March 2022.After reaching enough numbers of participants (392) the data analysis methods that are generally accepted in social sciences were applied. During the data collection period, theoretical background, and literature review sections were written. In the following, results of data analysis were reported and the dissertation was completed.

2. THEORETICAL BACKGROUND

2.1. ERP Systems

ERP systems are a category of business management software that contain modules to support functional units that includes planning, production, sales, marketing, distribution, bookkeeping, finance, human resources, project management, inventory management, after-sales service, maintenance, logistics, and e-business.

Enterprise Resource Planning (ERP) systems are software packages that enable companies to process and access information through different business units of the organization. (Wu & Wang, 2006, p. 884). Davenport explains that ERP systems have a single central database and each business unit sends and receives data between its own business module and this central database (Fig. 1) (Davenport, 1998, p. 124)

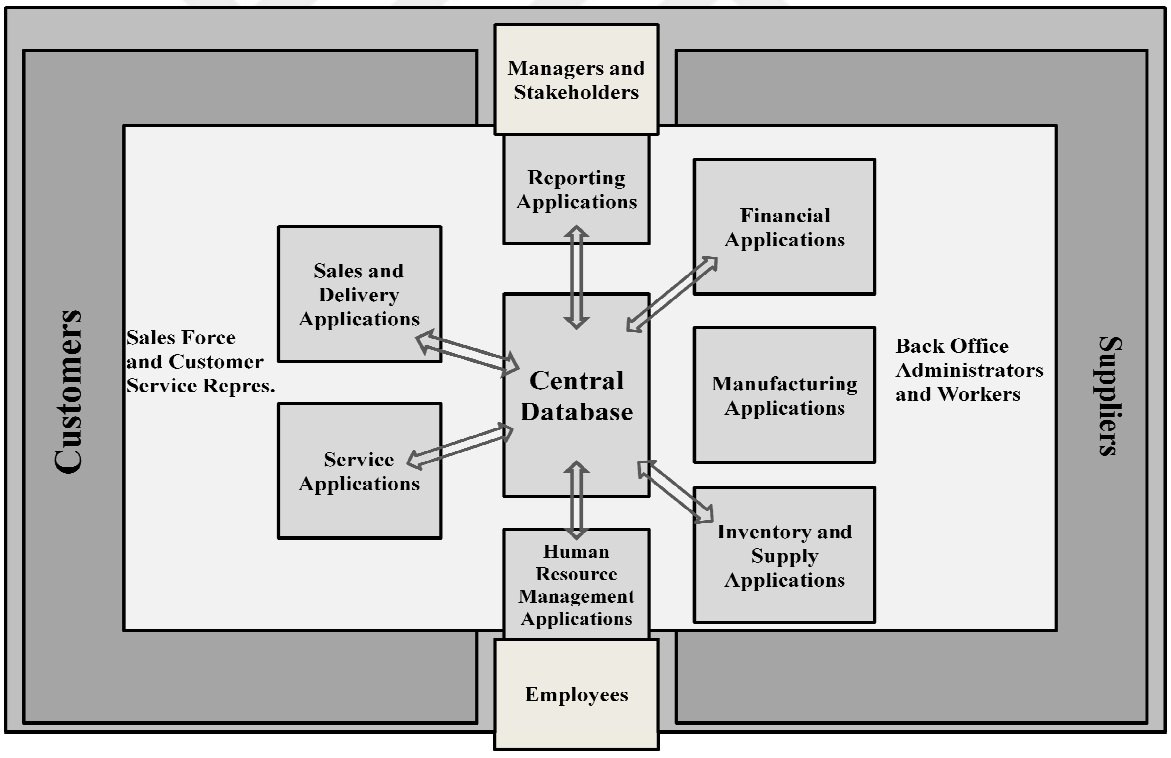


Figure 1: Anatomy of an Enterprise System (Davenport, 1998, p. 124)

The main idea of ERP solutions is planning and managing company resources by combining all departments and functions into a single information system. This way, it can deliver the needs of all separate units (Genoulaz& Millet, 2005, p. 573). Planning and managing company resources can be

achieved by establishing data integration. With this data integration, work processes that lower productivity can be eliminated, and also coordination between organization units can be improved. As a result, an organization's management can have a comprehensive understanding of its processes (Basoğlu, Daim, &Kerimoğlu, 2007, p. 73).

ERP systems are the type of software that carries out all the fundamental business processes from creating sales orders to customer service (Gupta, 2000, p. 114). In order to explain how ERP systems basically work, one can give an example of a sales and distribution workflow of a production company. From preparing an offer until the delivery, all the below steps take place by and in the ERP system. It is obvious that some of these steps and responsible departments may vary for different organizations however; the general working logic is the same.

- A potential customer asks for an offer and the customer gets defined,
- Offer is prepared,
- In case of the offer is accepted by the customer sales order is created,
- Planning department receives the information that what should be produced until when and creates production order,
- Production department receives production order and if there is any part, raw material, etc. is missing, purchasing department gets a list of these missing items,
- Purchasing department creates purchase orders and send to suppliers to provide missing items to production on time,
- Warehouse responsible enter the received items,
- When production is finished, planning department closes the production order and post the final product to stock. Simultaneously, by closing the production order all the items that are used for producing this order get deducted from the stock list,
- Logistics department and warehouse prepare the waybill and deliver the final product to the customer,
- Accounting department creates the invoice,
- Finance department follows payments of the invoice and process is finalized when payment is received and posted to the system.

The ability of ERP systems to connect and automate business operations, disseminate data across the firm, and enable people to create and access information whenever necessary are among their most crucial aspects. (Nah, Lau, &Kuang, 2001, p. 285)

ERP systems are different from traditional in-house or tailor-made system in three points:

1. Business processes should be modified to fit the ERP system,

2. ERP systems may need customization to fit the unique business processes,

3. Users are mostly dependent on ERP vendors for support and updates (Lucas, Walton, &Ginzberg, 1988, p. 539).

2.1.1. Historical Development of ERP Systems

In the 1960s, the main drive of the production companies' was keeping a high volume of stock to keep up with the high demand. Therefore, they had started to use inventory-controlled packages (Rashid, Hossain, & Patrick, 2002, p. 38). These automated packages were called Reorder Point Systems.

Companies in the 1970s could no longer afford to keep a high volume of stock (Umble, Haft, &Umble, 2003, p. 242) therefore, material requirements planning (MRP) was introduced by APICS (then American Production and Inventory Control Society, now APICS – The Association for Operations Management) (Umble, Haft, &Umble, 2003, p. 6837). MRP enabled companies to plan and manage their inventory according to the master production schedule (Umble, Haft, &Umble, 2003, p. 242) and bill of material (BOM) of the final product. (Olhager, 2013, p. 6837).

In the 1980s organizations had started to give more importance to operational efficiency and in the early years of this era, statements on just-in-time (JIT) and optimized production technology/theory of constraints (OPT/TOC) became visible (Olhager, 2013, p. 6838). As a result, a new system called Manufacturing Resource Planning (MRP II) was introduced.



Figure 2: ERP Evolution (Rashid, Hossain, & Patrick, 2002, p. 38)

ERP systems were evolved from MRP and MRP II in the late 1980s and early 1990s and provided business-wide cross-functional integration and coordination (Rashid, Hossain, & Patrick, 2002, p. 38). ERP provided concrete functions as well as abstract functions, such as service-related operations (Salimi, Dankbaar, &Davidrajuh, 2006, p. 84). The main difference between the ERP systems is that they include features such as decision support applications, human resources planning, regulatory control, quality assurance, supply chain management components, and maintenance assistance (Yusuf & Little, 1998, p. 70; Salimi, Dankbaar, &Davidrajuh, 2006, p. 84).

ERP providers launched additional modules and functions as "add-ons" to the main modules and created "extended ERPs." These ERP additions contain supply chain management (SCM), advanced planning and scheduling (APS), and e-business solutions like customer relationship management (CRM), (Rashid, Hossain, & Patrick, 2002, p. 38).

2.1.2. The Core ERP Modules

ERP systems are comprised of different modules and each module represents the different function of an organization. These modules work in integration according to workflow of the enterprises (Özen, 2019, p. 13). Main ERP modules provided by the vendors are; accounting and financial management, production and transportation management, sales and distribution management, human resource management, supply chain management, customer relations management, and e-business (Rashid, Hossain, & Patrick, 2002, p. 41)

2.1.3. ERP Life Cycle

According to Markus and Tanis (Markus & Tanis, 2000, p. 190), there are four phases of the ERP life cycle (Nah, Lau, &Kuang, 2001, p. 287).

- **The chartering phase:** All the tasks necessary to lay the groundwork for the ERP implementation project are included in this phase. Vendors, consultants, business executives, and IT experts participate in choosing the ERP package (this choice can be postponed until the project phase), working with the project manager to establish the price and timeline..After all the evaluations, it is possible to come to the decision to cancel the ERP project or carry on.
- **The project phase:** The project manager, team members (typically nontechnical employees from various departments), in-house IT specialists, suppliers, and consultants work together to complete the software configuration, system integration, testing, training, data conversion, and rollout tasks during this phase of the ERP life cycle. In this stage, it is also decided whether the ERP project will be carried out internally with outside assistance or outsourced.
- **The shakedown phase:** This phase starts from go-live and continues until normal operations are used. During this period, end-users start using ERP for their daily work and project team or consultants support them with fixing bugs, reworking, tuning system performance, retraining, staffing, and handling temporary inefficiencies. It is still possible to end the project if productivity is reduced at a high level or there are too many interruptions.
- **The onward and upward phase:** After normal operations are achieved and the system works efficiently, the onward and upward phase starts. This period ends when ERP is changed with an updated or a completely new system. Operating managers, final users, and external and internal IT personnel are the main players in this phase, and in case of upgrades vendor personnel and consultants take part as well. The core activities of this stage are; continuous business development, improving operator skills, and evaluations of the gains after ERP implementation. (Markus & Tanis, 2000, p. 190,195;Nah, Lau, &Kuang, 2001, p. 287)

Ehie and Madsen (2005) divide the ERP installation process into five stages;

- **Project preparation:** In this stage of the project, a detailed project plan is prepared with important points such as budget, time plan, and project group.

- **Business guide:** Business process analysis, selecting the ERP system that best suits the company's needs, customizing the ERP system, and adjusting business processes to obtain the greatest fit are all part of the business guide phase.
- **Realization:** In this phase data converting and testing of the system is made. Further modifications are made if any need is realized during testing. Testing is made at a limited scale.
- **Final preparation:** In this stage, testing is made with full data and different menus on a big scale. Training and education of the users are also carried out.
- **Go-live and support:** The actual application of the ERP system is covered under this phase. The system can be improved continually according to further needs and changes in the business (Ehie& Madsen, 2005, p. 548).

As each phase of the ERP life cycle has different characteristics, ERP critical success factors become more important at different stages. Marcus and Tanis grouped them as shown in Figure 3.

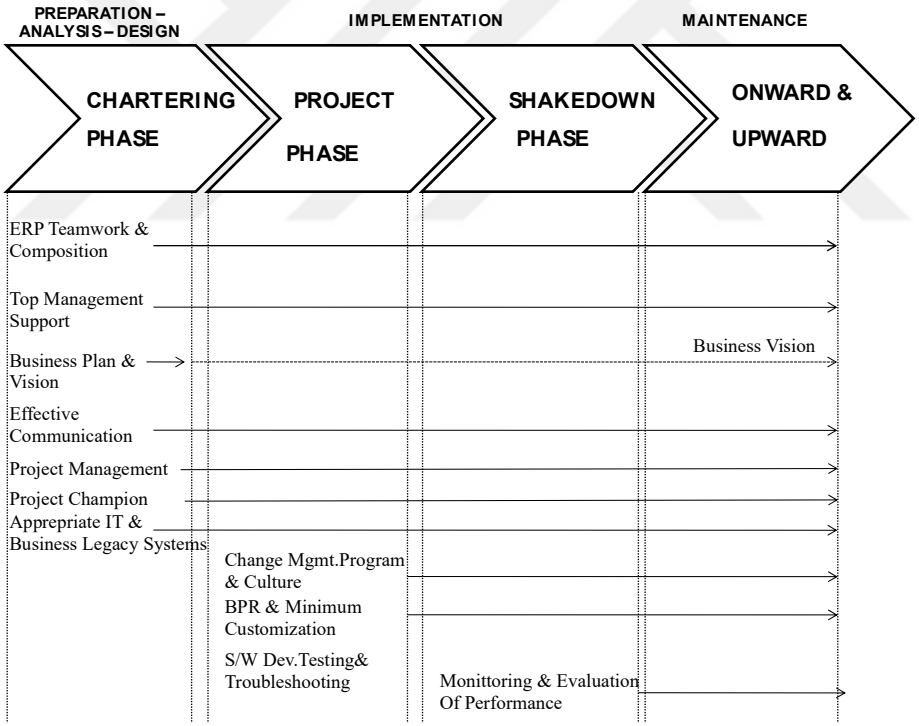


Figure3: Markus and Tanis' CSFs classification according to ERP life-cycle (Nah, Lau, &Kuang, 2001, s. 290)

Somers and Nelson (2001) made another classification according to significant CSFs at each implementation phase and they are;

Initiation phase: Architecture decisions, specific goals and objectives, vendor collaboration, high management backing, and cautious package selection.

Adoption phase: Support from senior management, project team expertise, utilization of a steering committee, collaboration with a vendor, and devoted resources.

Adaptation phase: Communication and cooperation between business units, project team abilities, committed resources, use of vendors' tools.

Acceptance phase: Communication and cooperation between business units, senior management support**,** project team abilities**,** and training on new business processes.

Routinization phase: Communication and cooperation between business units, senior management support**,** vendor collaboration**,** and user education on ERP.

Infusion phase: Communication and cooperation between business units, senior management support**,** vendor collaboration**,** partnership with vendor (Somers & Nelson, 2001, p. 7).

Top management support is a very significant factor as it is listed in all phases.

2.1.4. Failure Reasons

In case an information system can not fulfill the expectations of the users and other related groups, it can be considered a failure (Lyytinen &Hirschheim, 1987, p. 263). Robert Block classifies system failures in twelve categories (Block, 1983, p. 2; Sumner, 1999, p. 297). They are valid for the ERP systems as well. These are;

- **Resource failures,** refer to the discrepancy between the deadline and cost expectations management and the resources to satisfy these expectations. In other words, resources are not enough to keep up with deadlines. This causes delay and over budget which creates high pressure on the project team. This high pressure leads to low system quality and dissatisfied end users.
- **Requirement failures,** refer to the wrong system specifications due to incorrect, incomplete, or unclear system requirements that were realized at the beginning. In case of changes are required before the implementation phase, this will cause delay and overbudget issues. If changes are required after implementation, then a lot of maintenance will be needed to be made and this will cause dissatisfied end users.

- **Goal failures,** refer to the miscommunication between the management and system builders. The goals might not be explained in a good way by the management or the system builders misunderstand them. This will cause implementing a system with the wrong specifications.
- **Technique failures,** refer to the usage of wrong software development techniques by the developers. This would cause inadequate systems which would lead to the extra costs of time and money.
- **User contact failures,** refer to the lack of efficient communication between system developers and end-users. This would cause poor fulfillment of the end-user expectations.
- **Organizational failures,** refer to the inefficient organizational structure that causes poor coordination of tasks due to bad management or extremely prone to controlling. This would lead to delays and quality problems.
- **Technology failures,** refer to the poor quality or inefficient working of the hardware or software which is purchased for the new system.
- **Size failures,** refer to much more complex systems than resources can handle. These inefficient resources could be low-level methodology usage, complicated project control, etc.
- **People management failures,** refer to the low motivation level of the system development team due to mismanagement by the team leader. This would lead to poor system specifications, missing deadlines, and extra cost.
- **Methodology failures,** refer to the failures to perform necessary activities or performing unnecessary activities that would cause poor management of the system project.
- **Planning and control failures,** refer to poor planning, poor task allocation, and inefficient monitoring of the results.
- **Personality failures,** refer to the personality conflicts between either system developers or the leader of the development team and end-users. This failure causes a low level of cooperation which would cause a variety of problems according to the type of functions of the people involved. (Block, 1983, p. 2,3,4,5; Sumner, 1999, p. 298)

Başoğlu, Daim, and Kerimoğlu made a taxonomy study of ERP literature and they found additional failure reasons that (Basoğlu, Daim, &Kerimoğlu, 2007, p. 79) experts may not be competent enough to handle ERP systems' complexity and discrepancies between business needs and ERP features (Davenport, 1998, p. 122).

2.1.5. ERP Market and Main ERP Providers

2.1.5.1. The Global Market

The global market for ERP software is divided into segments based on settlement, function, business type, organization size, and region.

Based on The Settlement: On-premise and cloud solutions make up the majority of the worldwide ERP market.

Based on The Function: The ERP software industry has been divided into four categories based on function: supply chain and product management, sales and marketing, accounting and finance, and human resource.

Based on The Business Type: The Global ERP software market is categorized into production, communication, aerospace and defense, construction, and many others.

Based on The Organization Size: The ERP software market is segmented into large enterprises and small and medium enterprises based on the size of the organizations.

Based on The Region: The ERP market is segmented into North America, Europe, Asia Pacific, South America, and the Middle East and Africa on a geographical level (Market Research Future, 2020).

In this section, market figures and shares will cover all segments of ERP systems.

There are different market size values and expectations for the future growth of the ERP market between research companies however; they all agree that the ERP market will continue to increase. The following paragraphs give examples of figures and expectations of some of the research companies.

According to the SelectHub report, in 2018, the worldwide ERP market was worth $35.81 billion, and based on their global market share, the top 5 ERP systems are; Oracle ERP Cloud, SAP Business One, and Sage 100 Cloud, SAP S/4 Hana, and Infor ERP. (Reinbolt, 2020)

Allied Market Research reported that the global ERP market size was valued at $39,340 billion in 2019, and is predicted to increase up to $ 86,303 billion by 2026, expanding to a compound annual growth rate (CAGR) of 9.8% from 2020 to 2027. (Rake, 2021). However, their earlier prediction was 10.2% CAGR and $78.41 market volume by 2026. (Reinbolt, 2020) Another prediction by Market Research Future is 8.2% CAGR until the end of 2026 and the main vendors are Microsoft, IBM, Epicor, Oracle,

SAP, Yonyou, Infor, Sage, Plex Systems, NetSuite, Intuit, TOTVS, Unit4, Workday, and Kingdee (Market Research Future, 2020).

According to Gartner Research, The global ERP software market increased by 4%, to a market value of $40 billion in total in 2020. SAP, Oracle, and Workday keep the top 3 positions in market share (Gartner, Inc., 2021).

2.1.5.2. Turkish Market

International Data Corporation reported that the volume of the ERP market in Turkey was $301.67 back in 2016 and increased to $355.26 by the end of 2020. The CAGR between 2016 and 2020 varied from 3% to 5% and the highest rate was reached in 2020. Currently, 95% of the market is created by on-premise solutions and 5% by cloud solutions however, the growth rate (8.5%) of cloud solutions is double compared to on-premise solutions (International Data Corporation) which mean corporations are becoming more interested in cloud solutions.

The main vendors in the Turkish market and their market shares are;

- SAP 44.5%
- Logo 22.7%
- Microsoft 8.20%
- Others 24.6% (International Data Corporation)

According to the Turkish Statistical Institute (TUIK), ERP usage is 28% in 2021 and growth is 7.5% comparing to 2019. 74.9% of the organizations that have more than 250 workers use an ERP solution, this rate goes down to 45.7% for the organizations with 50-249 workers and 23.7% with 10-49 workers. (Turkish Statistic Institute, 2020)

2.1.6. Advantages and Disadvantages of ERP Systems

ERP systems offer a single database for all business functions of an entire organization. Increased competitiveness, having more product features, keeping a lower volume of stock, better supply chain management, reduced delivery times, and increased customer satisfaction are some of the usefulness of the integrated business functions (Bingi, Sharma, &Godla, 1999, p. 8).

In addition, ERP systems improve organizational effectiveness and productivity and provide faster and more accurate operations (Osman & Sahraoui, 2018, p. 32).

Mahraz, Benabbou, and Berrado made a systematic review of ERP literature and according to their findings, some of the benefits that drive organizations to implement ERP systems are increasing performance, allowing workers to do their jobs easier, supporting company growth, integrating business units that are operating in different locations, and standardization of business processes for all company branches around the world (Mahraz, Benabbou, &Berrado, 2020, p. 117).

Despite their many benefits, ERP systems can also have drawbacks especially when feasibility was not carried out properly before starting the implementation process. ERP implementations have high costs and take a very long time, sometimes years. Therefore, after implementation, canceling the project is very difficult and costly. In some cases, project failures cost millions of dollars that lead to lawsuits (Bingi, Sharma, &Godla, 1999, p. 7).

2.2. Critical ERP Success Factors

2.2.1. Critical ERP Success Factors Notion

ERP implementations are complex projects that different business units of the organizations should work together in harmony. These projects are strategically important as their success or failure of them would highly affect the future of the companies in a positive or negative way. Therefore, it is greatly important to take success factors into account to prevent failure risks (Tarhini et al., 2015, p. 27).

In order to evaluate whether ERP implementation is a success, companies should define their targets before implementation and measure the degree of their achievement (Mahraz, Benabbou, &Berrado, 2020, p. 118). Parr and Shanks explain that from the project phase model point of view ERP success is completing the implementation project on time and on a budget (Parr & Shanks, 2000, p. 291). On the other hand, Markus and Tanis have a more comprehensive view that includes a set of metrics to measure ERP success. These metrics are; Project metrics (being on time, on budget, and achieving functional scope that was planned), early operational metrics (increase or decrease in operational performance such as labor costs, delivery times, etc. just after go-live until normal business operations are achieved), and longer-term business results (return on investment, making better decisions by the upper management due to high-quality data created by ERP after some time passes from normal operation was achieved) (Markus & Tanis, 2000, p. 185).

Considering ERP implementation, critical success factors (CSFs) are the requirements that should be fulfilled for a successful implementation achievement (Finney & Corbett, 2007, p. 330).

2.2.2. Critical ERP Success Factors in Literature

There are many CSFs identified in the literature and they were examined according to different perspectives. For instance, Tarhini et al. classified them according to the stakeholder groups (Tarhini et al., 2015, p. 33) while Somers and Nelson grouped them according to the phases of ERP implementation (Somers & Nelson, 2001, p. 7). Tarhini et al. made a comprehensive systematic review by examining articles written after 2000 and listed all of them as shown in Table 1.

Table 1: CSFs ordered according to their appearance frequency in the literatures

(Tarhini et al., 2015, p. 34)

CSF Order	CSF Description	Frequency
1	Top management support	20
2	Training for different user groups	17
3	Project management	16
4	Clear vision, goals and objectives of the ERP system	15
5	Careful change management	14
6	Interdepartmental communication	14
7	Project champion	13
8	The use of ERP implementation consultant	12
9	Business process reengineering	12
10	Communication among the implementation team members	10
11	Adequate ERP software selection	10
12	Project team competence	10
13	Ongoing ERP vendor support	9
14	Project team composition/team skills	9
15	Minimal customization of packages	8
16	End user involvement	7
17	Education on new business process	7
18	Reduced trouble shooting	7
19	Steering committee	7
20	Management of expectations	7
21	Dedicated resources	7
22	Organizational culture / cultural change / political issues	7
23	Suitable IT legacy systems	6
24	Team work	6
25	Implementation strategies	6
26	Interdepartmental cooperation	6
27	Data analysis and conversion	6
28	Use of vendors' development tools	6

Table 1: CSFs ordered according to their appearance frequency in the literatures (Cont.)

CSF Order	CSF Description	Frequency
29	Vendor/customer partnership	6
30	Data and information quality	5
31	IT infrastructure	4
32	Empowered decision makers	4
33	Business plan and long term vision	4
34	Defining the architecture	4
35	Ease of system's use and users' acceptance	4
36	Formalized project plan/schedule	3
37	Organizational fit for ERP	2
8	IT department capability	2
39	Good project scope management	2
40	Experienced project manager leadership	2
41	Adequate resources	2
42	Managing consultants	2
43	Company-wide support	2
44	Monitoring and evaluation of performance	2
45	Integration of business planning with ERP	2
46	Technical issues	1
47	Motivational factors to implement ERP systems	1
48	Trust between partners	1
49	Effectiveness of management in reducing the users' resistance	1
50	Focus on users requirements	1
51	A formalized project approach and methodology	1

After 2 years from Tarhini's study, Saygılı, Öztürkoğlu, and Kocakulah carried out another systematic review but she listed 48 CSFs in total (Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 60). They examined the most cited 13 articles in the literature. The reason why their list is shorter could be limiting the examined articles according to the number of citations. Although their list is shorter, they found additional CSFs which are listed in Table 2.

Table 2: Additional CSFs listed by Saygılı, Öztürkoğlu, and Kocakulah

(Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 60)

CSF Order	CSF Description	Frequency
1	Feasibility and evaluation of ERP project	2
2	Implementation time	2
3	ERP vendor selection	2
4	Obtain business analyst	1
5	National culture	1
6	Country related functional requirements	1
7	Centralization	1

In 2018, Osman and Sahraoui made another systematic review and found additional CSFs shown in Table 3 (Osman & Sahraoui, 2018, p. 33).

Table 3: Additional CSFs listed by Osman and Sahraoui

(Osman & Sahraoui, 2018, p. 33)

CSF Order	CSF Description
1	Software configuration
2	Careful define information and system requirements
3	Rewards and recognition
4	Software reliability
5	Adequate testing of system

It can be seen that there are 63 CSFs factors in total based on these three studies. In both Tarhini's and Saygılı, Öztürkoğlu&Kocakulah's studies top management support is listed as the most studied and training is the second most studied CSFs in literature (Saygılı, Öztürkoğlu, &Kocakulah, 2017, s. 60 ; Tarhini et al., 2015, s. 34). These two factors are also considered in this study.

2.2.3. Definitions of Critical Success Factors in the Research Model

One of the objectives of this study is to investigate the relationship between CSFs and end-user satisfaction. After searching the literature in order to find the most suitable questionnaire to measure CSFs, Ehie and Madsen's (Ehie& Madsen, 2005, p. 556) CSFs scale was chosen. The reason is, that it focused on the CFSs that would affect end-users directly and also related these factors with other CSFs as sub-factors that would benefit to have more comprehensive research. In the following sections, the CSFs that are considered in Ehie and Madsen's research are explained in more detail.

2.2.3.1. Project Management Principles

A strong project management should have a solid dealing of well-defined targets, carefully planned implementation steps and resources, and close monitoring of the project plan (Laughlin, 1999, p. 35; Reitsma&Hilletofth, 2018, p. 290).

The scope of good project management contains efficient use of information, expertise, instruments, and techniques to fulfill project necessities. In addition, these sources should be in coordination for planning and evaluating the implementation progress (Mahraz, Benabbou, &Berrado, 2020, p. 113).

One of the important factors of project management is establishing a project team that consists of people from different business units of the organization with different expertise and backgrounds. This project team should be commited to planning and running the implementation project smoothly (Mahraz, Benabbou, &Berrado, 2020, p. 113). Team members should be selected based on their qualifications and prior performances as they have to be the best employees in their department (Umble, Haft, &Umble, 2003, p. 245). Outside experts should also participate in the project team in order to train internal employees to develop technical skills in the ERP system (Sumner, 1999, p. 300).

Ehie and Madsen measured the project management principles and found that this CSF had a significant correlation with ERP implementation (Ehie& Madsen, 2005, p. 554). They examined this factor based on the following points;

- Establishing a close focus and control on the ERP implementation,
- Choosing the project management team members with a strong knowledge, skills, and dedication,
- Having project team members take ownership,
- Benefiting from in-house expertise as much as possible,
- Having the project team members organize the ERP implementation as good as possible,
- Training the project team members and key users at a good level. (Ehie& Madsen, 2005, p. 556)

2.2.3.2. Feasibility / Evaluation of ERP Project

Feasibility and evaluation of the ERP project contains measuring the performance of the system, defining which tasks should be completed by what date, evaluating whether implementation progress is going according to the plan, and detailed planning of which tasks should be covered at what phase of the project. (Ehie& Madsen, 2005, p. 556).

Measuring the performance of the system refers to the productivity of the ERP and its contribution level to the achievements of the goals that were identified at the chartering phase. Loh and Koh pointed out that this CSF becomes important during the shakedown phase (Loh& Koh, 2004, p. 3444). Having a detailed project plan and continual evaluation of it will enable the project team to take necessary actions to prevent possible delays.

2.2.3.3. Business Process Re-engineering (BPR)

The Business Process Re-engineering is crucial for a successful ERP installation. Company business processes should be in harmony with the standard ERP processes and serve organization targets and strategies (Mahraz, Benabbou, &Berrado, 2020, p. 113).

Organizations should look for the best ERP package for their needs in order to maximize the success of ERP deployment. Janson and Subramanian made a systematic review of the factors of the package software selection and according to their findings degree to fit between software and organization's existing information systems, fit between organization and vendor, budget, organization's needs and software capabilities, organizational structure, etc. (Janson & Subramanian, 1996, p. 138).

BPR is a necessary factor for efficient ERP implementation and usage. The best ERP solutions can provide 70 percent of organization necessities therefore, existing processes should be modified to comply with the remaining 30 percent. This gap can also be filled by customizing the ERP system but this would increase the implementation cost and cause delays. The ideal way is to keep the customization at a minimum level (Sumner, 1999, p. 303) and use this option only for unique processes that should be kept as they are and try to reorganize the existing business procedures to fit ERP system procedures as much as possible (Bingi, Sharma, &Godla, 1999, p. 10; Holland, Light, & Gibson, 1999, p. 274).

ERP implementation should not be considered as an IT project as it requires coordination and cooperation of the different business units in order to integrate them within a single source (Akkermans&Helden, 2002, p. 36). This integration and coordination will lead to the re-engineering of

the existing processes and change in corporate culture (Gargeya& Brady, 2005, p. 512; Reitsma&Hilletofth, 2018, p. 292).

In this study, this CSF is examined according to whether ERP is integrated with other management information systems, business processes were mapped out, simplified, and standardized, data robustness and accuracy were provided, evaluated that ERP was suitable to the organization, and implementation has been made step by step (Ehie& Madsen, 2005, p. 556).

2.2.3.4. Top Management Support

Top management support is admitted as one of the most significant CSF of ERP projects (Mahraz, Benabbou, &Berrado, 2020, p. 112) and according to Tarhini et al., and Saygılı, Öztürkoğlu&Kocakulah researches this CSF is the most examined factor in literature (Saygılı, Öztürkoğlu, &Kocakulah, 2017, s. 60; Tarhini et al., 2015, s. 34). The main role of the top management is to set clear targets and goals to enable all stakeholders to work in harmony (Mahraz, Benabbou, &Berrado, 2020, p. 112).

Implementing ERP is more than simply an IT project; it affects the way how things work throughout the entire organization and even affects the corporate culture. Therefore, top management should be in the leading position and manage these fundamental changes (Bingi, Sharma, &Godla, 1999, p. 9).

Senior-level managers should be dedicated to the project and allocate important resources (Holland, Light, & Gibson, 1999, p. 276) such as enough people and time to finish the work. In addition, they should intervene when there is any conflict (Roberts &Barrar, 1992, p. 35).

The commitment of the top management spreads throughout the organization by reaching the employees from different levels and creating a commitment of the whole parties which is very important for successful implementation (Bingi, Sharma, &Godla, 1999, p. 10).

In this study, top management support is evaluated according to end users' opinions about whether they felt the support and commitment of the upper management, communication with employees was effective, and there has been good cooperation between IT and business managers (Ehie& Madsen, 2005, p. 556).

2.2.3.5. Human Resource Development

Human resource development contains considering ERP as an integrated business-wide system, explaining to people that ERP will be used for outside competition, not managing the business with fewer

numbers of employees, including all employees in the implementation process, and training employees properly (Ehie& Madsen, 2005, p. 556).

Considering ERP as an integrated business-wide system consists of establishing interdepartmental cooperation, teamwork, and company-wide support through managing corporate culture. In order to achieve these, willingness to share information and trust between parties is crucial for successful implementation (Stefanou, 1999, p. 801).

It is important to explain to the employees that the aim of the ERP system is to help them to work more efficiently, use company sources more effectively and consequently better competition with the rivals in the market rather than cost reduction from human resources. This requires efficient communication, culture, and change management.

Holland, Light, and Gibson (1999), Nah, Lau and Kuang (2001), and Ngai, Law, and Wat (2008) explain effective communication with the following conditions; Expectations from ERP projects should be explained properly at all company levels, the project team should promote the progress of the project throughout the organization, and project scope, targets, and activities should be announced before project start (Holland, Light, & Gibson, 1999, p. 276; Nah, Lau, &Kuang, 2001, p. 291; Ngai, Law, & Wat, 2008, p. 551).

Culture can be defined as the synthesis of common senses, beliefs, presumptions, mentalities, standards, values, and knowledge (Hatch, 2013, p. 159). Therefore, it determines how people will react to changes. ERP implementations cause major changes in how things are done and in some cases, it leads to changes in organizational structure. In order to achieve a successful implementation, organizational culture should drive members of the organization to be open to change, accept new technologies, and support implementation activities (Roberts &Barrar, 1992, p. 35). This can be possible with good change management.

Training is a significant factor that allows users to become familiar with the ERP system. Marler, Liang, and Dulebohn (2006, p.725) indicate that proper training is an important part of the implementation process and according to Amoako-Gyampah and Salam (2004, p.735) training will enable executives to spread useful information such as, how the system fits with the business processes throughout the organization. This will drive end-users to develop a positive approach toward the new system which will trigger end-user satisfaction after the go-live stage.

2.2.3.6. Consulting Services

ERP systems are complex information systems that require consultants to support the implementation process. Organizations rely on the expertise of consultants to transfer their knowledge about the system in order to allow employees to maintain and operate the system independently (Ko, Kirsch, & King, 2005, p. 59).

The factor of consulting services differs from training in the sense of sustainability. Training refers to educating the employees to use the ERP system, on the other hand, consulting services refer to maintaining ongoing operations, adapting to technological developments, etc. (Kwak et al., 2011, p. 270).

It is important to benefit from in-house expertise as organization members have a good level of knowledge about the business and business processes. This way, organization members and consultants can work together to create the best conformity of the ERP system for the organization.

2.3. Techno-Stress

Information and communication technologies (ICT) have a significant impact on both our personal and professional lives. They allow us to process and share data easier and faster and also remove a lot of barriers to communication. Along with benefits, they have negative effects on human psychology that we mainly define as techno-stress (Chiapetta et al., 2019, p. 13). In this circumstance, it is possible that ERP systems would create techno-stress on end-users which would affect their satisfaction level. According to the study by Fuglsethaand Sørebø (2014, p.167), there is a link between techno-stress creators and employee ICT satisfaction.

2.3.1. Definitions of Stress and Techno-Stress

Hans Selye, who is considered the father of stress made the most generic definition of stress as "*the non-specific response of the body to any demand*" (Selye, 1976, p. 15).

Stress is a process that contains the following elements;

1) Environmental conditions that an individual assesses as a stressor.

2) The stressor has difficult demands on the individual's sources and acts according to these demands.

3) Coping responses of the individuals that cause psychological, behavioral, and physiological results. (Cooper, Stich, &Tarafdar, 2019, p. 8)

Understanding the process of stress enables us to understand the process of techno-stress. (Cooper, Stich, &Tarafdar, 2019, p.8).In other words, one can understand the concept of techno-stress by simply replacing the terms “stress” and “techno-stress” in the above-mentioned process steps.

The term techno-stress was introduced in 1984 by clinical psychologist Craig Brod, who defined it as a contemporary illness brought on by a person's incapacity to manage or interact with ICTs in a healthy way. (Ayyagari, Grover, & Purvis, 2011, p. 832).

It is considered that there are two types of stress. The first type is the short-time response to a stressor that enables humans to survive. The second type is long-term chronic stress which is pathological. (Buck, et al., 2015, p. 491) In our topic, techno-stress can be defined as a long-term pathological reaction toward ICTs (Chiapetta et al., 2019, p. 14).

Another definition of techno-stress is “*an IT user’s experience of stress when using technologies”.* (Ragu-Nathan, Tarafdar, & Ragu-Nathan, 2008, p. 418).

According to Folkman, techno-stress is a situation that occurs when one’s abilities are not enough to fulfill expectations (Folkman, 2010, p. 901)

The most comprehensive definition is made by Wang, Shu, and Tu as a “*reflection of one’s discomposure, fear, tenseness, and anxiety when one is learning and using computer technology directly or indirectly, that ultimately ends in psychological and emotional repulsion and prevents one from further learning or using computer technology”* (Wang, Shu, & Tu, 2008, p. 3004)

2.3.2. Causes (Techno-Stressors) of Techno-Stress

Technology-related stress causes are generally called techno-stressors (Torre et al., 2019, p. 19). In this study, techno-stress is considered as moderating factor and this factor has been examined according to Tarafdar’s scale (Tarafda et al., 2007, p. 314,315) which is one of the most often used scales in literature. In their study, techno-stressors are identified in five categories; techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. Techno-invasion is excluded from this study as it is not in the research scope. The rest of the techno-stressors are explained in the sections that follow.

2.3.2.1. Techno-Overload

Techno-overload refers to the situation that which employees feel stressed because they have to carry out more tasks in less time than they usually have. This would lead to exhaustion and burnout

(Tarafdar et al., 2007, p. 315). Techno-overload is examined by questioning the amount of workload, time constraints, and changing work practices to adopt new technology.

2.3.2.2. Techno-Complexity

Techno-complexity is considered another techno-stressor because employees feel under pressure to remain current with constant updates and modifications (Tarafdar et al., 2007, p. 315). They develop concerns such as they are not competent enough to learn and embrace new systems, they lack the time to upgrade their technical abilities, and their co-workers are more adequate in terms of using technology. Therefore, this techno-stressor is examined from these angles in the study.

2.3.2.3. Techno-Uncertainty

Techno-uncertainty refers to that employees believe constant upgrades and changes in ICTs cause uncertainty for them and they always need to get familiar with these new ICTs (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007, p. 315). The employees who are strained due to techno-uncertainty express that the computer software, hardware, networks, and technology used by the company they work for changed and upgraded constantly.

2.3.2.4. Techno-Insecurity

When workers worry that new technologies could cost them their jobs or that others are more technologically skilled than they are, this is known as techno-insecurity. (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007, p.315). Techno-insecurity is measured by asking workers if they feel their job security is at risk from new technologies or colleagues who possess more advanced technological skills, if they share their knowledge with other workers, and if they feel they need to keep up with technological advancements to avoid being replaced.

2.3.3. Antecedents of Techno-Stress

In ERP literature, antecedents refer to the characteristics of technology that create techno-stressors. Ayyagari, Grover, and Purvis' research is one of the most cited researches on this topic, and their simple but good explanatory model is shown below. They categorized characteristics of technology into three traits; usability feature (usefulness, complexity, reliability), intrusive feature (presenteeism, anonymity), and dynamic feature (pace of change). Techno-stressors are consisting of work overload, role ambiguity, work-home conflict, job insecurity, and invasion of privacy (Ayyagari, Grover, & Purvis, 2011, p. 839).

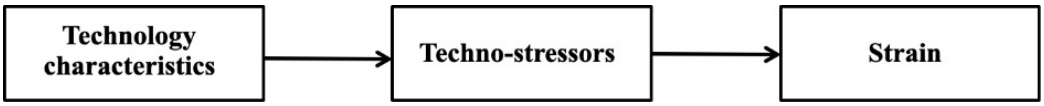


Figure 4: Techno-stress model (Ayyagari, Grover, & Purvis, 2011, s. 384)

According to the results of their research, usefulness, and reliability decreases the perception of work-overload. Complexity has no correlation with the perception of work overload. Presenteeism increases the perceived work-home conflict, invasion of privacy, work overload, and role ambiguity. On the other hand, anonymity decreases the perception of privacy invasion. The pace of change increases the perceived work overload, role ambiguity, and job insecurity (Ayyagari, Grover, & Purvis, 2011, p. 847).

2.3.4. Symptoms of Techno-Stress

Chiapetta (2017) listed techno-stress symptoms in two categories as physical and mental symptoms.

Physical symptoms consists of "*increased heart rate, cardiovascular disorders (hypertension, coronary heart disease), gastrointestinal disorders (irritable bowel syndrome, gastritis, reflux), muscle tension pain, tingling in the limbs insomnia and sleep-waking rhythm disorders, headache, chronic fatigue, sweating, cervical pain, hormonal and menstrual disorders in women, and stress-related skin disorders (psoriasis, dermatitis)".*

"*Irritability, sadness, behavioral changes, decreased sexual desire, sobbing episodes, and apathy"* are among the behavioral and cognitive signs of mental illness (Chiappetta, 2017, p. 359).

In addition, Sandra Champion reported that she observed the following techno-stress symptoms among librarians; distress (fear of losing self determination), disaffirmation (fear of missing chances of career advancement), reluctate (apprehension of losing control of the workplace), technophobia (fear of being alone in society), panic (fear of transition), conflict (fear of loss of freedom, privacy, and authority), mental exhaustion (fear that technology will promote ignorance), intolerance (intimidation by documentation), perfectionism (fear of inability to keep up with fast developments), and physical discomforts (problems with relationships) (Champion, 1988, p. 48).

2.4. End User ERP Satisfaction

In this study, End-User ERP Satisfaction is investigated based on the End-User Computing Satisfaction model. End-user computing satisfaction is identified by Doll and Torkzadeh as *"the affective*

attitude towards a specific computer application by someone who interacts with the application directly" (Doll &Torkzadeh, 1988, p. 261).

2.4.1. Theoretical Background of End User ERP Satisfaction (EUES)

End-user Computing Satisfaction was measured for the first time in 1983 by Bailey and Pearson. They defined user satisfaction as one's overall approach to a set of factors. According to their research, the five most important factors for end-user computing satisfaction are; accuracy, reliability, timeliness, relevancy, and confidence in the system (Bailey & Pearson, 1983, p. 537).

In the following, Ives, Olson, and Baroudi put another brick to develop a reliable scale to measure EUCS. They used Bailey and Pearson's instrument but reached a higher number of professionals to re-test the reliability and also shortened the questionnaire to make it more applicable (Ives, Olson, & Baroudi, 1983, p. 788). They defined end-user information satisfaction as "*the extent to which users believe the information system available to them meets their information requirements*" (Ives, Olson, & Baroudi, 1983, p. 785).

Doll and Torkzadeh claimed that Ives, Olson, and Baroudi's instrument was designed for more traditional data processing systems and had not been used for end-user computing research. In addition, it was targeting electronic data processing (EDP) staff more than end computer users (Doll &Torkzadeh, 1988, p. 262). After examining the literature for preparing an adequate questionnaire, they reached 40 items in total. After the pilot and actual study with this item, they developed a scale with 12 items and 5 factors (content, accuracy, format, ease of use, and timeliness) (Doll &Torkzadeh, 1988, p. 268).

In 2001, Nelson and Somers extended Doll and Torkzadeh's instrument to measure End-User ERP Satisfaction (Nelson & Somers, 2001).

Most of the past studies regarding ERP success considered end-user satisfaction and their opinions about ERP as the main indicator (Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 61). In other words, ERP system implementation can be considered a successful project if the employees believe that using it makes their work easier, and faster, they can process and receive the more precise information and these beliefs drive them to use it voluntarily.

Saygılı, Öztürkoğlu, and Kocakulah stated that (Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 61) these past studies used different approaches to measure users' approach. For instance, Doll &Torkzadeh, (1988), Henry and Stone (1994), Adam et al. (2000), and Adamson and Shine (2003) used the end-user

satisfaction approach while Davis (1986), Davis (1989), Davis, Bagozzi and Warshaw (1989), Lee, Kim, and Lee (1995), Venkatesh et al. (2003) used user acceptance model.

2.4.2. End-User ERP Satisfaction (EUES) Construct

Doll and Torkzadeh's EUCS construct which this study is based on contains five factors.

1. **Content:** It refers to that the information system providing correct and necessary information and reports.
2. **Accuracy:** It refers that the system which is evaluated in accuracy.
3. **Format:** This factor means that the output obtained from the information system is clear and usable.
4. **Ease of use:** It means the system is easy to use.
5. **Timeliness:** This factor refers to that the system provides up-to-date information on time (Doll &Torkzadeh, The Measurement of End-User Computing Satisfaction, 1988).

3. LITERATURE REVIEW

3.1. Past Studies on Critical Success Factors

Usages of ERP applications increase rapidly as companies consider them as a necessity to be competitive in the market and use their sources efficiently. ERP implementation projects are complex and costly therefore, these projects may not be carried out as they are planned initially. With the increasing number of failure cases on ERP projects, scholars have started to examine how the success of the future projects can be increased and identified critical factors that should be taken into account (Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 59). There have been different approaches by the scholars to identify these factors and these methods are explained in the following paragraphs.

Most of the publications are based on qualitative studies. For instance, Holland, Light & Gibson (1999) used the case study method and examined twelve cases from five different industries. They categorized CSFs into two classifications as strategic factors and tactical factors. Sumner (1999) also used the case study method by evaluating the ERP implementation processes of seven organizations and identifying CSFs specific to each organization. Umble, Haft, and Umble (2003) and Gergeya and Brady (2005) gave further examples of the case study.

Finney and Corbet (2007) made a systematic review to find out whether there is any missing point in CSFs of ERP implementation literature. Başoğlu, Daim, and Kerimoğlu (2007) and Ngai, Law, and Wat (2008) also used the same method to identify CSFs in literature.

Somers and Nelson (2001) carried out one of the few quantitative studies and according to Saygılı, Öztürkoğlu, and Kocakulah (2017), it is one of the most-cited research in ERP literature. They derived twenty-two CSFs from the literature and after receiving responses from 86 different organizations they classified the CSFs according to implementation phases. Nah, Lau and Kuang (2001) also made a similar classification but their study was based on a literature review only.

Ehie and Madsen's (2005) research stands out as their empirical research provided a validated questionnaire to measure CSFs for ERP projects. Another importance of their study is they gathered CSFs in literature and grouped them into eight categories. This study is based on their research however, six of these eight categories have been included as they are the most relevant CSFs that affect End-user ERP Satisfaction. These groups are explained below.

3.2. Classification of Critical Success Factors in the Model

As explained before 63 separate CSF were founded in the literature. However, some of them are related to each other or very similar. Therefore, it would be more convenient to group them under the main CSFs in order to achieve comprehensive research. In this section, each main CSF will be explained according to which sub-factor they include based on Ehie and Madsen's (2005) study. Although there are six CSF in the model, each construct in the questionnaire contains questions that refer to other sub-factors that are related to other CSF listed separately in the literature.

3.2.1. Project Management Principles

Project Management Principles refer to important points that should be taken into account before and during the implementation project. The questions of this main factor can be related to the below sub-factors;

- Project team competence,
- Project team composition/team skills,
- Implementation strategies,
- Formalized project plan/schedule,
- A formalized project approach, and methodology,
- Implementation time.

Good project management provides a smooth implementation and consequently, the employees of the organization have a higher level of belief that the ERP will be beneficial for them. In other words, successful implementation will lead to end-user ERP satisfaction. Tthe first hypothesis of this study is;

***H_1**:Project management principles have a direct positive influence on end-user ERP satisfaction.*

3.2.2. Feasibility/Evaluation of ERP Project

Feasibility/Evaluation of ERP Project refers to the measures that should be followed to keep track of whether the implementation project is going according to the project plan. The questions of this main factor can be related to the sub-factors as;

- Monitoring and evaluation of performance,
- Good project scope management.

After establishing a good project management plan, it is significant to control that everything is going according to the plan. This way, necessary actions can be taken to prevent from hinders and increase end-user motivation for ERP. Based on this, the second hypothesis of this study is;

***H_2**:Feasibility/evaluation of ERP project has a direct positive influence on end-user ERP satisfaction.*

3.2.4. Business Process Re-engineering (BPR)

The factor of Business Process Re-engineering contains the issues of re-constructing business procedures to work more efficiently and comply with ERP processes. The questions of this main factor can be related to the below sub-factors;

- Suitable IT legacy systems,
- Organizational fit for ERP,
- Data analysis and conversion,
- Data and information quality,
- Adequate ERP software selection,
- ERP vendor selection.

In order to work efficiently, the business processes of the organization and ERP processes and specifications should be in harmony. This way, end-users believe that they will work better and easier consequently, they will be more satisfied with the new system. Therefore, the third hypothesis of the study;

***H_3**:Business process re-engineering has a direct positive influence on end-user ERP satisfaction.*

3.2.5. Top Management Support

Top Management Support is one of the most studied CSFs in literature and the general outcome is it is a very significant factor to achieve successful implementation. In this study, this main CSF can be linked to the below sub-factors;

- Effectiveness of management in reducing the users' resistance,
- End-user involvement,
- Interdepartmental cooperation.

Support from the top management will show the employees that the ERP system is important and beneficial for all parties throughout the organization. Therefore, end-users will be motivated and involved in the ERP implementation and finally will be satisfied with the system. The fourth hypothesis of this study is;

***H_4**: Top management support has a direct positive influence on end-user ERP satisfaction.*

3.2.6. Human Resource Development

Human resource development regards to help the employees to understand the necessity of the ERP system and encourage and motivate them to use it. This main CSF can be related to the below sub-factors;

- Careful change management,
- Interdepartmental communication,
- Education on new business processes,
- Organizational culture / cultural change / political issues,
- Company-wide support,
- Motivational factors to implement ERP systems,
- Focus on users requirements,
- Training for different user groups.

One of the arguments of this study is that end-user satisfaction is the most significant indicator of successful ERP implementation. Good management of human resource development is the key to end-user satisfaction. Therefore, the fifth hypothesis of the study is;

***H_5**: Human resource development has a direct positive influence on end-user ERP satisfaction.*

3.2.7. Consulting Services

Consulting services refer to that companies should benefit from consultants' managerial and technical expertise. This main CSF can be related to the below sub-factors;

- The use of ERP implementation consultants,
- Managing consultants.

Consultants support the employees of the organization when needed consequently; users may benefit from ERP on a higher level and feel more satisfied. Therefore, the sixth hypothesis of the study is;

H_6: *Consulting services have a direct positive influence on end-user ERP satisfaction.*

3.3. Development of Techno-Stress Construct

The term techno-stress was introduced by clinical psychologist Craig Brod in 1984 (Weems-Landingham, 2020, p. 47), and since then it was examined from different angles and approaches by the researchers. For instance, Sandra Champion (1988) who was a librarian wrote an article to define symptoms, causes, and behavioral tendencies toward techno-stress and gave recommendations about how to cope with techno-stress based on her observations and surveys on librarians, teachers, and students. The terms computer phobia (Mcilroy, Sadler, &Boojavon, May 2007), cyber phobia, negative computer attitude (Weil & Rosen, 1990), and technophobia (Khasawneh, 2015) have also been used to explain users' negative feelings for technology or a particular device or software. In 1984, Maurer and Simonson carried out research with 614 samples from different professionals to develop a measure that could be used to identify individuals who had a tendency to become unusually computer anxious when faced with a situation in which computers were involved. Rosen and Sears (1987) have also tried to create instruments to measure technophobia. Ayyagari, Grover, and Purvis (2011) made comprehensive research to construct a model for techno-stress and discover the correlation between technology characteristics and related stressors by using existing scales in the literature. One of the most commonly used constructs to measure techno-stress was developed by Tarafdar et al. in 2007. The aim of their study was to identify factors of techno-stress and role stress and in addition to examining relationships between techno-stress, role stress, and productivity. They defined techno-stress creators as techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty. The scale was validated via a qualitative study and the questionnaire was used by many researchers (Ayyagari, Grover, & Purvis, 2011; Wang, Shu, & Tu, 2008; Fuglsetha&Sørebø, 2014) since. Past studies on ERP success examined which success factors should be considered from the organizational point of view. As effective usage of ERP systems depends on users' willingness to use them, it is important to identify their instinctive approach to new software and technology in general. In the case of having employees with techno-stress, the management can work on this negative approach and increase their productivity with ERP usage. Therefore, techno-stress is included in this study as a moderator and the hypothesis is;

H_7: *Techno-stress moderates the effect of ERP success factors on EUES.*

3.4. Development of End-User Satisfaction Construct

Computers was one of the first information technologies used in the workplace therefore; studies on information systems (IS) took computer usage as a reference point and generalized the user approach toward new technologies. With the increase in IS usage, scholars started to investigate measuring user satisfaction with IS.

Power and Dickson's study can be considered as one of the initiating ones as they find out that along with other factors user satisfaction is important for IS project success (Powers & Dickson, 1973, p. 155). In the same year, Seward (1973) who was a Ph.D. student at Harvard University constructed a questionnaire for his thesis. His aim was to measure user satisfaction which he considered the indicator of IS effectiveness. Following this point, Bailey and Pearson (1983) developed a semantic differential questionnaire to investigate why participants feel satisfied or dissatisfied. They conducted the research with 29 middle managers using a 39-item questionnaire. Using Bailey and Pearson's (1983) study as a foundation, Ives, Olson, and Baroudi (1983) made further research by repeating Bailey and Pearson's empirical research to validate their instrument and develop a short-form of the instrument for practical reasons. Treacy (1985) and Galetta and Lederer (1989) re-tested the questionnaire and raised concerns regarding its reliability. For this reason, Doll and Torkzadeh (1988) carried out another research to develop a short and reliable instrument in order to measure end-user satisfaction. After collecting 31 items from the literature, they added 7 items for ease of use construct which was missing in the previous studies, and 2 items for assessing satisfaction. 22 items were eliminated after the pilot study. An 18-item questionnaire was tested with 618 end users from 44 different firms which is essential for the reliability of the study. After data analysis, the final questionnaire was developed with 12 items. Another significance of their study was it provided a Likert-type scale instead of semantic differential scaling. Six years after their initial study, they re-tested the reliability and validity of their model and instrument by making another research with 409 computers and users from 18 organizations. As the result of this research, they reported that the EUCS instrument can be utilized as a standard measure of user satisfaction with a particular application (Doll, Xia, &Torkzadeh, 1994, p. 459). Their instrument is used in this study to measure end-user ERP satisfaction.

4. RESEARCH DESIGN AND METHODOLOGY

4.1. Research Objective

End-user satisfaction is considered as an indicator of an ERP implementation project (Saygılı, Öztürkoğlu, &Kocakulah, 2017, p. 61) therefore, it is significant to examine which organizational factors increase the user satisfaction. In addition, users' instinctive approach to the new technologies and software which we identify as techno-stress is another important issue that affects their satisfaction. Considering these issues, the aim of this study is to empirically examine the relationship between ERP success factors and end-user ERP satisfaction under techno-stress moderation.

4.2.Theoretical Framework of the Research

The conceptual model of this study is based on assumption that ERP success factors affect employees' ERP satisfaction in a positive direction under the circumstance they are managed well. In case of employees experiencing techno-stress, this factor influences ERP success factors and ERP satisfaction relationship. Consequently, the conceptual model of this research consists of ERP success factors as the independent variable, techno-stress as the moderating variable, and end-user ERP satisfaction as the dependent variable.

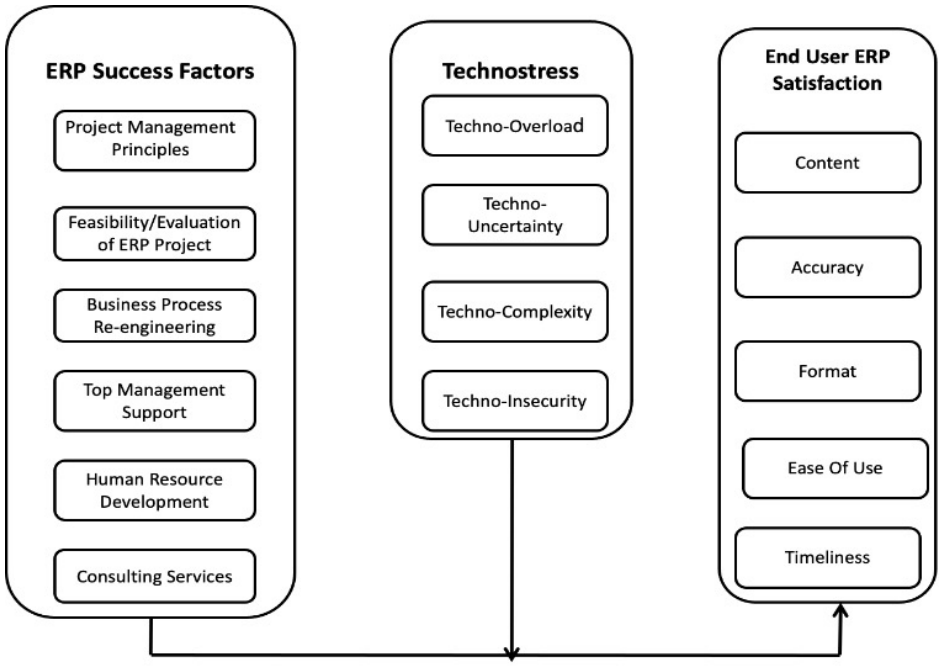


Figure 5: Conceptual research model

Hypotheses that were tested in this research can be seen in the following list;

H_{1a}: Project management principles have a direct positive influence on content.

H_{1b}: Project management principles have a direct positive influence on accuracy.

H_{1c}: Project management principles have a direct positive influence on format.

H_{1d}: Project management principles have a direct positive influence on ease of use.

H_{1e}: Project management principles have a direct positive influence on timeliness.

H_{2a}: Feasibility/evaluation of ERP project has a direct positive influence on content.

H_{2b}: Feasibility/evaluation of ERP project has a direct positive influence on accuracy.

H_{2c}: Feasibility/evaluation of ERP project has a direct positive influence on format.

H_{2d}: Feasibility/evaluation of ERP project has a direct positive influence on ease of use.

H_{2e}: Feasibility/evaluation of ERP project has a direct positive influence on ease of timeliness.

H_{3a}: Business process re-engineering has a direct positive influence on content.

H_{3b}: Business process re-engineering has a direct positive influence on accuracy.

H_{3c}: Business process re-engineering has a direct positive influence on format.

H_{3d}: Business process re-engineering has a direct positive influence on ease of use.

H_{3e}: Business process re-engineering has a direct positive influence on timeliness.

H_{4a}: Top management support has a direct positive influence on content.

H_{4b}: Top management support has a direct positive influence on accuracy.

H_{4c}: Top management support has a direct positive influence on format.

H_{4d}: Top management support has a direct positive influence on ease of use.

H_{4e}: Top management support has a direct positive influence on timeliness.

H_{5a}: Human resource development has a direct positive influence on content.

H_{5b}: Human resource development has a direct positive influence on accuracy.

H_{5c}: Human resource development has a direct positive influence on format.

H_{5d}: Human resource development has a direct positive influence on ease of use.

H_{5e}: Human resource development has a direct positive influence on timeliness.

H_{6a}: Consulting services have a direct positive influence on content.

H_{6b}: Consulting services have a direct positive influence on accuracy.

H_{6c}: Consulting services have a direct positive influence on format.

H_{6d}: Consulting services have a direct positive influence on ease of use.

H_{6e}: Consulting services have a direct positive influence on timeliness.

H_{7a}: Techno-overload moderates the effect of project management principles on content.

H_{7b}: Techno-overload moderates the effect of project management principles on accuracy.

H_{7c}: Techno-overload moderates the effect of project management principles on format.

H_{7d}: Techno-overload moderates the effect of project management principles on ease of use.

H_{7e}: Techno-overload moderates the effect of project management principles on timeliness.

H_{8a}: Techno-uncertainty moderates the effect of project management principles on content.

H_{8b}: Techno-uncertainty moderates the effect of project management principles on accuracy.

H_{8c}: Techno-uncertainty moderates the effect of project management principles on format.

H_{8d}: Techno-uncertainty moderates the effect of project management principles on ease of use.

H_{8e}: Techno-uncertainty moderates the effect of project management principles on timeliness.

H_{9a}: Techno-complexity moderates the effect of project management principles on content.

H_{9b}: Techno-complexity moderates the effect of project management principles on accuracy.

H_{9c}: Techno-complexity moderates the effect of project management principles on format.

H_{9d}: Techno-complexity moderates the effect of project management principles on ease of use.

H_{9e}: Techno-complexity moderates the effect of project management principles on timeliness.

H_{10a}: Techno-insecurity moderates the effect of project management principles on content.

H_{10b}: Techno-insecurity moderates the effect of project management principles on accuracy.

H_{10c}: Techno-insecurity moderates the effect of project management principles on format.

H_{10d}: Techno-insecurity moderates the effect of project management principles on ease of use.

H_{10c}: Techno-insecurity moderates the effect of project management principles on timeliness.

H_{11a}: Techno-overload moderates the effect of feasibility/evaluation of ERP project on content.

H_{11b}: Techno-overload moderates the effect of feasibility/evaluation of ERP project on accuracy.

H_{11c}: Techno-overload moderates the effect of feasibility/evaluation of ERP project on format.

H_{11d}: Techno-overload moderates the effect of feasibility/evaluation of ERP project on ease of use.

H_{11e}: Techno-overload moderates the effect of feasibility/evaluation of ERP project on timeliness.

H_{12a}: Techno-uncertainty moderates the effect of feasibility/evaluation of ERP project on content.

H_{12b}: Techno-uncertainty moderates the effect of feasibility/evaluation of ERP project on accuracy.

H_{12c}: Techno-uncertainty moderates the effect of feasibility/evaluation of ERP project on format.

H_{12d}: Techno-uncertainty moderates the effect of feasibility/evaluation of ERP project on ease of use.

H_{12e}: Techno-uncertainty moderates the effect of feasibility/evaluation of ERP project on timeliness.

H_{13a}: Techno-complexity moderates the effect of feasibility/evaluation of ERP project on content.

H_{13b}: Techno-complexity moderates the effect of feasibility/evaluation of ERP project on accuracy.

H_{13c}: Techno-complexity moderates the effect of feasibility/evaluation of ERP project on format.

H_{13d}: Techno-complexity moderates the effect of feasibility/evaluation of ERP project on ease of use.

H_{13e}: Techno-complexity moderates the effect of feasibility/evaluation of ERP project on timeliness.

H_{14a}: Techno-insecurity moderates the effect of feasibility/evaluation of ERP project on content.

H_{14b}: Techno-insecurity moderates the effect of feasibility/evaluation of ERP project on accuracy.

H_{14c}: Techno-insecurity moderates the effect of feasibility/evaluation of ERP project on format.

H_{14d}: Techno-insecurity moderates the effect of feasibility/evaluation of ERP project on ease of use.

H_{14e}: Techno-insecurity moderates the effect of feasibility/evaluation of ERP project on timeliness.

H_{15a}: Techno-overload moderates the effect of business process re-engineering on content.

H_{15b}: Techno-overload moderates the effect of business process re-engineering on accuracy.

H_{15c}: Techno-overload moderates the effect of business process re-engineering on format.

H_{15d}: Techno-overload moderates the effect of business process re-engineering on ease of use.

H_{15e}: Techno-overload moderates the effect of business process re-engineering on timeliness.

H_{16a}: Techno-uncertainty moderates the effect of business process re-engineering on content.

H_{16b}: Techno-uncertainty moderates the effect of business process re-engineering on accuracy.

H_{16c}: Techno-uncertainty moderates the effect of business process re-engineering on format.

H_{16d}: Techno-uncertainty moderates the effect of business process re-engineering on ease of use.

H_{16e}: Techno-uncertainty moderates the effect of business process re-engineering on timeliness.

H_{17a}: Techno-complexity moderates the effect of business process re-engineering on content.

H_{17b}: Techno-complexity moderates the effect of business process re-engineering on accuracy.

H_{17c}: Techno-complexity moderates the effect of business process re-engineering on format.

H_{17d}: Techno-complexity moderates the effect of business process re-engineering on ease of use.

H_{17e}: Techno-complexity moderates the effect of business process re-engineering on timeliness.

H_{18a}: Techno-insecurity moderates the effect of business process re-engineering on content.

H_{18b}: Techno-insecurity moderates the effect of business process re-engineering on accuracy.

H_{18c}: Techno-insecurity moderates the effect of business process re-engineering on format.

H_{18d}: Techno-insecurity moderates the effect of business process re-engineering on ease of use.

H_{18e}: Techno-insecurity moderates the effect of business process re-engineering on timeliness.

H_{19a}: Techno-overload moderates the effect of top management support on content.

H_{19b}: Techno-overload moderates the effect of top management support on accuracy.

H_{19c}: Techno-overload moderates the effect of top management support on format.

H_{19d}: Techno-overload moderates the effect of top management support on ease of use.

H_{19e}: Techno-overload moderates the effect of top management support on timeliness.

H_{20a}: Techno-uncertainty moderates the effect of top management support on content.

H_{20b}: Techno-uncertainty moderates the effect of top management support on accuracy.

H_{20c}: Techno-uncertainty moderates the effect of top management support on format.

H_{20d}: Techno-uncertainty moderates the effect of top management support on ease of use.

H_{20e}: Techno-uncertainty moderates the effect of top management support on timeliness.

H_{21a}: Techno-complexity moderates the effect of top management support on content.

H_{21b}: Techno-complexity moderates the effect of top management support on accuracy.

H_{21c}: Techno-complexity moderates the effect of top management support on format.

H_{21d}: Techno-complexity moderates the effect of top management support on ease of use.

H_{21e}: Techno-complexity moderates the effect of top management support on timeliness.

H_{22a}: Techno-insecurity moderates the effect of top management support on content.

H_{22b}: Techno-insecurity moderates the effect of top management support on accuracy.

H_{22c}: Techno-insecurity moderates the effect of top management support on format.

H_{22d}: Techno-insecurity moderates the effect of top management support on ease of use.

H_{22e}: Techno-insecurity moderates the effect of top management support on timeliness.

H_{23a}: Techno-overload moderates the effect of human resource development on content.

H_{23b}: Techno-overload moderates the effect of human resource development on accuracy.

H_{23c}: Techno-overload moderates the effect of human resource development on format.

H_{23d}: Techno-overload moderates the effect of human resource development on ease of use.

H_{23e}: Techno-overload moderates the effect of human resource development on timeliness.

H_{24a}: Techno-uncertainty moderates the effect of human resource development on content.

H_{24b}: Techno-uncertainty moderates the effect of human resource development on accuracy.

H_{24c}: Techno-uncertainty moderates the effect of human resource development on format.

H_{24d}: Techno-uncertainty moderates the effect of top human resource development on ease of use.

H_{24e}: Techno-uncertainty moderates the effect of human resource development on timeliness.

H_{25a}: Techno-complexity moderates the effect of human resource development on content.

H_{25b}: Techno-complexity moderates the effect of human resource development on accuracy.

H_{25c}: Techno-complexity moderates the effect of human resource development on format.

H_{25d}: Techno-complexity moderates the effect of human resource development on ease of use.

H_{25e}: Techno-complexity moderates the effect of human resource development on timeliness.

H_{26a}: Techno-insecurity moderates the effect of human resource development on content.

H_{26b}: Techno-insecurity moderates the effect of human resource development on accuracy.

H_{26c}: Techno-insecurity moderates the effect of human resource development on format.

H_{26d}: Techno-insecurity moderates the effect of human resource development on ease of use.

H_{26e}: Techno-insecurity moderates the effect of human resource development on timeliness.

H_{27a}: Techno-overload moderates the effect of consulting services on content.

H_{27b}: Techno-overload moderates the effect of consulting services on accuracy.

H_{27c}: Techno-overload moderates the effect of consulting services on format.

H_{27d}: Techno-overload moderates the effect of consulting services on ease of use.

H_{27e}: Techno-overload moderates the effect of consulting services on timeliness.

H_{28a}: Techno-uncertainty moderates the effect of consulting services on content.

H_{28b}: Techno-uncertainty moderates the effect of consulting services on accuracy.

H_{28c}: Techno-uncertainty moderates the effect of consulting services on format.

H_{28d}: Techno-uncertainty moderates the effect of consulting services on ease of use.

H_{28e}: Techno-uncertainty moderates the effect of consulting services on timeliness.

H_{29a}: Techno-complexity moderates the effect of consulting services on content.

H_{29b}: Techno-complexity moderates the effect of consulting services on accuracy.

H_{29c}: Techno-complexity moderates the effect of consulting services on format.

H_{29d}: Techno-complexity moderates the effect of consulting services on ease of use.

H_{29e}: Techno-complexity moderates the effect of consulting services on timeliness.

H_{30a}: Techno-insecurity moderates the effect of consulting services on content.

H_{30b}: Techno-insecurity moderates the effect of consulting services on accuracy.

H_{30c}: Techno-insecurity moderates the effect of consulting services on format.

H_{30d}: Techno-insecurity moderates the effect of consulting services on ease of use.

H_{30e}: Techno-insecurity moderates the effect of consulting services on timeliness.

4.3. Sample Selection and Data Collection

4.3.1. Sample Selection

Convenience and snowball sampling methods were applied where sample units were selected based on what the researchers could reach. The selected sample includes white-collar ERP users working in different departments, at different working levels at various companies and around Turkey.

4.3.2. Data Collection

Research data was collected via Google Docs Survey program by sending the link to the possible ERP end-users via email and social media (LinkedIn). There was not any preference for a specific industry, company size, or working level within the organizations in order to generalize the results as much as possible. The data collection process continued between September 2021 and March 2022. In total, 591 employees participated, and 99 of them were eliminated as they stated that they were working for an information technology company. As this study aims at ERP end-users, these employees had to be excluded as they are ERP providers. Another 100 participants were eliminated as they stated that they work in the IT department. IT professionals are not considered ERP end-users as they are mainly in a supporting position to the ERP end-users. The remaining participant quantity of 392 was competent as the minimum sample size was calculated as 384 with a 5% error range. The Statistical Package for Social Sciences (SPSS 26.0) software was used to upload the acquired data and perform the necessary analysis and evaluation. Participants were instructed to complete each question in order to get healthy results.

4.4. Design of Questionnaire

The questionnaire used in the study consists of four sections and 70 questions. In the first section, 10 questions were asked for demographic information, in the second section 19 questions were asked for the techno-stress scale, in the third section 29 questions were asked for the CSFs scale, and in the fourth section, 12 questions were asked for the EUS scale. 5-point Likert scale was used for the measurement of dependent, independent, and moderating variables. The answers ranged from strongly disagree to strongly agree.

4.5. Survey Instruments

4.5.1. Demographic Information

Below demographic information was asked the participants. Name of the participants and the company they work for were not asked due to confidentially which would make them feel comfortable answering questions genuinely.

- Working area: Participants chose one of the areas from a list consisting of 28 industries.
- Department: Participants chose from a list consisting of 20 business units.
- Number of employees: Participants chose an option from 0-49, 50-249, 250-499, and 500+.
- Working position level: Participants chose their level from upper-level executive, middle-level executive, executive candidate, specialist, staff member, and intern.
- Name of the ERP used: Answers were chosen from a list containing 18 different ERP systems.
- Year of experience: Answers were open-ended.
- Education level: Participants chose their education level from primary school, high school, associate, university, master's degree, and Ph.D. degree.
- Year of ERP usage: Answers were open-ended.
- Age: Answers were open-ended.
- Gender: Answers were chosen from female, male, and other, and I don’t want to specify.

4.5.2. Techno-Stress Scale

Techno-stress scale was developed by MonideepaTarafdar, Qiang Tu, Bhanu S. Ragu-Nathan, and T. S. Ragu-Nathan to measure the impact of techno-stress on role stress and productivity (Ragu-Nathan, Ragu-Nathan, Tarafdar, & Tu, 2007). Techno-stress scale in the questionnaire has 4 sub-dimensions; techno-overload (5 questions), techno-uncertainty (4 questions), techno-complexity (5 questions), and techno-insecurity (5 questions). The scale was adapted to Turkish by Gökhan Ilgaz, Hasan Özgür, and Cem Çuhadar (Ilgaz, Özgür, &Çuhadar, 2016), and their translation was used in this study to ask respondents to express their feelings about technology usage.

Table 4:Techo-stress scale items

	Construct	Item	Abbreviation
Techno-stress	**Techno-overload**	I am forced by this technology to do more work than I can handle.	TO1
		I am forced by this technology to work with very tight time schedules.	TO2
		I am forced to change my work habits to adapt to new technologies.	TO3
		I am forced by this technology to work much faster.	TO4
		I have a higher workload because of increased technology complexity.	TO5
	Techno-uncertainty	There are constant changes in computer software in our organization.	TU1
		There are frequent upgrades in computer networks in our organization.	TU2
		There are constant changes in computer hardware in our organization.	TU3
		There are always new developments in the technologies we use in our organization.	TU4
	Techno-complexity	I need a long time to understand and use new technologies.	TC1
		I do not find enough time to study and upgrade my technology skills.	TC2
		I often find it too complex for me to understand and use new technologies.	TC3
		I do not know enough about this technology to handle my job satisfactorily.	TC4
		I find new recruits to this organization know more about computer technology than I do.	TC5
	Techno-insecurity	I feel constant threat to my job security due to new technologies.	Tİ1
		I have to constantly update my skills to avoid being replaced.	Tİ2
		I am threatened by coworkers with newer technology skills.	Tİ3
		I do not share my knowledge with my coworkers for fear of being replaced.	Tİ4
		I feel there is less sharing of knowledge among coworkers for fear of being replaced.	Tİ5

4.5.3. Critical Success Factors Scale

The Critical Success Factors scale was developed by Ike C. Ehie and Mogens Madsen (Ehie & Madsen, 2005). The scale was originally developed in English; thus it was translated into Turkish, and it was translated into English again by a translator who also has ERP experience. After a comparison of the two English versions, minor revisions were made to have more clear expressions and be suitable for the Turkish working environment. CSF scale has six sub-dimensions; Project Management Principles (7 questions), Feasibility/Evaluation of ERP Project (4 questions), Business Process Re-engineering (8 questions), Top Management Support (3 questions), Human Resource Development (4 questions), and Consulting Services (3 questions).

Table 5: CSF scale items

	Construct	Item	Abbreviation
Critical Success Factors	Project Management Principles	Have a tight focus/control on the ERP implementation.	PM1
		Carefully pick the right (i.e., the most knowledgeable and dedicated) employees for the ERP project team(s).	PM2
		Have people with strong knowledge of financial and manufacturing processes present in the project team(s).	PM3
		Have project team members take ownership.	PM4
		Maximize utilization of in-house expertise.	PM5
		Have ERP project team members carefully organize the ERP implementation.	PM6
		Properly educate the project team and key individuals about the ERP implementation.	PM7
	Feasibility/ Evaluation of ERP Project	Develop performance measures for system.	FE1
		Establish appropriate deadlines/milestones (i.e., what to achieve by what date).	FE2
		Have a timely implementation.	FE3
		Have a detailed project plan (i.e., what activities to cover at what stage).	FE4
	Business Process Re-engineering	Integrate ERP with other management information systems.	PR1
		Initially map out business processes.	PR2
		Simplify (that is re-engineered) business processes in the initial stage.	PR3
		Standardize the business processes to the extent possible.	PR4
		Ensure data robustness (no loss of data) between the business processes.	PR5
		Ensure data accuracy (no change of data) between the business processes.	PR6
		Consider if the ERP system was right for the company.	PR7
		Have a step-by-step implementation (i.e., one function implemented ERP at a time.)	PR8
	Top Management Support	Experience strong support/commitment from upper-management.	TM1
		Communicate effectively with employees.	TM2
		Demonstrate close cooperation between IT and business managers.	TM3
	Human Resource Development	Consider ERP as an integrated business-wide system.	HR1
		Introduce the ERP system as a weapon against outside competition rather than reduction in number of internal employees.	HR2
		Include all employees in the implementation.	HR3
		Train employees extensively.	HR4
	Consulting Services	Utilize outside consultant group only when in-house expertise was not present.	CS1
		Value the managerial support provided by the consultant group.	CS2
		Value the technical support provided by the consultant group.	CS3

4.5.4. End-User ERP Satisfaction Scale

End-user computing satisfaction scale was developed by William J. Doll and Gholamreza Torkzadeh to measure end-user computing satisfaction which they considered as the indicator of successful information system implementation (Doll &Torkzadeh, 1988). The scale was adapted to Turkish by Yenipazar and Turan to measure the Information Platform of Sakarya University (SABİS) (Yenipazar&Turan, 2017). Minor changes with wording have been made to adapt the scale for ERP software. EUES scale has five sub-dimensions; Content (4 questions), Accuracy (2 questions), Format (2 questions), Ease of Use (2 questions), and Timeliness (2 questions).

Table 6: End user ERP satisfaction scale items

	Construct	Item	Abbreviation
End User ERP Satisfaction	Content	The ERP system provides the precise information I needed.	C1
		The information content meets my needs.	C2
		The ERP system provides reports that seem to be just about what I need.	C3
		The ERP system provides sufficient information.	C4
	Accuracy	The ERP system is accurate.	A1
		I am satisfied with the accuracy of the ERP system.	A2
	Format	The output presented is in a useful format.	F1
		The information is clear.	F2
	Ease of Use	The ERP system is user-friendly.	E1
		The ERP system is easy to use.	E2
	Timeliness	I get the information I need on time.	T1
		The ERP system provides up-to-date information.	T2

4.6. Data Analysis Methods

SPSS version 26.0 which is a widely used program for data analysis in social sciences was used.

Demographic information of the samples was analyzed by frequency distribution analysis which is a descriptive statistics method.

Before extraction of the factors, Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity tests were used to assess the suitability of the respondent data for factor analysis. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis. The Bartlett's Test of Sphericity should be significant ($p<0.05$) for factor analysis to be suitable (Williams,

Onsman, & Brown, 2010, p. 5). In addition measures of sampling adequacy (MSA) results were also examined to exclude any item under 0.50 score.

Factor and reliability analyzes were conducted to find out how many dimensions the scales were perceived by the respondents and to eliminate inappropriate items in accordance with these dimensions (Durmuş, Yurtkoru, &Çinko, 2011, p. 73). During factor analysis, the items which were grouped as a single item in a separate factor, or have a close factor loading value in two or more factors, or have a factor loading value less than 0.50, or grouped with other items which are inconsistent in meaning were eliminated. Cronbach's Alpha method was used for reliability analysis in order to measure the internal consistency of scales (Tavakol&Dennick, 2011, p. 53). The factors that have less than 0.70 Cronbach's Alpha score were eliminated from the data set.

Hypothesis (from H_{1a} to H_{4e}) of the model was tested by applying the multiple linear regression method. The multiple linear regression method is used for identifying how an independent variable is explained by dependent variables (Durmuş, Yurtkoru, & Çinko, 2011, p. 154). In other words, it is used for examining whether independent variables have any effect on dependent variables. The hypotheses which has a p-value higher than 0.05 were not accepted.

As stated in the conceptual model, the Techno-stress factor is classified as a moderator variable. Moderator means the factor that influences how the independent variable(s) affect the dependent variable(s) (Igartua& Hayes, 2021, p. 7). The hypotheses of the moderator variables (from H_{5a} to H_{20e}) were tested via Process Macro which was developed by Andrew Hayes. The effect of the moderator variable was tested only on dependent and independent variables that were found to be correlated. The hypothesis which has an interaction p-value higher than 0.05 were not accepted.

Difference tests were applied to investigate whether there are differences regarding perceptions of research model variables between independent demographic groups. For two independent groups, an independent sample t-test was applied. The t-test is used to statistically examine whether two means differ based on an assumption of equal variances (White, Redford, & Macdonald, 2019, p. 1). For more than two independent groups, one-way analyses of variance (ANOVA) were applied. One-way ANOVA is used for testing whether the means of more than two independent groups are different from each other (Durmuş, Yurtkoru, & Çinko, 2011, p. 124).

RESEARCH FINDINGS

In this chapter, research findings are presented. To start, the demographic characteristics of the survey respondents are specified. Second, the results of factor and reliability analysis were discussed. In accordance with these results, the research model and hypotheses were modified. Thirdly, multiple linear regression and moderated multiple regression tests were conducted to examine the relationship between dependent, independent, and moderator variables. For last, the T-Test and One-Way ANOVA test were applied to examine which demographic groups have different perceptions regarding research model variables.

5.1. Descriptive Statistics for Demographic Variables

Working area, department, number of employees, working position level, name of the ERP, year of experience, education level, year of ERP usage, age, and gender as demographic variables. Frequencies and percentages of the data are presented in the following sections.

5.1.1. Working Area

As shown in the below table, the 5 highest of the 28 industries are the construction industry (14%), automotive industry (12.8%), production/industrial goods (9.9%), and machine industry (7.9), and textile industry (7.1%).

Table 7: Frequency distribution of industry

Working Area	Freq.	%	Working Area	Freq.	%
Packaging Industry	7	1.8	Machine Industry	31	7.9
Maritime Industry	6	1.5	Furniture and Accessories	4	1.0
Education	3	0.8	Automotive Industry	50	12.8
Electric & Electronic	14	3.6	Plastic Industry	3	0.8
Energy	12	3.1	Retail	8	2.0
Food Industry	21	5.4	Healthcare	4	1.0
Aerospace	3	0.8	Defense Industry	10	2.6
Fast Moving Consumer Goods	2	0.5	Agriculture	2	0.5
Service	13	3.3	Transportation	2	0.5
Pharmaceutical	12	3.1	Textile	28	7.1
Construction	55	14.0	Telecommunication	5	1.3
Chemical	11	2.8	Trade Industry	7	1.8
Mining and Metal Industry	12	3.1	Tourism	6	1.5
Production / Industrial Goods	39	9.9	Other	22	5.6

5.1.2. Department

Most of the survey respondents are working in planning (16.3%), accounting (12.8%), management (9.4%), sales and marketing (8.7%), and engineering (6.9%) departments. The details are shown in Table 8.

Table 8: Frequency distribution of working department

Working Area	Freq.	%	Working Area	Freq.	%
R&D	18	4.6	Engineering / Design	27	6.9
Maintenance	3	0.8	Customer Relations (Services)	3	0.8
Warehouse	1	0.3	Operation	9	2.3
Finance	25	6.4	Planning	64	16.3
Administration	6	1.5	Purchasing	21	5.4
Human Resource	18	4.6	Sales and/or Marketing	34	8.7
Import & Export (Foreign Trade)	10	2.6	After Sales Service	5	1.3
Quality Management	22	5.6	Production	20	5.1
Logistics	7	1.8	Management	37	9.4
Accounting	50	12.8	Other	12	3.1
Total				**392**	**100**

5.1.3. Number of Employees

As shown in Table 9, the majority of the respondents are working in organizations that have from 50 to 249 employees and 500 and above.

Table 9: Frequency distribution of number of employees

Number of Employees	Frequency	%
0-49	51	13.0
50-249	143	36.5
250-499	75	19.1
500 and above	123	31.4
Total	**392**	**100**

5.1.4. Working Position Level

Most of the survey participants are working as middle-level executives (37.5%), specialists (29.6%), and upper-level executives (20.4%).

Table 10: Frequency distribution of working position level

Working Position Level	Frequency	%
Upper Level Executive	80	20.4
Middle Level Executive	147	37.5
Executive Candidate	22	5.6
Specialist	116	29.6
Staff Member	24	6.1
Intern	3	0.8
Total	**392**	**100**

5.1.5. Name of the ERP System

There are many ERP solutions in the market and the most commonly used 16 ERP was chosen as the answer option. As can be seen in Table 11, most of the respondents are using SAP (26.8%) which is also reported as the leader in the ERP market. The second most chosen answer was other (17.9%) which means there are many rather small-sized ERP providers. The third most chosen answer was IFS (11.7%).

Table 11: Frequency distribution of ERP system

Name of ERP System	Frequency	%
SAP	105	26.8
Canias	38	9.7
CPM Yazılım	3	0.8
J.D. Edwards	8	2.0
Login ERP	3	0.8
Logo	32	8.2
Microsoft Axapta	14	3.6
Microsoft Navision	3	0.8
Model ERP	4	1.0
Oracle	14	3.6
Set Yazılım	1	0.3
Uyumsoft	15	3.8
Workcube	2	0.5
IFS	46	11.7
Nebim	1	0.3
Scienta	1	0.3
Software specially developed for your company	32	8.2
Other	70	17.9
Total	**392**	**100**

5.1.6. Year of Experience

The minimum working experience of the survey participants is less than 1 year and the maximum is 40 years with an average of 12 years (standard deviation is 8.43).

Table 12: Frequency distribution of year of experience

Year of Experience	Frequency	%
0-10	181	46.2
11-20	142	36.2
21-30	57	14.5
31-40	12	3.1
Total	**392**	**100**

5.1.7. Education Level

The majority of the survey participants hold a university degree and master's degree in the following.

Table 13: Frequency distribution of education level

Education Level	Frequency	%
Primary school	1	0.3
High school	18	4.6
Associate	23	5.9
University	244	62.2
Masters degree	101	25.8
PhD degree	5	1.3
Total	**392**	**100**

5.1.8. Year of ERP Usage

Survey samples are using an ERP solution between less than 1 year and 29 years. The majority of the samples have 5 years of experience with an ERP and the average usage is 9 years (standard deviation is 6.33).

Table 14: Frequency distribution of ERP usage duration

Year of ERP Usage	Frequency	%
0-4	118	30.1
5-9	104	26.5
10-14	78	19.9
15-19	56	14.3
20-24	27	6.9
24-29	9	2.3
Total	**392**	**100**

5.1.9. Age

The majority of the samples are between 29 – 48 years old with an average age of 38 (standard deviation is 8.15).

Table 15: Frequency distribution of age

Age	Frequency	%
18-28	54	13.8
29-38	159	40.6
39-48	146	37.2
49-58	27	6.9
59-62	6	1.5
Total	**392**	**100**

5.1.10. Gender

As can be seen in Table 16, the number of male respondents (249) is nearly double of female respondents (141).

Table 16: Frequency distribution of gender

Gender	Frequency	%
Female	141	36.0
Male	249	63.5
Other	1	0.3
I don't want to specify	1	0.3
Total	**392**	**100**

5.2. Factor Analysis and Reliability Analysis

In order to examine the constructs of scales, exploratory factor analysis was applied as the initial step. In the questionnaire, there are 3 scales and each scale was analyzed separately as they were taken from different topics and research from the literature. Kaiser-Meyer-Olkin Measure (KMO) was used for measuring sample adequacy and Bartlett's Test of Sphericity was used for investigating whether there is a significant correlation between variables. Measures of Sampling Adequacy (MSA) values were also investigated in order to find out and eliminate the items which were not compatible for factor analysis. In the following, Principal Component Analysis and Varimax Rotation were applied to eliminate inappropriate items.

After eliminating the unsuited items and constructing the factors of scales, a Reliability Analysis was carried out in order to measure the level of internal consistency of each sub-dimension (factor). For this purpose, Cronbach's Alpha was measured.

5.3. Summary of Reliability Analysis for Each Construct

5.3.1. Factor and Reliability Analysis of Critical ERP Success Factors

Critical ERP success factors variable in the model has 29 items and 6 sub-dimensions. At the first exploratory factor analysis, items were distributed into 4 sub-dimensions, KMO value was measured as 0,948 which is higher than the minimum accepted value of 0.50, and also 0.80 which is considered a perfect value. Bartlett's test value (^{2}=7032.379, df=406, p=0.000) was also adequate which means appropriateness for factor analysis.Anti-image correlation diagonals were all exceeding 0.50, meaning all single items in the factor analysis are to be involved.

Following these measurements, component analysis and varimax rotation were performed. Items HR4, PR8, and PR1 were excluded from the data set as they had similar loading values at two factors. Item HR3 was excluded for having less than 0.50 factor loading value and finally item PR7 was excluded for being inconsistent in meaning with the other items in the same factor. Factor analysis was performed repeatedly after every item was deleted.

Table 17: Items excluded from critical success factors scale

Factor Name	Item
Human Resource Development	Train employees extensively.
	Include all employees in the implementation.
Business Process Re-engineering	Have a step-by-step implementation (i.e., one function implemented ERP at a time.)
	Integrate ERP with other management information systems.
	Consider if the ERP system was right for the company.

After factor analysis, reliability analysis was performed and Cronbach's alpha coefficient was determined, and it was estimated to be reliable. Four dimensions were found as a result of the analysis and the total variance was 63.695%.

Table 18: Factor and Reliability Analysis of Critical Success Factors

Factor Name	Item	FactorLoading	VarianceExplained (%)	Cronbach's Alpha
Project Management and Evaluation	Have ERP project team members carefully organize the ERP implementation.	0.823	25.540	0.932
	Carefully pick the right (i.e., the most knowledgeable and dedicated) employees for the ERP project team(s).	0.781		
	Have people with strong knowledge of financial and manufacturing processes present in the project team(s).	0.766		
	Maximize utilization of in-house expertise.	0.758		
	Properly educate the project team and key individuals about the ERP implementation.	0.714		
	Have project team members take ownership.	0.654		
	Develop performance measures for system.	0.631		
	Establish appropriate deadlines/milestones (i.e., what to achieve by what date).	0.613		
	Have a tight focus/control on the ERP implementation.	0.596		
	Have a detailed project plan (i.e., what activities to cover at what stage).	0.574		
	Have a timely implementation.	0.558		
Business Process Re-engineering	Simplify (that is re-engineered) business processes in the initial stage.	0.791	15.542	0.858
	Standardize the business processes to the extent possible.	0.728		
	Ensure data accuracy (no change of data) between the business processes.	0.679		
	Ensure data robustness (no loss of data) between the business processes.	0.662		
	Initially map out business processes.	0.650		
Top Management Support and Communication	Experience strong support/commitment from upper-management.	0.780	12.870	0.826
	Demonstrate close cooperation between IT and business managers.	0.681		
	Communicate effectively with employees.	0.659		
	Consider ERP as an integrated business-wide system.	0.615		
	Introduce the ERP system as a weapon against outside competition rather than reduction in number of internal employees.	0.585		
Consulting Services	Utilize outside consultant group only when in-house expertise was not present.	0.798	9.743	0.792
	Value the managerial support provided by the consultant group.	0.796		
	Value the technical support provided by the consultant group.	0.744		
		Total	63.695	
		KMO	0.941	
		Bartlett's Test		
		Chi-square	5953.188	
		df	300	
		p-value	0.000	

5.3.2. Factor and Reliability Analysis of Techno-Stress

Techno-stress scale in the questionnaire consists of 4 factors and 19 items in total. At the initial exploratory factor analysis, items were distributed into 5 sub-dimensions, KMO value was measured as 0,836 which is higher than the minimum accepted value of 0.50, and also 0.80 which is considered a perfect value. Bartlett's test value (χ^2=1980.553, df=171, p=0.000) was also adequate which means appropriateness for factor analysis.Anti-image correlation diagonals were all exceeding 0.50, meaning all single items in the factor analysis are to be involved.

Component analysis and varimax rotation were performed and items Tİ2 and TO3 were eliminated for being grouped inconsistent with the scale of the literature. Items TC4 and TC5 were excluded for having lower than 0.50 factor loading. Item Tİ5 was eliminated during reliability analysis in order to increase Cronbach's Alpha value to higher than 0.70 which is the minimum score to consider a factor reliable. Factor and reliability analysis was performed repeatedly after every item was deleted.

Table 19: Items excluded from techno-stress scale

Factor Name	Item
Techno-insecurity	I have to constantly update my skills to avoid being replaced. I feel there is less sharing of knowledge among coworkers for fear of being replaced.
Techno-overload	I am forced to change my work habits to adapt to new technologies.
Techno-complexity	I do not know enough about this technology to handle my job satisfactorily. I find new recruits to this organization know more about computer technology than I do.

After repeated factor and reliability analysis, four dimensions were found and the total variance was 61.064%. As shown below table, items were distributor in accordance with the literature, and factor loadings and Cronbach's alpha values were acceptable.

Table 20: Factor and Reliability Analysis of Techno-stress

Factor Name	Item	Factor Loading	Variance Explained (%)	Cronbach's Alpha
Techno-uncertainty	There are frequent upgrades in computer networks in our organization.	0.795	17.138	0.771
	There are constant changes in computer hardware in our organization.	0.789		
	There are constant changes in computer software in our organization.	0.751		
	There are always new developments in the technologies we use in our organization.	0.707		
Techno-overload	I am forced by this technology to do more work than I can handle.	0.772	15.608	0.709
	I am forced by this technology to work with very tight time schedules.	0.728		
	I have a higher workload because of increased technology complexity.	0.709		
	I am forced by this technology to work much faster.	0.621		
Techno-insecurity	I am threatened by coworkers with newer technology skills.	0.818	14.475	0.703
	I do not share my knowledge with my coworkers for fear of being replaced.	0.736		
	I feel constant threat to my job security due to new technologies.	0.734		
Techno-complexity	I do not find enough time to study and upgrade my technology skills.	0.792	13.843	0.711
	I often find it too complex for me to understand and use new technologies.	0.721		
	I need a long time to understand and use new technologies.	0.719		
		Total	61.064	
		KMO	0.798	
		Bartlett's Test Chi-square	1487.255	
		df	91	
		p-value	0.000	

5.3.3. Factor and Reliability Analysis of End User ERP Satisfaction

End-user ERP satisfaction scale has 12 items and 5 sub-dimensions. The extent to which the data is useful and suitable for the factor analysis, Kaiser Mayer-Olkin and Bartlett test measures were obtained. The results (KMO=0.917, Bartlett test χ^2=3218.346, df=66, p=0.000) were adequate. Anti-image

correlation diagonals are all exceeding 0.50, meaning all single items in the factor analysis are to be involved.

Following these measurements, component analysis and varimax rotation were performed. Cronbach's alpha coefficient was determined, and it was estimated to be reliable. 5 dimensions were found as a result of the analysis and the total variance is 82.414%. None of the items were excluded from the data set during factor and reliability analysis.

Table 21: Factor and Reliability Analysis of End User ERP Satisfaction

Factor Name	Item	Factor Loading	Variance Explained (%)	Cronbach's Alpha
Content	The ERP system provides reports that seem to be just about what I need.	0.765	23.869	0.889
	The information content meets my needs.	0.762		
	The ERP system provides sufficient information.	0.762		
	The ERP system provides the precise information I needed.	0.731		
Accuracy	I am satisfied with the accuracy of the ERP system.	0.851	18.066	0.875
	The ERP system is accurate.	0.829		
Ease of Use	The ERP system is easy to use.	0.856	16.139	0.850
	The ERP system is user-friendly.	0.709		
Format	The output presented is in a useful format.	0.788	12.493	0.748
	The information is clear.	0.526		
Timeliness	I get the information I need on time.	0.687	11.846	0.741
	The ERP system provides up-to-date information.	0.658		
		Total	82.414	
		KMO	0.917	
		Bartlett's Test Chi-square	3218.346	
		df	66	
		p-value	0.000	

5.4. Modified Research Model and Modified Hypotheses

After performing factor and reliability analysis, sub-dimensions of the Critical Success Factors scale were reduced from six to four. Project Management Principles and Feasibility/ Evaluation of ERP project factors were merged as a single sub-dimension and named Project Management and Evaluation.

Top Management Support and Human Resource Development factors were also merged as a single sub-dimension and named Top Management Support and Communication. 5 items of this scale were excluded. Sub-dimensions of the Techno-stress scale remained the same however, 5 items were eliminated. The End-user ERP Satisfaction scale remained the same and none of the items were excluded.

In accordance with the analysis results explained in previous chapters, the proposed research model and hypotheses were modified.

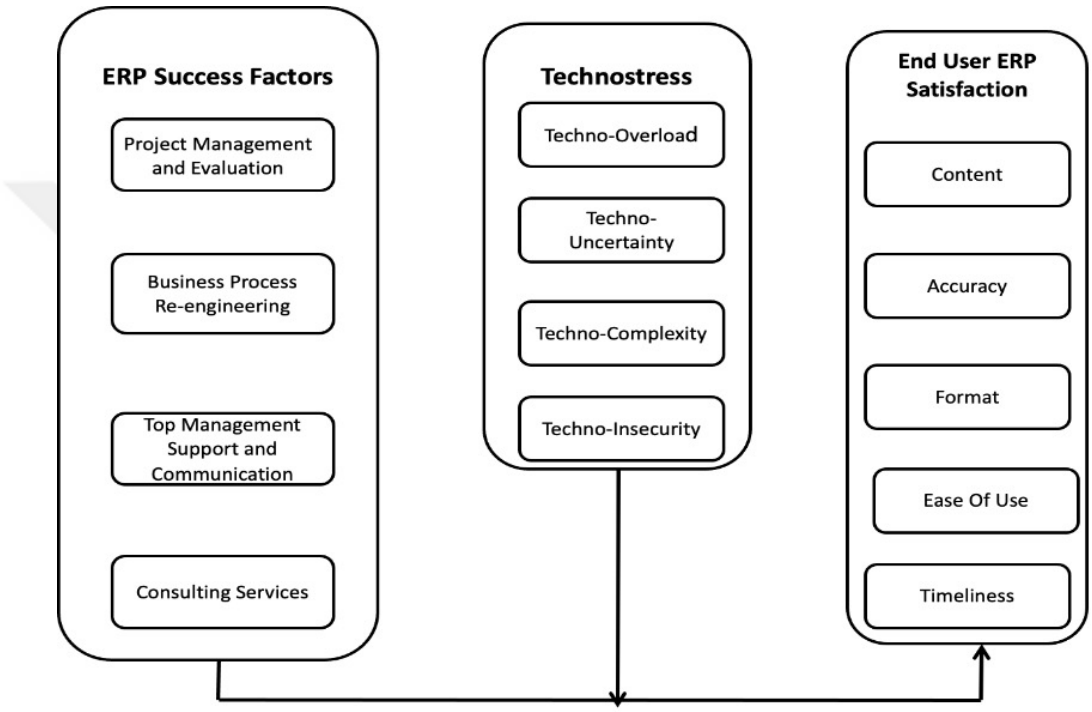


Figure 6: Modified research model

H_{1a}: Project management and evaluation has a direct positive influence on content.

H_{1b}: Project management and evaluation has a direct positive influence on accuracy.

H_{1c}: Project management and evaluation has a direct positive influence on format.

H_{1d}: Project management and evaluation has a direct positive influence on ease of use.

H_{1e}: Project management and evaluation has a direct positive influence on timeliness.

H_{2a}: Business process re-engineering has a direct positive influence on content.

H_{2b}: Business process re-engineering has a direct positive influence on accuracy.

H_{2c}: Business process re-engineering has a direct positive influence on format.

H_{2d}: Business process re-engineering has a direct positive influence on ease of use.

H_{2e}: Business process re-engineering has a direct positive influence on timeliness.

H_{3a}: Top management support and communication has a direct positive influence on content.

H_{3b}: Top management support and communication has a direct positive influence on accuracy.

H_{3c}: Top management support and communication has a direct positive influence on format.

H_{3d}: Top management support and communication has a direct positive influence on ease of use.

H_{3e}: Top management support and communication has a direct positive influence on timeliness.

H_{4a}: Consulting services have a direct positive influence on content.

H_{4b}: Consulting services have a direct positive influence on accuracy.

H_{4c}: Consulting services have a direct positive influence on format.

H_{4d}: Consulting services have a direct positive influence on ease of use.

H_{4e}: Consulting services have a direct positive influence on timeliness.

H_{5a}: Techno-overload moderates the effect of project management and evaluation on content.

H_{5b}: Techno-overload moderates the effect of project management and evaluation on accuracy.

H_{5c}: Techno-overload moderates the effect of project management and evaluation on format.

H_{5d}: Techno-overload moderates the effect of project management and evaluation on ease of use.

H_{5e}: Techno-overload moderates the effect of project management and evaluation on timeliness.

H_{6a}: Techno-uncertainty moderates the effect of project management and evaluation on content.

H_{6b}: Techno-uncertainty moderates the effect of project management and evaluation on accuracy.

H_{6c}: Techno-uncertainty moderates the effect of project management and evaluation on format.

H_{6d}: Techno-uncertainty moderates the effect of project management and evaluation on ease of use.

H_{6e}: Techno-uncertainty moderates the effect of project management and evaluation on timeliness.

H_{7a}: Techno-complexity moderates the effect of project management and evaluation on content.

H_{7b}: Techno-complexity moderates the effect of project management and evaluation on accuracy.

H_{7c}: Techno-complexity moderates the effect of project management and evaluation on format.

H_{7d}: Techno-complexity moderates the effect of project management and evaluation on ease of use.

H_{7e}: Techno-complexity moderates the effect of project management and evaluation on timeliness.

H_{8a}: Techno-insecurity moderates the effect of project management and evaluation on content.

H_{8b}: Techno-insecurity moderates the effect of project management and evaluation on accuracy.

H_{8c}: Techno-insecurity moderates the effect of project management and evaluation on format.

H_{8d}: Techno-insecurity moderates the effect of project management and evaluation on ease of use.

H_{8e}: Techno-insecurity moderates the effect of project management and evaluation on timeliness.

H_{9a}: Techno-overload moderates the effect of business process re-engineering on content.

H_{9b}: Techno-overload moderates the effect of business process re-engineering on accuracy.

H_{9c}: Techno-overload moderates the effect of business process re-engineering on format.

H_{9d}: Techno-overload moderates the effect of business process re-engineering on ease of use.

H_{9e}: Techno-overload moderates the effect of business process re-engineering on timeliness.

H_{10a}: Techno-uncertainty moderates the effect of business process re-engineering on content.

H_{10b}: Techno-uncertainty moderates the effect of business process re-engineering on accuracy.

H_{10c}: Techno-uncertainty moderates the effect of business process re-engineering on format.

H_{10d}: Techno-uncertainty moderates the effect of business process re-engineering on ease of use.

H_{10e}: Techno-uncertainty moderates the effect of business process re-engineering on timeliness.

H_{11a}: Techno-complexity moderates the effect of business process re-engineering on content.

H_{11b}: Techno-complexity moderates the effect of business process re-engineering on accuracy.

H_{11c}: Techno-complexity moderates the effect of business process re-engineering on format.

H_{11d}: Techno-complexity moderates the effect of business process re-engineering on ease of use.

H_{11e}: Techno-complexity moderates the effect of business process re-engineering on timeliness.

H_{12a}: Techno-insecurity moderates the effect of business process re-engineering on content.

H_{12b}: Techno-insecurity moderates the effect of business process re-engineering on accuracy.

H_{12c}: Techno-insecurity moderates the effect of business process re-engineering on format.

H_{12d}: Techno-insecurity moderates the effect of business process re-engineering on ease of use.

H_{12e}: Techno-insecurity moderates the effect of business process re-engineering on timeliness.

H_{13a}: Techno-overload moderates the effect of top management support and communication on content.

H_{13b}: Techno-overload moderates the effect of top management support and communication on accuracy.

H_{13c}: Techno-overload moderates the effect of top management support and communication on format.

H_{13d}: Techno-overload moderates the effect of top management support and communication on ease of use.

H_{13e}: Techno-overload moderates the effect of top management support and communication on timeliness.

H_{14a}: Techno-uncertainty moderates the effect of top management support and communication on content.

H_{14b}: Techno-uncertainty moderates the effect of top management support and communication on accuracy.

H_{14c}: Techno-uncertainty moderates the effect of top management support and communication on format.

H_{14d}: Techno-uncertainty moderates the effect of top management support and communication on ease of use.

H_{14e}: Techno-uncertainty moderates the effect of top management support and communication on timeliness.

H_{15a}: Techno-complexity moderates the effect of top management support and communication on content.

H_{15b}: Techno-complexity moderates the effect of top management support and communication on accuracy.

H_{15c}: Techno-complexity moderates the effect of top management support and communication on format.

H_{15d}: Techno-complexity moderates the effect of top management support and communication on ease of use.

H_{15e}: Techno-complexity moderates the effect of top management support and communication on timeliness.

H_{16a}: Techno-insecurity moderates the effect of top management support and communication on content.

H_{16b}: Techno-insecurity moderates the effect of top management support and communication on accuracy.

H_{16c}: Techno-insecurity moderates the effect of top management support and communication on format.

H_{16d}: Techno-insecurity moderates the effect of top management support and communication on ease of use.

H_{16e}: Techno-insecurity moderates the effect of top management support and communication on timeliness.

H_{17a}: Techno-overload moderates the effect of consulting services on content.

H_{17b}: Techno-overload moderates the effect of consulting services on accuracy.

H_{17c}: Techno-overload moderates the effect of consulting services on format.

H_{17d}: Techno-overload moderates the effect of consulting services on ease of use.

H_{17e}: Techno-overload moderates the effect of consulting services on timeliness.

H_{18a}: Techno-uncertainty moderates the effect of consulting services on content.

H_{18b}: Techno-uncertainty moderates the effect of consulting services on accuracy.

H_{18c}: Techno-uncertainty moderates the effect of consulting services on format.

H_{18d}: Techno-uncertainty moderates the effect of consulting services on ease of use.

H_{18e}: Techno-uncertainty moderates the effect of consulting services on timeliness.

H_{19a}: Techno-complexity moderates the effect of consulting services on content.

H_{19b}: Techno-complexity moderates the effect of consulting services on accuracy.

H_{19c}: Techno-complexity moderates the effect of consulting services on format.

H_{19d}: Techno-complexity moderates the effect of consulting services on ease of use.

H_{19e}: Techno-complexity moderates the effect of consulting services on timeliness.

H_{20a}: Techno-insecurity moderates the effect of consulting services on content.

H_{20b}: Techno-insecurity moderates the effect of consulting services on accuracy.

H_{20c}: Techno-insecurity moderates the effect of consulting services on format.

H_{20d}: Techno-insecurity moderates the effect of consulting services on ease of use.

H_{20e}: Techno-insecurity moderates the effect of consulting services on timeliness.

5.5. Correlation Analysis and Regression Analysis with Hypothesis Testing

According to Pearson Correlation, multicollinearity risk (higher than 0.70) were detected between sub-constructs of the dependent variable (Timeliness and Content, Ease of Use and Format) and sub-constructs of the independent variable (business process re-engineering and process management and evaluation).

In order to test whether there is multicollinearity between these sub-constructs, the linear regression method was used. It was found that variance inflation factor values were lower than 10 that mean there is no multicollinearity between variables.

There is no strong correlation (higher than 0.70) was detected between other sub-constructs. Based on these analyses it was concluded that regression analyses can be applied.

Table 22: Pearson Correlation Results of the Constructs

	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Content	1												
2.Accuracy	.655**	1											
3.Format	.672**	.536**	1										
4.Ease of use	.594**	.451**	.712**	1									
5.Timeliness	.704**	.658**	.634**	.605**	1								
6.Project Management and Evaluation	.591**	.505**	.567**	.458**	.494**	1							
7.Business Process Re-engineering	.558**	.473**	.548**	.447**	.485**	.711**	1						
8. Top management support and communication	.535**	.482**	.452**	.385**	.497**	.660**	.587**	1					
9.Consulting Services	.325**	.363**	.348**	.366**	.331**	.440**	.421**	.524**	1				
10.Techno-uncertainty	.144**	.109*	.122*	.099*	0.079	.162**	.156**	.183**	.118*	1			
11.Techno-overload	-.206**	-.143**	-.135**	-.133**	-.171**	-.221**	-.159**	-.119*	-.107*	.182**	1		
12.Techno-insecurity	-0.09	-.107*	-0.019	-0.057	-.147**	-0.04	-0.062	-0.088	-0.051	.202**	.269**	1	
13.Techno-complexity	-.215**	-.185**	-.149**	-.177**	-.250**	-.214**	-.226**	-.250**	-0.074	0.086	.422**	.400**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 23: VIF-Value Analysis for Project Feasibility and Management, Business Process Re-engineering, Managerial Support, and Communication, and Consulting Services

Independent variables	Tolerance	VIF
Project Management and Evaluation	0.402	2.486
Business Process Re-engineering	0.465	2.149
Top Management Support and Communication	0.481	2.080
Consulting Services	0.702	1.425

The hypotheses of the research were tested via multiple linear regression and moderated multiple regression in order to analyze relationships between variables shown in the modified research model. Multiple linear regression was used for examining relationships between independent (predictor) and dependent variables. Moderated multiple regression was used for analyzing the influence of moderator variables on the relationship between predictor and dependent variables.

The results of regression analysis were shown in the Tables from 24 to 28.

As it is shown in Table 24, the independent variables Project Management and Evaluation, Business Process Re-engineering, and Top Management Support and Communication have a positive effect on the dependent variable Content. Consulting Services have no significant effect on Content as the p-value is higher than 0.05 (p=0.800). The overall explanatory power of the model is 41.1% (R=0.641, R^2=0.411, F=67.635, p<0.001).

Table 24: Multiple Linear Regression of Project Management and Evaluation, Business Process Re-engineering, Top Management Support, and Communication, Consulting Services, and Content

Dependent variable: Content			
Independent variables:	**Stand. Beta**	**t-value**	**p-value**
Project Management and Evaluation	0.292	4.744	0.000
Business Process Re-engineering	0.231	4.045	0.000
Top Management Support and Communication	0.213	3.779	0.000
Consulting Services	-0.012	-0.253	0.800

As reflected Table 25, Project Management and Evaluation, Business Process Re-engineering, and Top Management Support and Communication have positive effect explaining 31.5% variation of dependent variable Accuracy (R=0.562, R^2=0.315, F=44.593, p<0.001). Consulting Services have no significant effect on Accuracy as the p-value is higher than 0.05 (p=0.052).

Table 25: Multiple Linear Regression of Project Management and Evaluation, Business Process Re-engineering, Top Management Support, and Communication, Consulting Services, and Accuracy

Dependent variable: Accuracy			
Independent variables:	**Stand. Beta**	**t-value**	**p-value**
Project Management and Evaluation	0.221	3.331	0.001
Business Process Re-engineering	0.164	2.664	0.008
Top Management Support and Communication	0.188	3.105	0.002
Consulting Services	0.098	1.949	0.052

Independent variables Project Management and Evaluation and Business Process Re-engineering have positive effect on dependent variable Format (table 26). Top Management Support and Communication (p=0.354) and Consulting services (p=0.139) do not affect the dependent variable Format as the p-value is higher than 0.05. The overall explanatory power of the model is 37.1% (R=0.609, R^2=0.371, F=57.000, p<0.001).

Table 26: Multiple Linear Regression of Project Management and Evaluation, Business Process Re-engineering, Top Management Support, and Communication, Consulting Services, and Format

Dependent variable: Format			
Independent variables:	**Stand. Beta**	**t-value**	**p-value**
Project Management and Evaluation	0.311	4.898	0.000
Business Process Re-engineering	0.265	4.477	0.000
Top Management Support and Communication	0.054	0.928	0.354
Consulting Services	0.071	1.483	0.139

According to Table 27, Project Management and Evaluation, Business Process Re-engineering, and Consulting Services have a positive effect on Ease of Use. Top Management Support and Communication has no significant effect on Ease of Use as the p-value is higher than 0.05 (p=0.571). The overall explanatory power of the model is 26.4% (R=0.514, R^2=0.264, F=34.747, p<0.001).

Table 27: Multiple Linear Regression of Project Management and Evaluation, Business Process Re-engineering, Top Management Support, and Communication, Consulting Services, and Ease of Use

Dependent variable: Ease of use			
Independent variables	**Stand. Beta**	**t-value**	**p-value**
Project Management and Evaluation	0.218	3.167	0.002
Business Process Re-engineering	0.201	3.140	0.002
Top Management Support and Communication	0.036	0.568	0.571
Consulting Services	0.167	3.211	0.001

As can be seen in Table 28, Project Management and Evaluation, Business Process Re-engineering, and Top Management Support and Communication have positive effect explaining 31.7% variation of dependent variable Timeliness ($R=0.563$, $R^2=0.317$, $F=45.008$, $p<0.001$). Consulting Services have no significant effect on Accuracy as the p-value is higher than 0.05 ($p=0.381$).

Table 28: Multiple Linear Regression of Project Management and Evaluation, Business Process Re-engineering, Top Management Support, and Communication, Consulting Services, and Timeliness

Dependent variable: Timeliness			
Independent variables:	**Stand. Beta**	**t-value**	**p-value**
Project Management and Evaluation	0.169	2.558	0.011
Business Process Re-engineering	0.204	3.316	0.001
Top Management Support and Communication	0.242	3.998	0.000
Consulting Services	0.044	0.876	0.381

According to Process Makro, there were no moderator effect of the hypothesis $H_{5a,}$ $H_{5C,}$ H_{5d}, H_{5e}, H_{6a}, H_{6b}, $H_{6d,}$ $H_{7a,}$ $H_{7ab,}$ H_{7c}, H_{7d}, H_{7e}, H_{8a}, H_{8b}, H_{8c}, $H_{8d,}$ $H_{8e,}$ H_{9a}, H_{9c}, H_{9d}, H_{9e}, $H_{10b,}$ H_{11a}, H_{11b}, H_{11c}, H_{11d}, $H_{11e,}$ H_{12a}, H_{12b}, H_{12c}, H_{12d}, H_{12e}, H_{13a}, H_{13b}, H_{13e}, $H_{14b,}$ $H_{15a,}$ $H_{15b,}$ $H_{15e,}$ H_{16a}, H_{16b}, H_{16e}, $H_{17d,}$ $H_{18d,}$ $H_{19d,}$ and H_{20d} as interaction p-values were higher than 0.05.

Moderator effect of the hypothesis H_{13c}, H_{13d}, H_{14c}, H_{14d}, H_{15c}, $H_{15d,}$ H_{16c}, $H_{16d,}$ H_{17a}, H_{17b}, H_{17c}, H_{17e}, H_{18a}, H_{18b}, H_{18c}, $H_{18e,}$ H_{19a}, H_{19b}, H_{19c}, $H_{19e,}$ H_{20a}, H_{20b}, H_{20c}, and H_{20e} have been disregarded because there was no significant effect of independent variable Top management support and communication on dependent variables Format and Ease of Use and independent variable Consulting services on dependent variables Content, Accuracy, Format, and Timeliness.

As shown in Table 29, the interaction of Techno-overload and Project Management and Evaluation accounted for a significant proportion of the variance in Accuracy, (ΔR^2 = .0137, $\Delta F(1, 388)$ = 7.298, p = .007, b = -.129, t = -2.702). Techno-overload was found to be a significant moderator of the effect of Project Management and Evaluation on Accuracy.

Interaction plot showed an enhancing effect that as Techno-overload and Project Management and Evaluation increased, Accuracy increased. At the low level of Techno-overload, the high level of Project Management and Evaluation resulted the best Accuracy, whereas when the high level of Techno-overload existed, the worst Accuracy was observed.

Table 29: Moderator Effect of Techno-overload on The Relationship Between Project Management and Evaluation and Accuracy

Dependent variable: Accuracy						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Project Management and Evaluation	0.469	0.413	11.338	0.000	0.387	0.550
Techno-overload	-0.019	0.038	-0.511	0.610	-0.093	0.055
Interaction	-0.130	0.048	-2.701	0.007	-0.224	-0.035
R^2=0.270 F=47.814 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

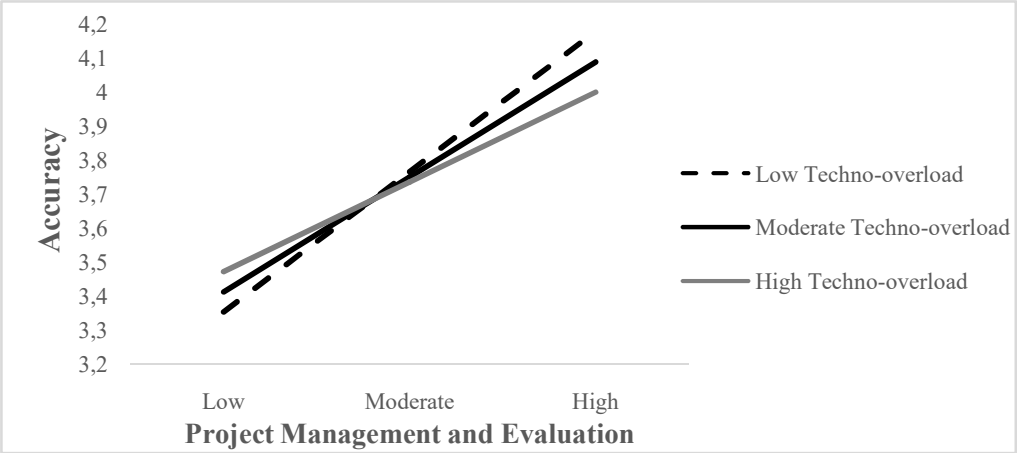


Figure 7: Interaction Effects of Techno-overload, Project Management and Evaluation, and Accuracy

According to Table 30, the interaction of Techno-uncertainty and Project Management and Evaluation accounted for a significant proportion of the variance in Format, (ΔR^2 = .0074, ΔF (1, 388)

= 4.2533, p = .039, b = .097, t = 2.062). Techno-uncertainty was found to be a significant moderator of the effect of Project Management and Evaluation on Format.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Project Management and Evaluation increased, Format increased. At the high level of Techno-uncertainty, high level of Project Management and Evaluation resulted the best Format, whereas when high level of Techno-uncertainty and low level of Project Management and Evaluation existed, the worst Format was observed.

Table 30: Moderator Effect of Techno-uncertainty on The Relationship Between Project Management and Evaluation and Format

Dependent variable: Format						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Project Management and Evaluation	0.584	0.436	13.386	0.000	0.498	0.669
Techno-uncertainty	0.032	0.040	0.803	0.423	-0.047	0.111
Interaction	0.097	0.047	2.062	0.040	0.005	0.190
R^2=0.329 F=63.526 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

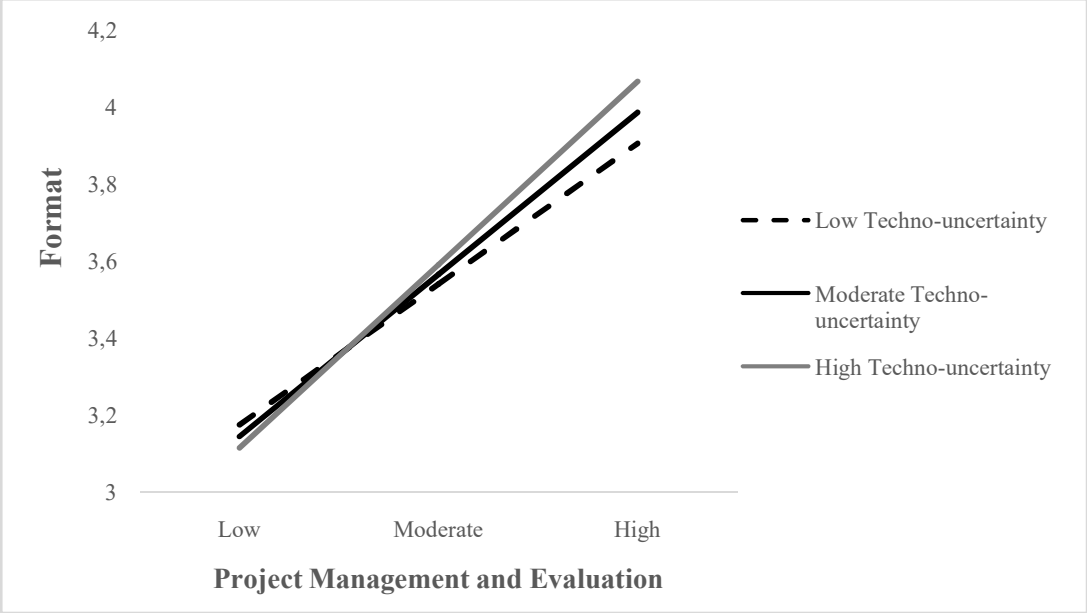


Figure 8: Interaction Effects of Techno-uncertainty, Project Management and Evaluation, and Format

As shown in Table 33, the interaction of Techno-uncertainty and Project Management and Evaluation accounted for a significant proportion of the variance in Timeliness, (ΔR^2 = .0083, $\Delta F(1, 388)$ = 4.301, p = .038, b =.090, t = 2.074). Techno-uncertainty was found to be a significant moderator of the effect of Project Management and Evaluation on Timeliness.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Project Management and Evaluation increased, Timeliness increased. At high level of Techno-uncertainty, high level of Project Management and Evaluation resulted the best Timeliness, whereas when high level of Techno-uncertainty and low level of Project Management and Evaluation existed, the worst Timeliness was observed.

Table 31: Moderator Effect of Techno-uncertainty on The Relationship Between Project Management and Evaluation and Timeliness

Dependent variable: Timeliness						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Project Management and Evaluation	0.452	0.041	11.156	0.000	0.372	0.532
Techno-uncertainty	0.002	0.037	0.049	0.961	-0.071	0.075
Interaction	0.091	0.044	2.074	0.039	0.005	0.177
R^2=0.252 F=43.590 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

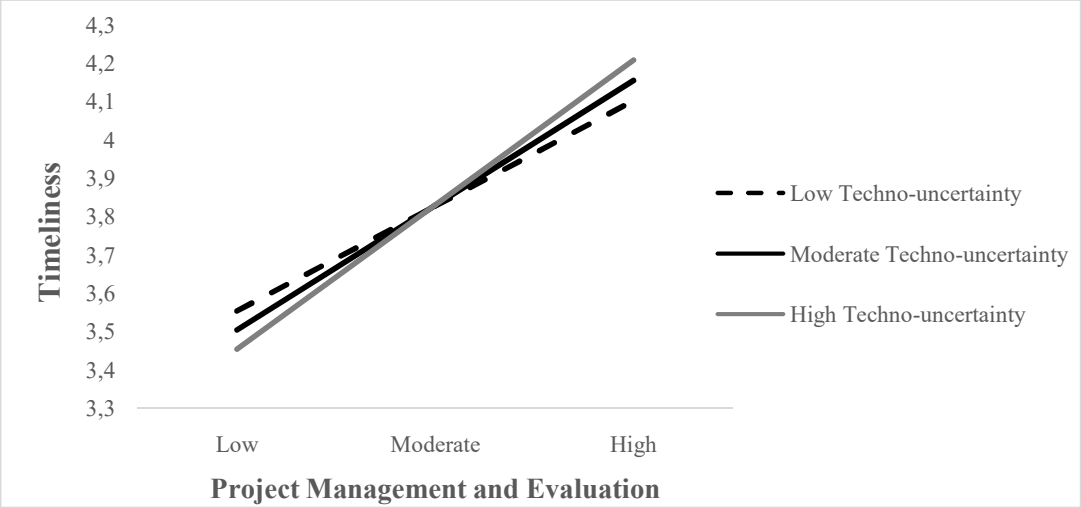


Figure 9: Interaction Effects of Techno-uncertainty, Project Management and Evaluation, and Timeliness

The interaction of Techno-overload and Business Process Re-engineering accounted for a significant proportion of the variance in Accuracy (table 32), (ΔR^2 = .0141, $\Delta F(1, 388)$ = 7.2122, p = .008, b = -.133,t = -2.686). Techno-overload was found to be a significant moderator of the effect of Business Process Re-engineering on Accuracy.

Interaction plot showed an enhancing effect that as Techno-overload and Business Process Re-engineering increased, Accuracy increased. At low level of Techno-overload, high level of Business Process Re-engineering resulted the best Accuracy, whereas when low level of Techno-overload and low level of Business Process Re-engineering existed, the worst Accuracy was observed.

Table 32: Moderator Effect of Techno-overload on The Relationship Between Business Process Re-engineering and Accuracy

Dependent variable: Accuracy						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Business Process Re-engineering	0.434	0.042	10.251	0.000	0.351	0.517
Techno-overload	-0.049	0.038	-1.302	0.194	-0.124	0.025
Interaction	-0.133	0.050	-2.686	0.008	-0.231	-0.036
R^2=0.243 F=41.402 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

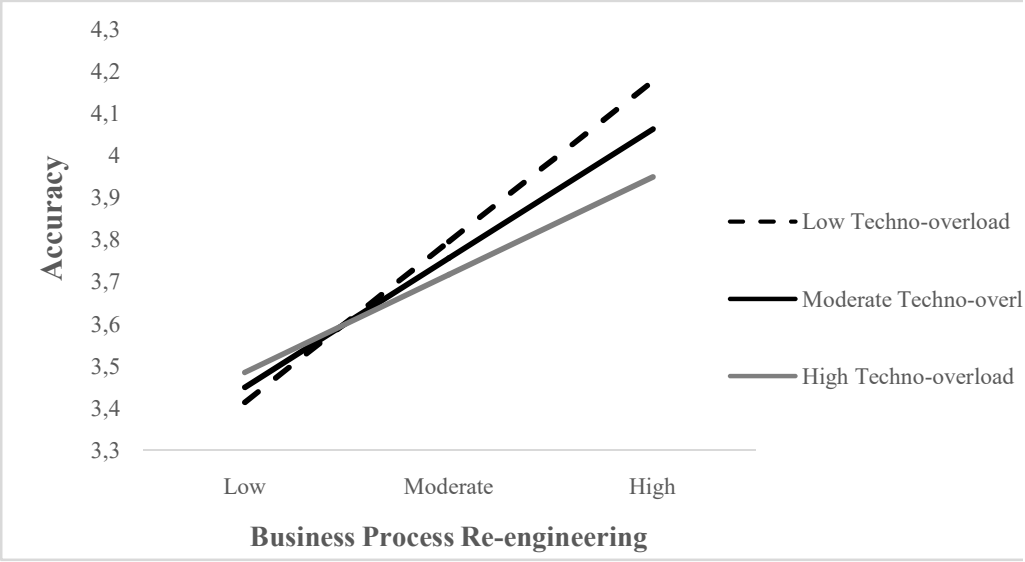


Figure 10: Interaction Effects of Techno-overload, Business Process Re-engineering, and Accuracy

As shown in Table 33, the interaction of Techno-uncertainty and Business Process Re-engineering accounted for a significant proportion of the variance in Content, (ΔR^2 = .0084, $\Delta F(1, 388)$ = 4.8118, p = .003, b = .101, t = 2.194). Techno-uncertainty was found to be a significant moderator of the effect of Business Process Re-engineering on Content.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Business Process Re-engineering increased, Content increased. At high level of Techno-uncertainty, high level of Business Process Re-engineering resulted the best Content, whereas when high level of Techno-uncertainty and low level of Business Process Re-engineering existed, the worst Content was observed.

Table 33: Moderator Effect of Techno-uncertainty on The Relationship Between Business Process Re-engineering and Content

Dependent variable: Content						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Business Process Re-engineering	0.522	0.040	13.101	0.000	0.444	0.600
Techno-uncertainty	0.056	0.036	1.550	0.122	-0.015	0.126
Interaction	0.101	0.046	2.194	0.029	0.010	0.191
R^2=0.323 F=61.848 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

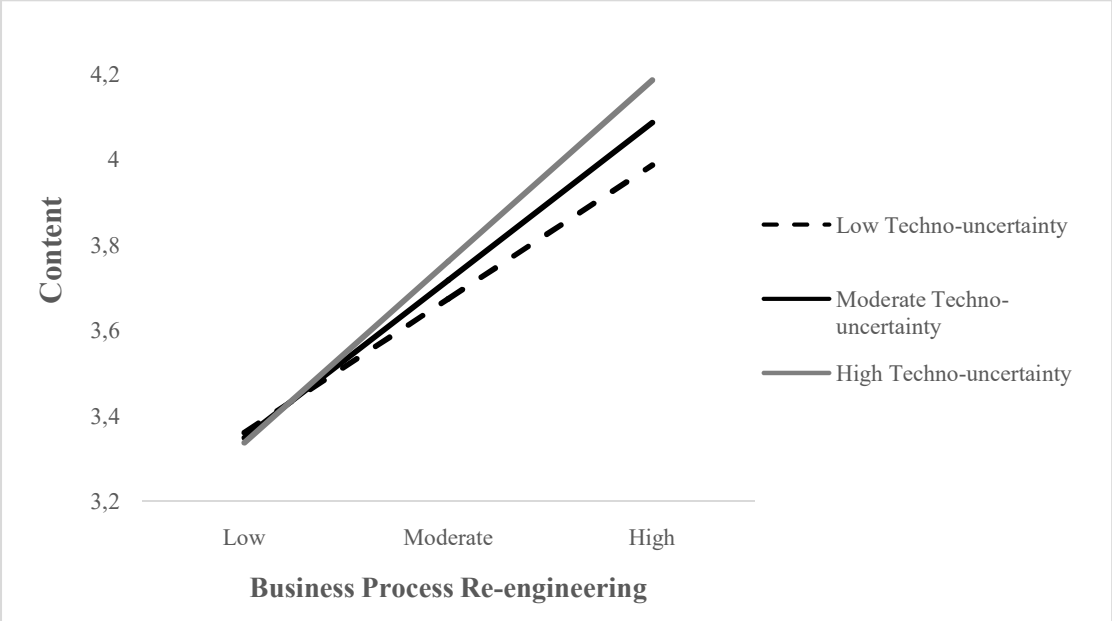


Figure 11: Interaction Effects of Techno-uncertainty, Business Process Re-engineering, and Content

As shown in Table 34, the interaction of Techno-uncertainty and Business Process Re-engineering accounted for a significant proportion of the variance in Format, (ΔR^2 = .0135, $\Delta F(1, 388)$ = 7.6259, p = .006, b = .143, t = 2.761). Techno-uncertainty was found to be a significant moderator of the effect of Business Process Re-engineering on Format.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Business Process Re-engineering increased, Format increased. At high level of Techno-uncertainty, high level of Business Process Re-engineering resulted the best Format, whereas when high level of Techno-uncertainty and low level of Business Process Re-engineering existed, the worst Format was observed.

Table 34: Moderator Effect of Techno-uncertainty on The Relationship Between Business Process Re-engineering and Format

Dependent variable: Format						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Business Process Re-engineering	0.579	0.045	12.880	0.000	0.491	0.667
Techno-uncertainty	0.044	0.041	1.098	0.273	-0.035	0.124
Interaction	0.143	0.052	2.762	0.006	0.041	0.245
R^2=0.315 F=59.444 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

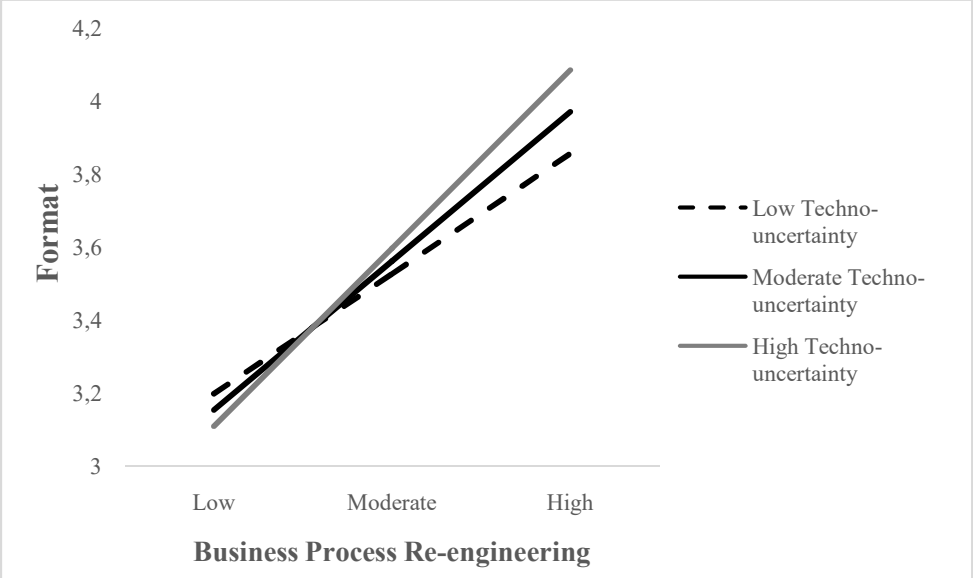


Figure 12: Interaction Effects of Techno-uncertainty, Business Process Re-engineering, and Format

According to Table 35, the interaction of Techno-uncertainty and Business Process Re-engineering accounted for a significant proportion of the variance in Ease of Use, (ΔR^2 = .0137, $\Delta F(1, 388)$ = 6.7402, p = .010, b = .160, t = 2.596). Techno-uncertainty was found to be a significant moderator of the effect of Business Process Re-engineering on Ease of Use.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Business Process Re-engineering increased, Ease of Use increased. At high level of Techno-uncertainty, high level of Business Process Re-engineering resulted the best Ease of Use, whereas when high level of Techno-uncertainty and low level of Business Process Re-engineering existed, the worst Ease of Use was observed.

Table 35: Moderator Effect of Techno-uncertainty on The Relationship Between Business Process Re-engineering and Ease of Use

Dependent variable: Ease of Use						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Business Process Re-engineering	0.525	0.053	9.838	0.000	0.420	0.630
Techno-uncertainty	0.042	0.048	0.880	0.379	-0.052	0.137
Interaction	0.160	0.062	2.596	0.010	0.038	0.281
R^2=0.214 F=35.245 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

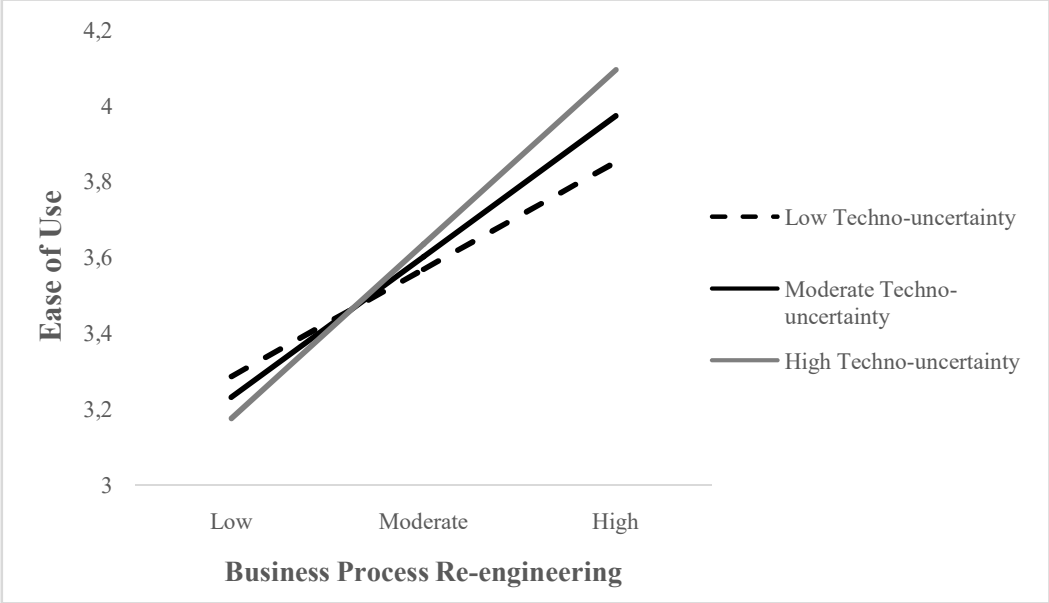


Figure 13: Interaction Effects of Techno-uncertainty, Business Process Re-engineering, and Ease of Use

According to Table 36, the interaction of Techno-uncertainty and Business Process Re-engineering accounted for a significant proportion of the variance in Timeliness, (ΔR^2 = .0128, $\Delta F(1, 388)$ = 6.5903, p = .011, b = .123, t = 2.577). Techno-uncertainty was found to be a significant moderator of the effect of Business Process Re-engineering on Timeliness.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Business Process Re-engineering increased, Timeliness increased. At high level of Techno-uncertainty, high level of Business Process Re-engineering resulted the best Timeliness, whereas when high level of Techno-uncertainty and low level of Business Process Re-engineering existed, the worst Timeliness was observed.

Table 36: Moderator Effect of Techno-uncertainty on The Relationship Between Business Process Re-engineering and Timeliness

Dependent variable: Timeliness						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Business Process Re-engineering	0.456	0.414	11.005	0.000	0.375	0.538
Techno-uncertainty	0.011	0.037	0.286	0.775	-0.063	0.084
Interaction	0.123	0.048	2.567	0.011	0.029	0.215
R^2=0.248 F=42.677 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

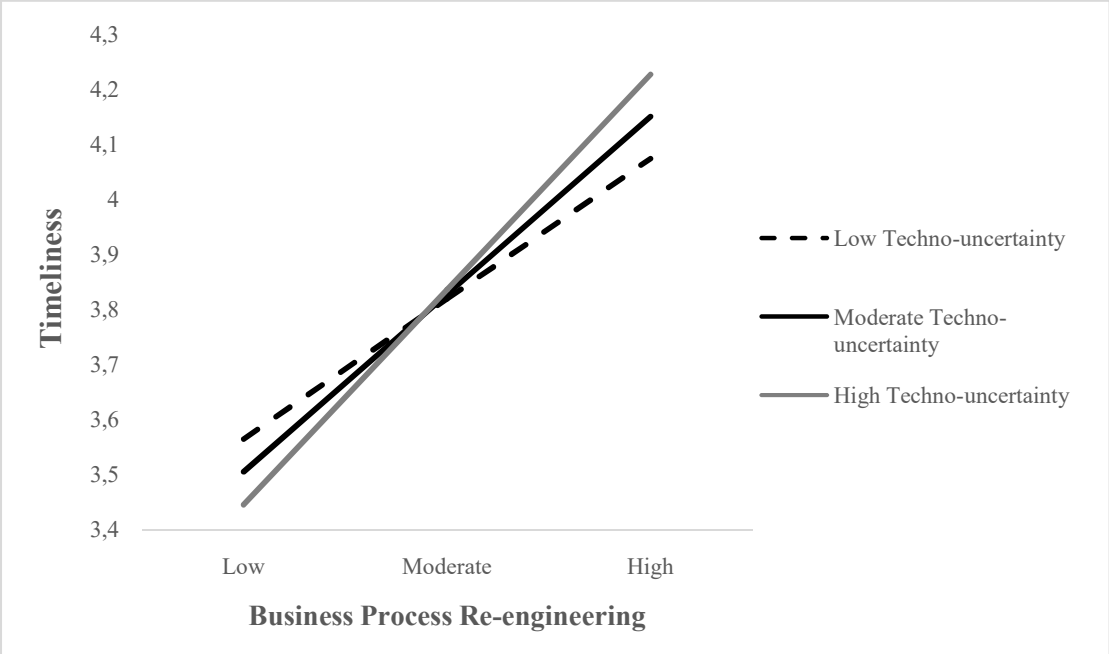


Figure 14: Interaction Effects of Techno-uncertainty, Business Process Re-engineering, and Timeliness

According to Table 37, the interaction of Techno-uncertainty and Top Management Support and Communication accounted for a significant proportion of the variance in Content, (ΔR^2 = .0181, $\Delta F(1, 388)$ = 10.1291, p = .002, b = .144, t = 3.183). Techno-uncertainty was found to be a significant moderator of the effect of Top Management Support and Communication on Content.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Top Management Support and Communication increased, Content increased. At high level of Techno-uncertainty, high level of Top Management Support and Communication resulted the best Content, whereas when high level of Techno-uncertainty and low level of Top Management Support existed, the worst Content was observed.

Table 37: Moderator Effect of Techno-uncertainty on The Relationship Between Top Management Support and Communication and Content

Dependent variable: Content						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Top Management Support and Communication	0.503	0.040	12.510	0.000	0.424	0.582
Techno-uncertainty	0.048	0.037	1.314	0.189	-0.024	0.120
Interaction	0.144	0.046	3.183	0.002	0.055	0.232
R^2=0.306 F=57.075 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

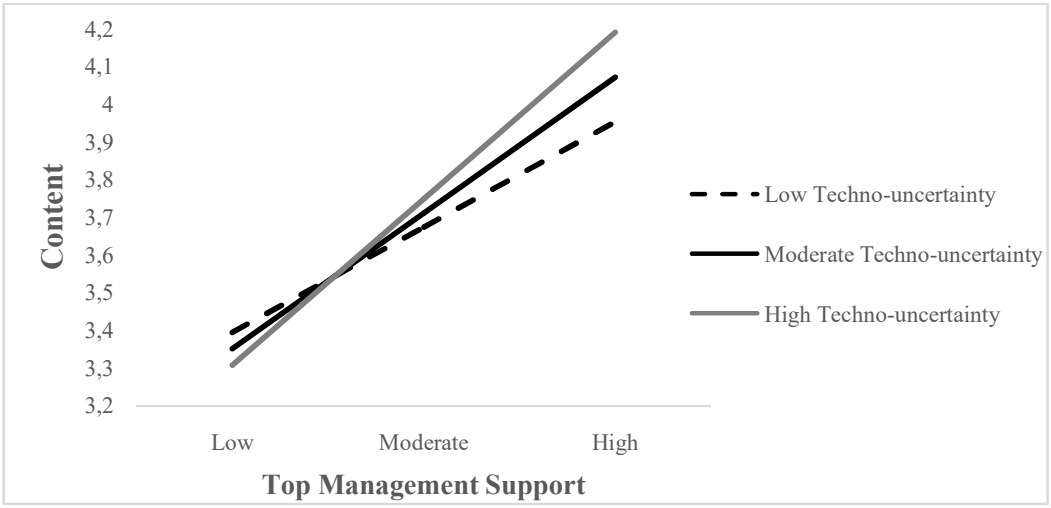


Figure 15: Interaction Effects of Techno-uncertainty, Top Management Support and Communication, and Content

As shown in Table 38, the interaction of Techno-uncertainty and Top Management Support and Communication accounted for a significant proportion of the variance in Timeliness, (ΔR^2 = .0189, $\Delta F(1, 388)$ = 10.0026, p = .002, b = .145, t = 3.163). Techno-uncertainty was found to be a significant moderator of the effect of Top Management Support and Communication on Timeliness.

Interaction plot showed an enhancing effect that as Techno-uncertainty and Top Management Support and Communication increased, Timeliness increased. At high level of Techno-uncertainty, high level of Top Management Support and Communication resulted the best Timeliness, whereas when high level of Techno-uncertainty and low level of Top Management Support existed, the worst Timeliness was observed.

Table 38: Moderator Effect of Techno-uncertainty on The Relationship between Top Management Support and Communication and Timeliness

Dependent variable: Timeliness						
Model	**Beta**	**Stand. Error**	**t-value**	**p-value**	**LLCI**	**ULCI**
Top Management Support and Communication	0.472	0.041	11.564	0.000	0.392	0.552
Techno-uncertainty	-0.003	0.037	-0.072	0.943	-0.075	0.070
Interaction	0.145	0.046	3.163	0.002	0.055	0.235
R^2=0.266 F=46.833 p<0.001						

LLCI:Lower limit of confidence interval, ULCI:Upper limit of confidence interval

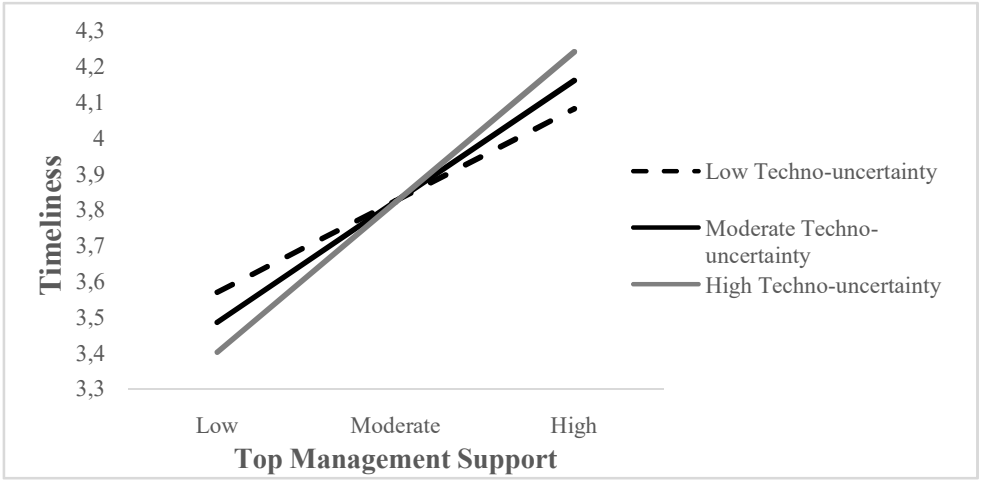


Figure 16: Interaction Effects of Techno-uncertainty, Top Management Support and Communication, and Content

5.6. Independent Sample T-Test and Analysis of Variance (ANOVA)

Independent sample t-test was applied to test means of two independent groups. For the same purpose, one-way ANOVA was applied when there are more than two independent groups in the same demographic category.

5.6.1. Independent Sample T-Test for Gender

As can be seen in Table 39, there is no significant difference between female and male participants for any construct except Ease of Use as their p-values are higher than 0.05.

Table 39: Independent Sample T-Test For Gender

Construct	Gender	Frequency	Mean	Std.Dev.	t-value	p-value
Proj. Man. and Evaluation	Female	141	3.518	0.694	1.047	0.289
	Male	249	3.438	0.731		
Business Proc. Re-engineering	Female	141	3.621	0.690	1.413	0.155
	Male	249	3.516	0.712		
Top Man. Supp.Comm.	Female	141	3.567	0.683	-1.354	0.169
	Male	249	3.669	0.729		
Consulting Services	Female	141	3.752	0.700	1.602	0.106
	Male	249	3.631	0.728		
Techno-overload	Female	141	2.592	0.778	-1.431	0.150
	Male	249	2.712	0.802		
Techno-uncertainty	Female	141	3.050	0.829	0.876	0.393
	Male	249	2.977	0.763		
Techno-Complexity	Female	141	2.383	0.704	0.372	0.572
	Male	249	2.355	0.730		
Techno-Insecurity	Female	141	1.865	0.612	0.566	0.708
	Male	249	1.826	0.683		
Content	Female	141	3.752	0.672	0.540	0.591
	Male	249	3.714	0.663		
Accuracy	Female	141	3.773	0.648	0.085	0.932
	Male	249	3.767	0.682		
Format	Female	141	3.652	0.770	1.505	0.139
	Male	249	3.534	0.732		
Ease of Use	Female	141	3.787	0.713	3.069	0.001
	Male	249	3.522	0.874		
Timeliness	Female	141	3.855	0.664	0.336	0.738
	Male	249	3.831	0.654		

p-value of t-test for Ease of Use is 0.001 therefore, it is accepted that perceptions of female and male participants are not equal. According to group statistics, female participants believe ERP systems are easy to use and user friendly at higher level comparing to male participants (table 40).

Table 40: Group Statistics of Ease of Use According to Gender

Construct	Gender	N	Mean
Ease of Use	Female	141	3.787
	Male	249	3.522

2 participants who answered "other" and "I don't want to specify" were excluded from analysis

5.6.2. One-way Variance Analysis (ANOVA) for Age

For ANOVA test, minimum sample size of each independent group should be higher than 30 therefore, age groups were revised as 18-28, 29-38, 39-48, and 49-62.

As shown in Table 41, p values for all constructs are higher than 0.05 which means the variances among age groups are homogeneous and ANOVA test can be applied.

Table 41: Test of Homogeneity of Variances For Age

Construct	Levene Statistic	df1	df2	p-value
Project Man. And Evaluation	1.115	3	388	0.343
Business Process Re-engineering	2.506	3	388	0.059
Top Management Supp. And Comm.	1.550	3	388	0.201
Consulting Services	1.509	3	388	0.212
Techno-uncertainty	0.123	3	388	0.947
Techno-overload	0.542	3	388	0.653
Techno-insecurity	1.219	3	388	0.303
Techno-complexity	1.304	3	388	0.273
Content	0.164	3	388	0.921
Accuracy	2.417	3	388	0.066
Format	0.038	3	388	0.990
Ease of Use	0.477	3	388	0.698
Timeliness	0.471	3	388	0.702

According to ANOVA test (Table 42), perceptions of Project Management and Evaluation and Business Process Re-engineering differ between age groups. For the rest of the constructs, there is no difference based on age groups as their p-values are higher than 0.05.

Table 42: ANOVA Result of All Constructs According to Age

Construct	F-value	p-value
Project Man. And Evaluation	2.869	0.036
Business Process Re-engineering	2.791	0.040
Top Management Supp. And Comm.	2.266	0.080
Consulting Services	0.449	0.718
Techno-uncertainty	1.299	0.274
Techno-overload	1.674	0.172
Techno-insecurity	1.111	0.344
Techno-complexity	0.360	0.782
Content	0.666	0.574
Accuracy	1.369	0.252
Format	1.511	0.211
Ease of Use	1.312	0.270
Timeliness	0.496	0.685

In order to find out which age groups have different perceptions regarding Project Management and Evaluation and Business Process Re-engineering, Scheffe test was performed and all of the p values are higher than 0.05 which mean there is no difference between age groups although ANOVA results indicated otherwise.

5.6.3. One-way Variance Analysis (ANOVA) for Education Level

For ANOVA test, minimum sample size of each independent group should be higher than 30 therefore, education level groups were revised as Primary/High school/Associate, University, and Masters/PhD.

According to homogeneity test, p values for all constructs are higher than 0.05 which means the variances among education levels are homogeneous and ANOVA test can be applied (Table 43).

Table 43: Test of Homogeneity of Variances for Education Level

Construct	Levene Statistic	df1	df2	p-value
Project Man. And Evaluation	2.401	2	389	0.092
Business Process Re-engineering	1.435	2	389	0.239
Top Management Supp. And Comm.	0.230	2	389	0.795
Consulting Services	0.407	2	389	0.666
Techno-uncertainty	1.769	2	389	0.172
Techno-overload	1.969	2	389	0.141
Techno-insecurity	1.957	2	389	0.143
Techno-complexity	0.011	2	389	0.989
Content	0.373	2	389	0.689
Accuracy	0.600	2	389	0.549
Format	2.528	2	389	0.081
Ease of Use	0.036	2	389	0.964
Timeliness	0.557	2	389	0.574

According to ANOVA test there is no difference between education level groups regarding their perceptions of constructs as all of the p-values are higher than 0.05 (Table 44).

Table 44: ANOVA Result of All Constructs According to Education Level

Construct	F-value	p-value
Project Man. And Evaluation	2.869	0.036
Business Process Re-engineering	2.791	0.040
Top Management Supp. And Comm.	2.266	0.080
Consulting Services	0.449	0.718
Techno-uncertainty	1.299	0.274
Techno-overload	1.674	0.172
Techno-insecurity	1.111	0.344
Techno-complexity	0.360	0.782
Content	0.666	0.574
Accuracy	1.369	0.252
Format	1.511	0.211
Ease of Use	1.312	0.270
Timeliness	0.496	0.685

5.6.4. One-way Variance Analysis (ANOVA) for Working Position Level

For ANOVA test, minimum sample size of each independent group should be higher than 30 therefore, working position level groups were revised as Upper Level Executive, Middle Level Executive, and First Level Employee.

According to the Table 45, variance among working position level for Ease of Use and Timeliness are not homogeneous as their p-values are significant ($p<0.05$). Therefore, Welch tests were applied to these two variables to identify which position levels are not homogenous. However, for the rest of the constructs the variances among education levels are homogeneous and ANOVA test can be applied ($p>0.05$).

Table 45: Test of Homogeneity of Variances for Working Position Level

Construct	Levene Statistic	df1	df2	p-value
Project Man. And Evaluation	1.669	2	389	0.190
Business Process Re-engineering	0.802	2	389	0.449
Top Management Supp. And Comm.	0.631	2	389	0.532
Consulting Services	2.631	2	389	0.073
Techno-uncertainty	1.610	2	389	0.201
Techno-overload	0.216	2	389	0.806
Techno-insecurity	0.804	2	389	0.448
Techno-complexity	0.684	2	389	0.505
Content	1.508	2	389	0.223
Accuracy	2.857	2	389	0.059
Format	2.882	2	389	0.057
Ease of Use	3.167	2	389	0.043
Timeliness	4.776	2	389	0.009

As can be seen in Table 46, in different working position levels only perceptions of Top Management Support and Communication and Accuracy constructs showed difference. Top Management Support and Accuracy were found statistically significant ($p<0.05$). Scheffe test was implemented in order to find which groups show differences for these two constructs.

Table 46: ANOVA Result of All Constructs Except Ease of Use and Timeliness According to Working Position Level

Construct	F-value	p-value
Project Man. And Evaluation	1.636	0.196
Business Process Re-engineering	1.739	0.177
Top Management Supp. And Comm.	7.954	0.000
Consulting Services	2.828	0.060
Techno-uncertainty	1.177	0.309
Techno-overload	0.994	0.371
Techno-insecurity	1.138	0.322
Techno-complexity	0.050	0.951
Content	0.597	0.551
Accuracy	4.294	0.014
Format	0.405	0.667

Table 47 shows the results of Scheffe tests. As can be seen, the perception of Top Management Support and Communication is different between first-level employees and middle and upper-level employees (p=0.003, p=0.006). For Accuracy, a meaningful difference was found between first and upper-level employees (p=0.044).

Table 47: Scheffe Test for Top Management Support and Communication and Accuracy According to Working Position Level

Construct	Working Position	Working Position	Mean Difference (I-J)	Std. Error	p-value
Top Management Support and Communication	Upper Level	First Level	.330	0.096	0.003
	Middle Level	First Level	.256	0.080	0.006
Accuracy	Upper Level	First Level	.227	0.090	0.044

Based on homogeneous subsets, middle and high-level employees feel more supported by their top management and have better communication compared to first-level employees (Table 48). Upper-level employees are more satisfied than first-level employees with the accuracy of the ERP system they use (Table 49).

Table 48: Homogeneous Subsets of Top Management Support and Communication

Position	N	Subsets for alpha=0.05	
		1	2
First Level Employee	165	3.470	
Middle Level Employee	147		3.727
Upper Level Employee	80		3.800

Table 49: Homogeneous Subsets of Accuracy

Position	N	Subsets for alpha=0.05	
		1	2
First Level Employee	165	3.655	
Middle Level Employee	147		3.833
Upper Level Employee	80		3.881

According to Welch test, there is no statistically significant difference between working position levels in terms of Ease of Use and Timeliness, as their p-values are higher than 0.05 (Table 50).

Table 50: Welch Test of EOU and Timeliness According to Working Position Level

Construct	Welch Statistic	p-value
Ease of Use	0.629	0.534
Timeliness	1.747	0.177

5.6.5. One-way Variance Analysis (ANOVA) for Year of Experience

For ANOVA test, minimum sample size of each independent group should be higher than 30 therefore, experience groups were revised as 0-10, 11-20, higher than 20.

According to Table 51, variance among different experience duration groups for Consulting Services is not homogeneous as its p-value is significant ($p<0.05$). However, for the rest of the constructs, the variances among different experience duration groups are homogeneous and ANOVA test can be applied ($p>0.05$). For Consulting Services, a Welch test was applied to identify which groups are not homogenous.

Table 51: Test of Homogeneity of Variances for Year of Experience

Construct	Levene Statistic	df1	df2	p-value
Project Man. And Evaluation	0.623	2	389	0.537
Business Process Re-engineering	0.244	2	389	0.784
Top Management Supp. And Comm.	0.015	2	389	0.985
Consulting Services	3.216	2	389	0.041
Techno-uncertainty	1.074	2	389	0.343
Techno-overload	1.137	2	389	0.322
Techno-insecurity	2.041	2	389	0.131
Techno-complexity	1.678	2	389	0.188
Content	0.177	2	389	0.838
Accuracy	2.516	2	389	0.082
Format	1.385	2	389	0.252
Ease of Use	0.855	2	389	0.426
Timeliness	0.659	2	389	0.518

According to ANOVA test there is no difference between year of experience group regarding their perceptions of constructs as none of their p-values are less than 0.05 (Table 52).

Table 52: ANOVA Result of All Constructs Except Consulting Services According to Year of Experience

Construct	F-value	p-value
Project Man. And Evaluation	1.642	0.195
Business Process Re-engineering	0.801	0.450
Top Management Supp. And Comm.	3.013	0.050
Techno-uncertainty	1.358	0.259
Techno-overload	0.387	0.679
Techno-insecurity	0.009	0.991
Techno-complexity	0.888	0.412
Content	2.838	0.060
Accuracy	2.519	0.082
Format	1.549	0.214
Ease of Use	1.575	0.208
Timeliness	0.501	0.607

According to Welch test, group variances of Consulting Services are homogenous as its p value is higher than 0.05 (Table 53).

Table 53: Welch Test of Consulting Services According to Year of Experience

Construct	Welch Statistic	p-value
Consulting Services	2.153	0.119

5.6.6. One-way Variance Analysis (ANOVA) for Year of ERP Usage

For ANOVA test, minimum sample size of each independent group should be higher than 30 therefore, ERP usage groups were revised as 0-4, 5-9, 10-14, 15-19, and higher than 19.

According to the Table 54, variance among different experience duration groups for Consulting Services is not homogeneous as its p-value is significant ($p<0.05$). However, for the rest of the constructs the variances among different experience duration groups are homogeneous and ANOVA test can be applied ($p>0.05$).

Table 54: Test of Homogeneity of Variances for Year of ERP Usage

Construct	Levene Statistic	df1	df2	p-value
Project Man. And Evaluation	0.895	4	387	0.467
Business Process Re-engineering	1.347	4	387	0.252
Top Management Supp. And Comm.	1.354	4	387	0.249
Consulting Services	2.712	4	387	0.030
Techno-uncertainty	0.232	4	387	0.920
Techno-overload	1.429	4	387	0.224
Techno-insecurity	0.650	4	387	0.627
Techno-complexity	1.039	4	387	0.387
Content	0.443	4	387	0.777
Accuracy	0.989	4	387	0.413
Format	0.166	4	387	0.956
Ease of Use	0.523	4	387	0.719
Timeliness	0.487	4	387	0.745

As can be seen in Table 55, perceptions of the employees who are in different ERP usage duration groups are not homogeneous regarding Top Management Support and Communication as it was found statistically significant ($p<0.05$). Scheffe test was implemented in order to find which groups show this difference.

Table 55: ANOVA Result of All Constructs Except Consulting Services According to Year of ERP Usage

Construct	F-value	p-value
Project Man. And Evaluation	0.981	0.418
Business Process Re-engineering	0.867	0.484
Top Management Supp. And Comm.	2.650	0.033
Techno-uncertainty	1.441	0.220
Techno-overload	1.350	0.251
Techno-insecurity	1.218	0.303
Techno-complexity	0.943	0.439
Content	0.831	0.506
Accuracy	0.850	0.494
Format	0.726	0.574
Ease of Use	0.761	0.551
Timeliness	0.560	0.692

Although ANOVA results show the otherwise, according to the results of Scheffe test, there is no difference for perception of Top Management Support and Communication between the employees who belong different ERP usage time groups.

According to Welch test, group variances of Consulting Services are not homogenous as its p value is less than 0.05 (Table 56). Therefore, Tamhane's T2 test was applied for identifying which groups have different approach to Consulting Services.

Table 56: Welch Test of Consulting Services According to Year of ERP Usage

Construct	Welch Statistic	p-value
Consulting Services	2.653	0.035

According to Table 57, Tamhane's T2 test indicate that perceptions of Consulting Services are different between the groups who have ERP experience between 0-4 years and 15-19 years because p value is less than 0.05 (p=0.028).

Table 57: Tamhane's T2 Test for Consulting Services According to Year of ERP Usage

Construct	Year of ERP Usage	Year of ERP Usage	Mean Difference (I-J)	Std. Error	p-value
Consulting Services	0-4	15-19	-.318	0.104	0.028

The participants who have been using an ERP system between 15 – 19 years believe they get support from Consulting Services more than the participants who have been using an ERP system between 0 – 4 years.

5.7. Summary of Hypotheses Results

Table 58 represents the results of the regression analysis of the proposed hypothesis of this research.

Table 58: Result Summary of The Research Hypothesis

Hypothesis	Result
H_{1a}: Project management and evaluation has a direct positive influence on content.	Supported
H_{1b}: Project management and evaluation has a direct positive influence on accuracy.	Supported
H_{1c}: Project management and evaluation has a direct positive influence on format.	Supported
H_{1d}: Project management and evaluation has a direct positive influence on ease of use.	Supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{1e}: Project management and evaluation has a direct positive influence on timeliness.	Supported
H_{2a}: Business process re-engineering has a direct positive influence on content.	Supported
H_{2b}: Business process re-engineering has a direct positive influence on accuracy.	Supported
H_{2c}: Business process re-engineering has a direct positive influence on format.	Supported
H_{2d}: Business process re-engineering has a direct positive influence on ease of use.	Supported
H_{2e}: Business process re-engineering has a direct positive influence on timeliness.	Supported
H_{3a}: Top management support and communication has a direct positive influence on content.	Supported
H_{3b}: Top management support and communication has a direct positive influence on accuracy.	Supported
H_{3c}: Top management support and communication has a direct positive influence on format.	Not supported
H_{3d}: Top management support and communication has a direct positive influence on ease of use.	Not supported
H_{3e}: Top management support and communication has a direct positive influence on timeliness.	Supported
H_{4a}: Consulting services has a direct positive influence on content.	Not supported.
H_{4b}: Consulting services has a direct positive influence on accuracy.	Not supported.
H_{4c}: Consulting services has a direct positive influence on format.	Not supported.

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{4d}: Consulting services has a direct positive influence on ease of use.	Supported
H_{4e}: Consulting services has a direct positive influence on timeliness.	Not supported.
H_{5a}: Techno-overload moderates the effect of project management and evaluation on content.	Not supported.
H_{5b}: Techno-overload moderates the effect of project management and evaluation on accuracy.	Supported
H_{5c}: Techno-overload moderates the effect of project management and evaluation on format.	Not supported.
H_{5d}: Techno-overload moderates the effect of project management and evaluation on ease of use.	Not supported.
H_{5e}: Techno-overload moderates the effect of project management and evaluation on timeliness.	Not supported.
H_{6a}: Techno-uncertainty moderates the effect of project management and evaluation on content.	Not supported
H_{6b}: Techno-uncertainty moderates the effect of project management and evaluation on accuracy.	Not supported
H_{6c}: Techno-uncertainty moderates the effect of project management and evaluation on format.	Supported
H_{6d}: Techno-uncertainty moderates the effect of project management and evaluation on ease of use.	Not supported
H_{6e}: Techno-uncertainty moderates the effect of project management and evaluation on timeliness.	Supported
H_{7a}: Techno-complexity moderates the effect of project management and evaluation on content.	Not supported
H_{7b}: Techno-complexity moderates the effect of project management and evaluation on accuracy.	Not supported
H_{7c}: Techno-complexity moderates the effect of project management and evaluation on format.	Not supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{7d}: Techno-complexity moderates the effect of project management and evaluation on ease of use.	Not supported
H_{7e}: Techno-complexity moderates the effect of project management and evaluation on timeliness.	Not supported
H_{8a}: Techno-insecurity moderates the effect of project management and evaluation on content.	Not supported
H_{8b}: Techno-insecurity moderates the effect of project management and evaluation on accuracy.	Not supported
H_{8c}: Techno-insecurity moderates the effect of project management and evaluation on format.	Not supported
H_{8d}: Techno-insecurity moderates the effect of project management and evaluation on ease of use.	Not supported
H_{8e}: Techno-insecurity moderates the effect of project management and evaluation on timeliness.	Not supported
H_{9a}: Techno-overload moderates the effect of business process re-engineering on content.	Not supported
H_{9b}: Techno-overload moderates the effect of business process re-engineering on accuracy.	Supported
H_{9c}: Techno-overload moderates the effect of business process re-engineering on format.	Not supported
H_{9d}: Techno-overload moderates the effect of business process re-engineering on ease of use.	Not supported
H_{9e}: Techno-overload moderates the effect of business process re-engineering on timeliness.	Not supported
H_{10a}: Techno-uncertainty moderates the effect of business process re-engineering on content.	Supported
H_{10b}: Techno-uncertainty moderates the effect of business process re-engineering on accuracy.	Not supported
H_{10c}: Techno-uncertainty moderates the effect of business process re-engineering on format.	Supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{10d}: Techno-uncertainty moderates the effect of business process re-engineering on ease of use.	Supported
H_{10e}: Techno-uncertainty moderates the effect of business process re-engineering on timeliness.	Supported
H_{11a}: Techno-complexity moderates the effect of business process re-engineering on content.	Not supported
H_{11b}: Techno-complexity moderates the effect of business process re-engineering on accuracy.	Not supported
H_{11c}: Techno-complexity moderates the effect of business process re-engineering on format.	Not supported
H_{11d}: Techno-complexity moderates the effect of business process re-engineering on ease of use.	Not supported
H_{11e}: Techno-complexity moderates the effect of business process re-engineering on timeliness.	Not supported
H_{12a}: Techno-insecurity moderates the effect of business process re-engineering on content.	Not supported
H_{12b}: Techno-insecurity moderates the effect of business process re-engineering on accuracy.	Not supported
H_{12c}: Techno-insecurity moderates the effect of business process re-engineering on format.	Not supported
H_{12d}: Techno-insecurity moderates the effect of business process re-engineering on ease of use.	Not supported
H_{12e}: Techno-insecurity moderates the effect of business process re-engineering on timeliness.	Not supported
H_{13a}: Techno-overload moderates the effect of top management support and communication on content.	Not supported
H_{13b}: Techno-overload moderates the effect of top management support and communication on accuracy.	Not supported
H_{13c}: Techno-overload moderates the effect of top management support and communication on format.	Not supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{13d}: Techno-overload moderates the effect of top management support and communication on ease of use.	Not supported
H_{13e}: Techno-overload moderates the effect of top management support and communication on timeliness.	Not supported
H_{14a}: Techno-uncertainty moderates the effect of top management support and communication on content.	Supported
H_{14b}: Techno-uncertainty moderates the effect of top management support and communication on accuracy.	Not supported
H_{14c}: Techno-uncertainty moderates the effect of top management support and communication on format.	Not supported
H_{14d}: Techno-uncertainty moderates the effect of top management support and communication on ease of use.	Not supported
H_{14e}: Techno-uncertainty moderates the effect of top management support and communication on timeliness.	Supported
H_{15a}: Techno-complexity moderates the effect of top management support and communication on content.	Not supported
H_{15b}: Techno-complexity moderates the effect of top management support and communication on accuracy.	Not supported
H_{15c}: Techno-complexity moderates the effect of top management support and communication on format.	Not supported
H_{15d}: Techno-complexity moderates the effect of top management support and communication on ease of use.	Not supported
H_{15e}: Techno-complexity moderates the effect of top management support and communication on timeliness.	Not supported
H_{16a}: Techno-insecurity moderates the effect of top management support and communication on content.	Not supported
H_{16b}: Techno-insecurity moderates the effect of top management support and communication on accuracy.	Not supported
H_{16c}: Techno-insecurity moderates the effect of top management support and communication on format.	Not supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{16d}: Techno-insecurity moderates the effect of top management support and communication on ease of use.	Not supported
H_{16e}: Techno-insecurity moderates the effect of top management support and communication on timeliness.	Not supported
H_{17a}: Techno-overload moderates the effect of consulting services on content.	Not supported
H_{17b}: Techno-overload moderates the effect of consulting services on accuracy.	Not supported
H_{17c}: Techno-overload moderates the effect of consulting services on format.	Not supported
H_{17d}: Techno-overload moderates the effect of consulting services on ease of use.	Not supported
H_{17e}: Techno-overload moderates the effect of consulting services on timeliness.	Not supported
H_{18a}: Techno-uncertainty moderates the effect of consulting services on content.	Not supported
H_{18b}: Techno-uncertainty moderates the effect of consulting services on accuracy.	Not supported
H_{18c}: Techno-uncertainty moderates the effect of consulting services on format.	Not supported
H_{18d}: Techno-uncertainty moderates the effect of consulting services on ease of use.	Not supported
H_{18e}: Techno-uncertainty moderates the effect of consulting services on timeliness.	Not supported
H_{19a}: Techno-complexity moderates the effect of consulting services on content.	Not supported
H_{19b}: Techno-complexity moderates the effect of consulting services on accuracy.	Not supported
H_{19c}: Techno-complexity moderates the effect of consulting services on format.	Not supported

Table 58: Result Summary of The Research Hypothesis (Cont.)

Hypothesis	Result
H_{19d}: Techno-complexity moderates the effect of consulting services on ease of use.	Not supported
H_{19e}: Techno-complexity moderates the effect of consulting services on timeliness.	Not supported
H_{20a}: Techno-insecurity moderates the effect of consulting services on content.	Not supported
H_{20b}: Techno-insecurity moderates the effect of consulting services on accuracy.	Not supported
H_{20c}: Techno-insecurity moderates the effect of consulting services on format.	Not supported
H_{20d}: Techno-insecurity moderates the effect of consulting services on ease of use.	Not supported
H_{20e}: Techno-insecurity moderates the effect of consulting services on timeliness.	Not supported

6. DISCUSSION

6.1. Discussions and Conclusion

ERP is a software system that enables organizations to integrate all of their core business processes and units such as finance, manufacturing, human resource, etc. It gathers all the information under the same roof and this way, companies can plan and manage their operations and use their resources more efficiently. For instance, finance employees can plan their vendor payments, or purchasing employees can see the quantities they should order from the system easily.

In the beginning, enterprises aimed to control their inventory only, and in the 1960s ERP journey started. In time, they also wanted to plan their inventory and production and finally in the 1990s ERP systems were able to manage and plan all business units of a company. With the increasing benefits of ERP systems, more and more organizations have started to implement them in spite of complications and high costs.

With the increasing interest in the ERP systems, it became an important topic how to make successful ERP implementations and Critical ERP Success Factors have been identified. Some of these factors are used as independent variables in this research. This research also argues that End User Satisfaction is an indicator of successful ERP implementation. Consequently, it is considered a dependent variable. In addition, it is also worth examining users' techno-stress towards ICTs as it affects their satisfaction level. Therefore, techno-stress is considered a moderator variable.

392 ERP users participated in the research by filling in the online survey. The biggest groups of participants work in planning and accounting departments and they are mainly from the construction and automotive industries.

In the conceptual model, ERP Success Factors had six sub-dimensions as Project Management Principles, Feasibility/Evaluation of ERP Project, Business Process Re-engineering, Top Management Support, Human Resource Development, and Consulting Services. After factor and reliability analysis, it is found that participants perceived feasibility, evaluation, and management of an ERP project are closely related and considered as a single construct. Consequently, they are merged as a single dimension with the name of Project Management and Evaluation. Top Management Support and Human Resource Development were also evaluated as a single dimension by the participants therefore; they are turned into

a single construct as Top Management Support and Communication. To sum up, ERP Success Factors became a four sub-dimension scale in the model.

Techno-stress scale remained as four sub-dimensions after factor and reliability analysis however; five of the questions have been eliminated. Considering these eliminated questions, change of working habits due to new technologies, knowing enough about the ERP system to do one's job satisfactorily, knowing more about ICTs compared to new employees, and updating skills and sharing less knowledge with coworkers to avoid being replaced had not been found significant.

After factor and reliability analysis, End User ERP satisfaction resulted five sub-dimensions which are the same as the conceptual model. None of the questions have been excluded.

The hypothesis between H_{1a} and H_{4e} refers to the effects of ERP Success Factors sub-dimensions on End User ERP Satisfaction sub-dimensions. Multiple linear regression results show that Project Management and Principles increased ERP satisfaction for all sub-dimensions. It means end-users believe that the ERP system provides sufficient information and reports (content), the system is accurate (accuracy), outputs are clear and useful (format), it is easy to use (ease of use), and provides up-to-date information when they think members of the ERP project team are competent and dedicated, and implementation project is well planned and monitored closely. In other words, when the implementation project runs smoothly, employees tend to be more positive about ERP systems as a whole.

Similar to Project Management and Evaluation, Business Process Re-engineering effects ERP satisfaction positively. Identifying, simplifying, and standardizing business processes at the initial stage and ensuring accurate data flow between these processes make employees believe that the ERP system is satisfying from whole angles.

Top Management Support and Communication does not increase ERP users' satisfaction regarding the format of ERP outputs and they do not believe that the system is user-friendly. On the other hand, when employees feel the commitment of their top management and communication throughout the company is well established, they believe the system is accurate, the content of information is sufficient, and provide timely information.

Consulting Services increase the level of users' belief that ERP systems are user-friendly, however, this factor does not have similar effects on content, accuracy, format, and timeliness. This means when enough importance is given to consulting services, employees of the company feel more confident about using the system but this doesn't change their judgments about the system itself.

One of the aims of this research was to investigate whether users' technology-related stress has any influence on the relationship between Critical ERP Success Factors and End User ERP Satisfaction. The hypothesis from H_{5a} to H_{20e} questions this moderating effect.

Techno-overload means that employees feel they need to work faster and handle more than they can due to new technologies. According to moderated multiple regression results, techno-overload decreases the positive correlation between project management and evaluation and accuracy. This is also valid for business process re-engineering and accuracy. In other words, when employees feel that the ERP system is forcing them to do more in a shorter time, their satisfaction level with the system accuracy drops although they believe the implementation project was handled well and business processes were better structured compared to pre-ERP time. No other influence was detected regarding ERP Success Factors and End User ERP Satisfaction.

Techno-uncertainty suggests that constant changes and upgrades of the technology cause stress on the employees as they have difficulties coping during transitions. Moderated multiple regression results showed that among the other techno-stressors, Techno-uncertainty is the most effective one which causes a negative influence on the relationship between ERP Success Factors and End User ERP Satisfaction. The ERP users are less satisfied with the Format and Timeliness although they believe that the ERP implementation project was handled and monitored well. It also decreases end users' satisfaction level with Content, Format, Ease of Use, and Timeliness although they believe Business Process Re-engineering had a positive effect on their approach towards ERP systems. As explained within this section, Top Management Support and Communication do not have any influence on Format and Ease of Use. In addition to this, Techno-uncertainty makes the end-users less positive about the Content and Timeliness of the system in spite of their belief that they have managerial support and that communication between all parties was well. This means that Top Management Support and Communication can only increase the satisfaction level of accuracy although there are constant technological changes within the company. Of course, it can be argued that organizations should keep up with the technological developments in order to maintain their competitiveness however; in order to make the most of their technology investment; they have to take into account the adaptation level of their employees (end users) and establish a good balance.

Techno-insecurity refers to the concerns of the employees about losing their jobs if they do not keep up with the new technologies. These employees express that they intend to keep their knowledge to themselves in order to secure their position. Moderated multiple regression showed that this stressor does

not have any influence on the correlation between ERP Success Factors and End User ERP Satisfaction. This result reveals that the users who feel insecure can still be satisfied with the ERP systems they use if they believe that ERP implementation went well, business processes are better than earlier, top management is committed to the project and they get the consulting support when they need.

Techno-complexity means that technology users find new technologies too complex and they do not have enough time to upgrade their technological skills. Similar to techno-insecurity, techno-complexity does not have any influence on the correlation between ERP Success Factors and End User ERP Satisfaction either.

When it comes to demographics, female employees find it easier to use ERP systems compared to male employees. In addition, first, middle, and upper-level employees have different beliefs about Top Management Support and Communication. Middle and higher-level employees feel the managerial support better and think that they have good communication compared to first-level employees. Also, first-level employees are less satisfied with the accuracy of the ERP system. This indicates that top managements should pay more attention to first-level employees. Another difference is the employees who have ERP experience between 15 – 19 stated that the managerial and technical support is valued also, and they can get external consulting support when needed more than the employees who have 0 – 4 years of ERP experience.

6.2. Limitations and Implications for Further Research

Similar to most research, this research does also have limitations that should be considered and these limitations can be used as suggestions for future research. First of all, all of the participants are from Turkey therefore, research results may vary when it is conducted with the employees from other cultures. Also, the research was not focused on certain industries or company sizes. Consequently, it does not give information specific to these criteria. However; it provides a good ground to repeat the same study with the industry or company size when necessary.

The second limitation is that not all the ERP Success Factors were included in the research model. There are 63 success factors found in the literature and including all of them would cause a very long survey. As a result, it would be very difficult for people who fill in the questionnaire voluntarily as it was not easy already. Further research can focus on the eliminated success factors, for instance, technical factors and vendor/customer partnership.

For last, it was not possible to meet participants face to face due to time limitations. Future researchers can investigate the results further by asking open-ended questions to the participants face to face.

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APPENDIX

QUESTIONNAIRE

Son Kullanıcı ERP Memnuniyeti Anketi

Değerli Katılımcı;

Aşağıda yer alan anket formundaki yanıtlardan Dr. Hüseyin EKİZLER danışmanlığında Marmara Üniversitesi bünyesinde gerçekleştirdiğim yükseklisans tez araştırmasında yararlanılacaktır. Anketin amacı kritik başarı faktörlerinin ve son kullanıcıların tekno-stres seviyelerinin ERP memnuniyetlerine olan etkilerini incelemektir.

Araştırmaya katılım tamamen gönüllülük esasına dayalıdır. Ankette verdiğiniz cevaplar hiçbir şekilde üçüncü şahıslar ile paylaşılmayacak ve verilerin hiçbirinde kurumsal kimliğiniz ve isminiz geçmeyecektir. Bu nedenle sorulara içtenlikle yanıt vermenizi arz ediyorum.

Bu bilimsel araştırmaya katkınızdan dolayı şimdiden teşekkürü bir borç bilirim.

KişiselBilgiler

Aşağıdaki sorularda kendiniz ve çalıştığınız kurum ile ilgili bilgileri veriniz.

İş alanınız

1. Ambalaj
2. Bilişim
3. Dayanıklı Tüketim Ürünleri
4. Denizcilik
5. Eğitim
6. Elektrik & Elektronik
7. Enerji
8. Gıda
9. Havacılık
10. Hızlı Tüketim
11. Hizmet
12. İlaç
13. İnşaat
14. Kimya
15. Maden ve Metal Sanayi
16. Makine

17. Medya
18. Mobilya & Aksesuar
19. Ofis & Büro Malzemeleri
20. Otomotiv
21. Plastik
22. Perakende
23. Sağlık
24. Savunma Sanayi
25. Tarım ve Ziraat
26. Taşımacılık
27. Tekstil
28. Telekomünikasyon
29. Ticaret
30. Turizm
31. Üretim / Endüstriyel Ürünler
32. Diğer

Çalıştığınız departman

1. AR-GE
2. Bakım / Onarım
3. Bilgi İşlem
4. Depo / Antrepo
5. Finans
6. İdari İşler
7. İnsan Kaynakları
8. İthalat / İhracat (Dış Ticaret)
9. Kalite
10. Lojistik
11. Muhasebe
12. Mühendislik / Tasarım
13. Müşteri Hizmetleri / İlişkileri
14. Operasyon
15. Planlama
16. Satınalma
17. Satış ve/veya Pazarlama
18. Satış Sonrası Servis
19. Üretim
20. Yönetim
21. Diğer

Çalıştığınız kurumun çalışan sayısı

1. 0-49
2. 50-249

3. 250 - 499
4. 500 ve üzeri

Pozisyon seviyeniz

1. Üst düzey yönetici
2. Orta düzey yönetici
3. Yönetici adayı
4. Uzman
5. Eleman
6. Stajyer

Çalıştığınız kurumda kullanılan ERP sistemi

1. SAP
2. Canias
3. CPM Yazılım
4. J.D. Edwards
5. Login ERP
6. Logo
7. Microsoft Axapta
8. Microsoft Navision
9. Model ERP
10. Oracle
11. Set Yazılım
12. Teknosol
13. Uyumsoft
14. Workcube
15. IFS
16. Nebim
17. Scienta
18. Minerva ERP
19. Abas ERP
20. Firmanıza özel geliştirilen yazılım
21. Diğer

Deneyim süreniz. Yıl olarak belirtiniz.

…….

Eğitim seviyeniz

1. İlköğretim
2. Lise
3. Önlisans
4. Lisans
5. Yüksek Lisans
6. Doktora

Ne kadar zamandır ERP kullanıyorsunuz? Yıl olarak belirtiniz.

……..

Yaşınız nedir? Sayı olarak yazınız.

……

Cinsiyetiniz

1. Kadın
2. Erkek
3. Diğer
4. Belirtmek istemiyorum

TEKNO-STRESS

	Aşağıdaki soruları şu anda kendi durumunuza en iyi uyan seçeneği işaretleyerek yanıtlayınız	Hiç katılmıyorum	Katılmıyorum	Ne katılıyorum, ne katılmıyorum	Katılıyorum	Tamamen katılıyorum
1	Teknoloji beni yapabileceğimden daha fazla iş yapmaya zorluyor.					
2	Teknoloji beni çok kısıtlı zamanlarda çalışmaya zorluyor.					
3	Yeni teknolojilere adapte olmak için çalışma alışkanlıklarımı değiştirmem gerekiyor.					
4	Teknoloji beni daha hızlı çalışmaya zorluyor.					
5	Artan teknoloji karmaşıklığı nedeniyle daha fazla iş yüküne sahibim.					
6	Kurumumuzda bilgisayar yazılımlarında sürekli değişiklikler mevcuttur.					
7	Kurumumuzdaki bilgisayar ağlarında sık güncellemeler yapılmaktadır.					
8	Kurumumuzda bilgisayar donanımlarında sürekli değişiklikler mevcuttur.					
9	Kurumumuzda teknoloji konusunda devamlı olarak kullandığımız yeni gelişmeler mevcuttur.					
10	Yeni teknolojileri anlamak ve kullanmak için uzun bir zamana ihtiyaç duyuyorum.					
11	Teknolojik yeteneklerimi geliştirmek için çalışmaya yeterli zaman bulamıyorum.					
12	Yeni teknolojileri anlamak ve kullanmak çoğu kez bana çok karmaşık geliyor.					
13	İşimi tatmin edici seviyede yapabilecek kadar teknolojiye hakim değilim.					
14	Bu kurumda yeni çalışanların bilgisayar teknolojisi konusunda benden fazla şey bildiklerini düşünüyorum.					
15	Yeni teknolojiler nedeniyle iş güvencemi sürekli tehdit altında hissediyorum.					
16	İş pozisyonumun değiştirilmemesi için sürekli becerilerimi geliştirmek zorundayım.					

17	Daha fazla teknolojik yeteneğe sahip iş arkadaşlarının tehdidi altındayım.					
18	İş pozisyonumun değiştirilmemesi için bilgilerimi iş arkadaşlarımla paylaşmıyorum.					
19	İş pozisyonu değişikliği korkusu nedeniyle iş arkadaşları arasında daha az bilgi paylaşımı olduğunu hissediyorum.					

KRİTİK ERP BAŞARI FAKTÖRLERİ

	Aşağıdaki soruları kurumunuzdaki ERP kurulum projesini ve kurulum sonrasını değerlendirerek yanıtlayınız.	Hiç katılmıyorum	Katılmıyorum	Ne katılıyorum, ne katılmıyorum	Katılıyorum	Tamamen katılıyorum
1	ERP'nin devreye alınmasına sıkı bir şekilde odaklanılıp, kontrol edilmiştir.					
2	ERP proje ekibi/ekipleri için doğru (örneğin en bilgili ve kendini işine adamış) çalışanlar dikkatlice seçilmiştir.					
3	ERP proje ekibinde/ekiplerinde finansal ve üretim süreçleri hakkında güçlü bilgiye sahip kişiler bulunur.					
4	ERP proje ekibi işi sahiplenir.					
5	ERP'nin uygulanmasında şirket içi uzmanlığından en üst seviyede faydalanılmıştır.					
6	ERP proje ekibi üyeleri ERP'nin devreye alınmasını dikkatlice organize etmiştir.					
7	Proje ekibi ve kilit kişiler ERP uygulaması hakkında iyi bir şekilde eğitilmiştir.					
8	ERP sistemi için performans ölçütleri geliştirilmiştir.					
9	ERP'nin devreye alınması için uygun terminler/adımlar belirlenmiştir (örneğin hangi tarihe kadar neyin başarılacağı).					
10	ERP zamanında devreye alınmıştır.					
11	Detaylı bir ERP proje planı vardır (hangi aşamada hangi işlemlerin yerine getirileceği).					
12	ERP sistemi diğer yönetim bilgi sistemleri ile entegrelidir.					
13	ERP projesinin ilk aşamasında iş süreçlerinin haritası çıkarılmıştır.					
14	ERP projesinin ilk aşamasında yeniden tasarlanmış iş süreçleri basitleştirilmiştir.					
15	ERP projesi için iş süreçleri mümkün olduğu ölçüde standartlaştırılmıştır.					
16	ERP projesinde iş süreçleri arasında veri kaybı olmaması sağlanmıştır.					

17	ERP projesinde iş süreçleri arasında veri değişikliği olmaması sağlanmıştır.					
18	ERP sisteminin şirket için doğru olup olmadığı değerlendirilmiştir.					
19	ERP adım adımdevreye alınmıştır (örneğin her seferde bir fonksiyon eklenmesi).					
20	ERP projesinde üst yönetimin güçlü desteği ve kararlığı hissedilmektedir.					
21	ERP projesinde üst yönetim ve çalışanlar arasında etkin iletişim vardır.					
22	ERP projesinde bilgi teknolojileri yöneticileri ve işletme yöneticileri arasında yakın işbirliği görülmektedir.					
23	ERP işletme çapında entegre bir sistem olarak düşünülmektedir.					
24	ERP sistemi şirket içi çalışan sayısındaki azalmadan ziyade dış rekabete karşı bir silah olarak tanıtılmaktadır.					
25	Tüm çalışanlar ERP'nin devreye alınmasına dahil edilmiştir.					
26	Çalışanlar kapsamlı bir ERP eğitimi almaktadır.					
27	ERP sistemi için sadece kurum içi uzmanlık mevcut olmadığında dışarıdan danışman grubundan yararlanılmaktadır.					
28	ERP için danışman grubu tarafından sağlanan yönetimsel desteğe kurumumuz tarafından değer verilir.					
29	ERP için danışman grubu tarafından sağlanan teknik desteğe kurumumuz tarafından değer verilir.					

SON KULLANICI ERP MEMNUNİYETİ

	Aşağıdaki soruları kurumunuzdaki ERP sistemini göz önünde bulundurarak yanıtlayınız.	Hiç katılmıyorum	Katılmıyorum	Ne katılıyorum, ne katılmıyorum	Katılıyorum	Tamamen katılıyorum
1	ERP sistemi ihtiyacım olan bilgiyi sağlamaktadır.					
2	ERP'deki bilgi içeriği ihtiyaçlarımı karşılamaktadır.					
3	ERP sistemi ihtiyacıma tam olarak uygun raporları sağlamaktadır.					
4	ERP sistemi yeterli bilgiyi sağlamaktadır.					
5	ERP sisteminin içeriği ve bilgileri doğrudur.					
6	ERP sisteminin doğruluğundan memnunum.					
7	ERP çıktılarının (örneğin raporların, ekran menülerinin) kullanışlı formatta sunulduğunu düşünüyorum.					
8	ERP'de sunulan bilgiler net ve anlaşılırdır.					
9	ERP sistemi kullanıcı dostudur.					
10	ERP sisteminin kullanışı kolaydır.					
11	ERP sisteminden ihtiyacım olan bilgiyi zamanında alabilmekteyim.					
12	ERP sistemi güncel bilgi sağlamaktadır.					