

DEVELOPMENT OF A TASK INFORMATION FIT MODEL: A STUDY OF
RELATIONSHIP BETWEEN TASK, INFORMATION AND INDIVIDUAL
PERFORMANCE

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Thesis Abstract

Sinan ayır, Development of a Task Information Fit Model: A Study of Relationship
between Task, Information and Individual Performance

In the world of Information Technologies the question of finding the best solution for particular business needs is ongoing debate for decades. This debate evolves with the development of technology. Effects of this spiral extend to social-organizational attitudes of people, rising new questions and requirements. The main goal of this study is to find an abstraction model to address the relations between information and task leading to better business performance. The goal of the abstraction is to eliminate the effect of time and technology.

The goal of the study was to develop a model of Task Information Fit. Results indicate that the tool has been successful to model the underlying structure between system characteristics, task characteristics, information characteristics and their impact to perceived business success to some degree. TIF model targeted to discover the relation between task characteristics, information characteristics and their effect on business performance on per item basis. The correlations between the items supported the proposed relations. One of the unique contributions of this study is to reveal the underlying relations between task and information characteristics.

Tez Özeti

Sinan ayır, Görev Bilgi Uyumu Modeli'nin Geliştirilmesi: Görev, Bilgi ve Kişisel Performans Arasındaki İlişkilerin İncelenmesi

Bilgi Teknolojileri dünyasında işin ihtiyaçlarına en uygun çözümü araştırıp buna göre geliştirme yapma ve sunma on yıllardır devam eden bir yarışdır. Bu yarışın kuralları gelişen teknoloji ile değişir. Değişim sadece teknoloji ile kalmaz, aynı zamanda insanların sosyal ve kültürel değerleri ile beklentilerini etkiler, bu da yeni soruların ve taleplerin geliştirilmesine sebep olur. Bu çalışmanın esas amacı bilgi ve iş görevleri arasındaki ilişkileri irdeleyip iş performansını olumlu yönde etkileyen özelliklerin tespiti ve ilişki seviyesinin belirlenmesidir. Bununla amaçlanan bilgi teknolojilerini etkileyen zaman ve teknolojik değişim gibi etkenlerden bağımsız bir yapı geliştirmektir.

Bu amaçla çalışmada Görev Bilgi Uyumu (GBU) modeli geliştirilmiştir. Sonuçlar geliştirilen modelin; sistem özelliklerini, görev özelliklerini, bilgi özelliklerini ve bunların algılanan iş başarısı üzerindeki etkilerini belirli ölçüde temsil edebildiği görülmüştür. İlk geliştirilen yapıda modelin sistem özellikleri, işe yaklaşım gibi çevresel etkenlerle bir arada değerlendirilmiştir. GBU modelinde ise önermelerde dile getirilen bilgi ve görev bileşenleri arasındaki ilişki ve bunların performans üzerindeki etkinlikleri araştırılmıştır. Bu çalışmanın farklı yönlerinde biri bilgi ve görev özellikleri arasındaki ilişkileri açıklamaya çalışmasıdır.

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PREFACE

In the world of Information Technologies the question of finding the best solution for particular business needs is an ongoing debate for decades. This debate evolves with the development of technology. Effects of this spiral extend to social-organizational attitudes of people, rising new questions and requirements. Those thoughts led to the following questions,

- Is it possible to develop a model that favors Information System (IS) development and is independent from technology?
- What are the main factors in IS development? Information, system ...
What else?
- How about interoperability between different ISs? Why do we need interoperability?

Those questions started a chain reaction of other questions that led to the creation of Task Information Fit model. This thesis can be in particular interest to whom want to look underneath the surface of information based solutions.

CHAPTER I

INTRODUCTION

In the world of Information Technologies the question of finding the best solution for particular business needs is ongoing debate for decades. This debate evolves with the development of technology. Effects of this spiral extend to social-organizational attitudes of people, rising new questions and requirements. The main goal of this study is to find an abstraction model to address the relations between information and task leading to better business performance. The goal of the abstraction is to eliminate the effect of time and technology.

The characteristics of information, task, and system were covered in the literature review. The relationship between task and information was explored. The concepts of integration and interoperability were studied. Finally, the effect of user acceptance on the use information technologies was discussed.

In the framework proposed; general system properties, task characteristics, information characteristics, beliefs of self and work, and their effect to perceived business success was examined.

The study is composed of six chapters. Chapter 2 contains the literature review on information characteristics, task characteristics, technology acceptance, and information systems characteristics. In Chapter 3, research frameworks of Task Information Fit are presented, and afterwards research methodologies and primary studies are discussed in Chapter 4. The findings of the study are discussed in Chapter 5. The final chapter ends with review of goals, results, methods, and further recommendations of the study.

CHAPTER II

LITERATURE REVIEW

Work Environment Basic Characteristics

Work in general can be defined as a mental or physical activity or set of activities introduced to produce or accomplish something. When considered in work environment it can be defined as activities necessary to accomplish a given set of job objective(s). The activities can be mental or physical; can be performed by human or by machines and/or computers.

Process is a set of interrelated or interacting activities which transforms inputs into outputs (ISO 9000).

Procedure is a specified way to carry out an activity or a process (ISO 9000). The term work instruction is also used as equivalent of procedure.

ISO 9001 is defined as a family of standards for quality management systems in the organizations. The standard emphasizes definition, monitoring and reviewing of business processes as the key elements leading to good quality management. The requirements for process management by ISO 9001:2008 are (ISO, 2009):

4.1a Identify processes needed

4.1b Determine the sequence and interaction of these processes

4.1c Determine criteria and methods needed to ensure that both the operation and control of these processes are effective

4.1d Ensure the availability of resources and information necessary to support the operation and monitoring of these processes

4.1e Monitor measure and analyze these processes

4.1f Implement actions necessary to achieve planned results and continual improvement of these processes

4.2.1 Document procedures. Document the requirements for effective planning, operation and control of the processes.

4.2.2c Description of the interaction between the processes of the quality management system

A basic process description is composed of three components: Inputs, Process, and Output (ISO 9001). They are shown in Figure 1.

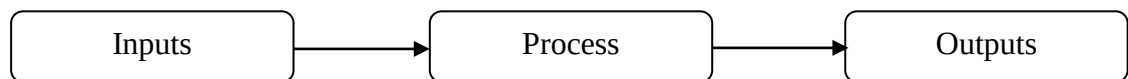


Fig. 1. Process Schema

The requirements and definitions for processes were chosen from ISO 9001:2008 standards specification, since they represent a comprehensive, summarized best practices guide developed over years and also concurrent.

Activities can be defined as functional work requirements deliberately planned and organized. They are functionally related to do work to be done. In other words, activities can stated with work domain elements in the time of the task happening. Further those descriptions can be transformed into representations of information for states of knowledge designed for specific decision making processes.

In general, task can be defined as an activity or set of activities complete within itself or forming a part of a process. The task is individuals' point of view.

Job and Job Design

Jobs can be defined as aggregation of activities across time for a particular individual. Proper job design for the organization is highly important as it has effect on other jobs structures, stimulates interactions between peers and divides responsibilities among workers. It dictates the hiring policy of the Human Resources department, as well as the training and education schemes. Most interesting for us is that it is also used to indicate how an Information System shall be designed. In general division of work can be done using different criteria as functional de-coupling, load sharing, worker competency, or allocation for problem solving. Whether design is used it is important to develop a coordinated and coherent structure in itself in pursuit of job requirements.

The objective of job design is to generate deliberate specification of the job holders' responsibilities. The process of job design was defined as,

“...specification of the contents, methods, and relationships, of jobs in order to satisfy technological and organizational requirements as well as the social and personal requirements of the job holder.” (Buchanan, 1979)

Business perspective expects from job design to design the whole organizational structure to address the transformation processes from inputs to outputs and generation or revenue. Job design deals with work organization as adding tasks, job structuring as giving control over work, and job scheduling and location.

Some of the significant job characteristics from workers perspective include; variety, career development implications, autonomy, social significance, intrinsic motivation, collaboration opportunities, recognition, feedback, and responsibility (William et. al., 1976; Campion & Thayer, 1987; Campion 1988; Buchanan, 1979; Lauche, 2005; Hackman and Oldham, 1976; Holman et. al., 2002, Hackman et. al.,

1975). The mentioned characteristics are important for motivation of people. These are the points to be accounted in good job design for higher job satisfaction leading to better achievement of business objectives.

A good job design at individual level shall consider the following criteria;

- Optimum variety based on job requirements and people skills
- Being part of a whole and giving that feeling
- Work cycle optimized for workers needs
- Control over results and feedback
- Utilization of workers skills, knowledge and effort
- Perceivable contribution to the end product and recognition

Another study builds a model on Hackman and Oldham's, 1976 proposal on motivational factors of skill variety, task identity, task significance, autonomy and feedback (Garg and Rastogi, 2006). The study adds factors as human resource management, ergonomics, organizational culture, leadership style, human performance improvement and workplace spirituality. All the factors emphasize the workplace's role on employee motivation. The model proposed for job design takes into account external and internal organizational factors, individual values, group level and social level factors are also accounted. All of them combined result in employee motivation and high performance environment. The overall system facilitates higher productivity for the organization.

The primary rationale of survival for productive corporations is continuous creation of value. Creation value relies on information processing which is in the hands of knowledge workers. Creating motivating job design for knowledge workers is

targeting to foster innovation for the company. Innovation motivation antecedents model try to cover that aspect (Amar, 2004). The model relies on four motivating drivers: sociological, psychological, generational, work, and cultural. Management is expected to analyze right drivers for motivation of their knowledge workers, and then apply those drivers as antecedents of creating the target environment. Findings indicate that the job done is the primary source of motivation, followed by intrinsic and extrinsic job outcomes. The last point of motivation is the organizational system, considering corporate culture, rules, procedures, work environment, environment, etc.

Job Design in Teams

Another point to be considered for job design is the formation of teams. Classical functional job design targets to accomplish a complete set of tasks within in a team. For an example let us consider a production line team. They get some semi-products in line and assemble some parts on it or do some services. The team members do predefined and usually repetitive tasks. At the end of the line the product is more complete or ready to go in trough another process. The structure of that team requires some level of collaboration between team members, but the level of inter-team interaction is not present or very limited. The modern work environment on the contrary requires much higher level of interaction across team borders. Even it goes beyond company borders. There is considerable ongoing research on effective team design.

Good starting point in team design is to consider team types: work, project, and management (Cohen and Bailey, 1997). The study indicates that work teams have productivity, response times as drivers for effectiveness. Project teams are required to follow budgets, schedules, and quality measures. Management teams are expected to

satisfy the requirements of the board for higher return on equity. The major factors effecting team success noted were;

- The type of the team matters for its effectiveness
- Group cohesion has positive effects on performance
- Autonomy is good for work teams, but usually has negative effect on project teams performance
- Diversity in demographic variables may have both positive and negative effect on teams performance
- Task based conflict has positive effect on performance, while relationship based (emotional) conflicts has negative effect on teams performance

Job design is considered as an input parameter in work group formation along with interdependence, composition and context (Campion et. al., 1993). These are controllable input variables. The management is expected to carefully analyze these variables and construct work groups based on that evidence. Higher level of self management, interdependence, and management support were determined as basic factors for building successful work groups.

Task Characteristics

Other basic construct that is to be explored is task. Firstly a brief introduction of the task will be provided, followed by task concept and its implications in the literature.

In general, task can be defined as an activity or set of activities complete within itself or forming a part of a process. There may be or may not be roles related to a task. Usually, the task takes some input resources and produces some output products or semi-products. For an information or knowledge worker, the input is usually information provided from a system and the output is a decision given or knowledge processed to be deployed.

In a usual control decision, involved information processes include activation, observation, identification, interpretation, evaluation, definition of task(s), formulation of procedure(s), and finally execution of that procedure (Rasmussen, 1986). Though the steps shall be sequential the islands of generated information after each process can use information from previous steps. In the study the role of designer, operator, and computer are questioned. The designer faces most of the difficulties by designing identification, interpretation, evaluation, task definition, and formulation of procedure. The operator is asked whether to execute or not to execute the formulized procedure. This is the case of a well defined problem. The context and interaction between actors can be completely different in a case where the problem is not so well defined. The designed system shall refer much more often to the operator to ask for decisions, and directions.

Another study concentrates on derivation of taxonomy for cognitive work analysis (Rasmussen et al, 1990). They define socio-technical systems to be self-organizing and adaptive to in the current dynamic environment. In a complex work context such as the interactions between large Information Systems and its users (i.e. agents) there exist multiple layers of representation for relating cognitive and emotional characteristics of a user to her/his work environment; users resources, criteria, and values; possible user strategies, tasks in decision terms, tasks in situation domains, means-ends structure of work domain, work system environment, information system itself. The study covers subjects from multiple disciplines: Domain Expertise, Work Psychology, Decision Theory, Work Sociology, Psychology, Organization and Management, Information Science.

Task is defined as the smallest controllable work unit performed by an employee or group of employees from different departments (Sitter et. al., 1997). Job design requires functional decomposition into tasks. For higher quality achievements the management shall include control capacity in the individual tasks. Work structure design can be broken into job designs. A good work design improves efficiency and effectiveness. A usual task control cycle consists of four basic functions; perception of state, evaluation per aspect, integrated evaluation of all related aspects, and choosing the control activity to be performed. Establishing the task as the basic unit of business control gives us the cue to design Information Systems to assert business control methods at that level. The information provided in task level could be used in decision making processes at more integral levels of the business.

Another discussion in job design arena is to decide between parallel, serial or some semi-structured designs. In most of the Integral Organizational Renewal (IOR) projects the corporations introduce parallel business process decomposition in order to overcome the current business challenges (Sitter et. al., 1997). On the contrary there is an argument that parallel work design may degrade the overall performance by the introduction of increased process variability, extra coordination efforts (Zapf et. al., 2007)

Task Environment for Knowledge Workers

Knowledge workers form most of the working class in the contemporary society. Their job tasks heavily rely on information and they use information systems to complete them.

Jonassen (2000) summarizes problem solving activities and categorizes them as; logical, algorithmic, story, rule-using, decision making, trouble-shooting, diagnosis-solution, strategic performance, case analysis, design problems and dilemmas. Those categories can be applied to differentiate between tasks as well. Task complexity was analyzed and related to several factors in the literature (Campbell, 1988). Task complexity depends on task attributes as path multiplicity, goal multiplicity, interrelated subtasks, and uncertainty of the interaction between different paths and goals result in increased information load, diversified by type and source and changing rapidly (Campbell, 1988).

In order to perform a task, make a decision, or solve a problem one needs to collect the essential input information. The information required can be problem identification information, domain information, and problem solving information

(Byström & Järvelin, 1995). They analyze the relation between task complexity, necessary information types, information channels and sources on task level. The findings include positive relation with task complexity, amount of information and sources of information. As task complexity increases the need for domain and problem solving information increases and the number of sources increase. Fidel et al. (2004) make a study on collaborative information retrieval. They define task analysis in decision making terms and in terms of strategies as characteristics of cognitive work. Both of the properties require some sort of information to be completed. The case study revealed that the nature of information sources and nature of information needed had an impact on collaboration attitude. The information source used required interpretation by more experienced users so that lead to more collaboration. The nature of information needed for the project was mostly undocumented and sometimes interpretation was needed, so the designer needed to collaborate with colleagues.

Vakkari (2003) makes a contribution to find the relation between the task to be performed and its effect on the information search behavior by reviewing most of the papers on search behavior. The study shows that the task characteristics have direct impact on search behavior. As the complexity of task increases searchers tends to spend more time and resources to search. A person's domain knowledge affects the tools and tactics used as they become more complex and diverse with more experienced ones. Kim and Soergel (2005) further extend the relation between task and information by proposing independent task characteristics affecting the nature of the information requirements. Byström and Hansen (2005) propose a conceptual framework for tasks in information search studies. They address the conceptual levels of information seeking

tasks and information search tasks. Information retrieval is defined as a sub process of information search tasks. The papers were used to derive properties of task properties relevant for the study.

A study on reduction of costs by improving the problem solving skills in a plastics manufacturing company shows the effect of problem nature on information gathering behavior. The study included the formal training of 5S problem solving model; problem identification, information gathering, generating alternative solutions, evaluating solutions and ends with implementing the best solution. After a year of experience only %25 of problems were solved using the sequential pattern. Most of the problems continued to be solved by using time and resource costly cyclical pattern. This was due to the nature of complex problems requiring more information to identify problems, or requiring more information to generate alternative solutions (Chakravorty et al., 2008). This case illustrates the importance of information and its relative value for the task or problem being treated.

In this study, task characteristics are grouped according to their complexity, multipath and multisource nature. Tasks at operational level are characterized by being simple, usually one step or few defined steps to complete. Tasks at decision making level are defined by level of collaboration, info seeking behavior, iterative nature, novelty, rule using requirements, judgmental, and decision making properties. Strategic task are defined by properties of fuzziness, interrelatedness and strategic performance requirements.

Information Characteristics

The information lies in the heart of Information Systems. It would be noteworthy to tap into the world of information and seek about hints of information quality. Gorry and Scott-Morton (1971) proposed a framework considering business activities, information requirements for implementation of Management Information Systems. Their framework consists of two dimensions: problem structure dimension and management activity dimensions. Problem structure defines three sub dimensions as structured, semi-structured, and unstructured. A structured problem can be differentiated by being well defined in the three phases of problem solving; intelligence, design and choice. Some examples are Accounts receivable, order entry, payroll. Semi-structured and unstructured problems do not have a well defined environment, methodology and solution spectrum in contrast to the structured ones. It is not surprising that most of the managerial decisions fall in semi-structured and unstructured domain. Management Information Systems are designed and developed to meet well structured problems. Though they try to address unstructured problems is usually misleading. Since, the nature of unstructured problems is not well defined. Figure 2 illustrates the proposed Information System Framework.

In their observation managerial activities require different information characteristics between operational and strategic. They define source, scope, level of aggregation, time horizon, currency, required accuracy, and frequency of use as important information characteristics. Information requirements of operational control rely on largely internal sources, the scope is well defined, level of aggregation is detailed, accuracy, and currency levels are high. On the contrary information

requirements for strategic planning level tend to have external source, the scope is wide, time horizons targets the future, currency and accuracy tend to be not very important.

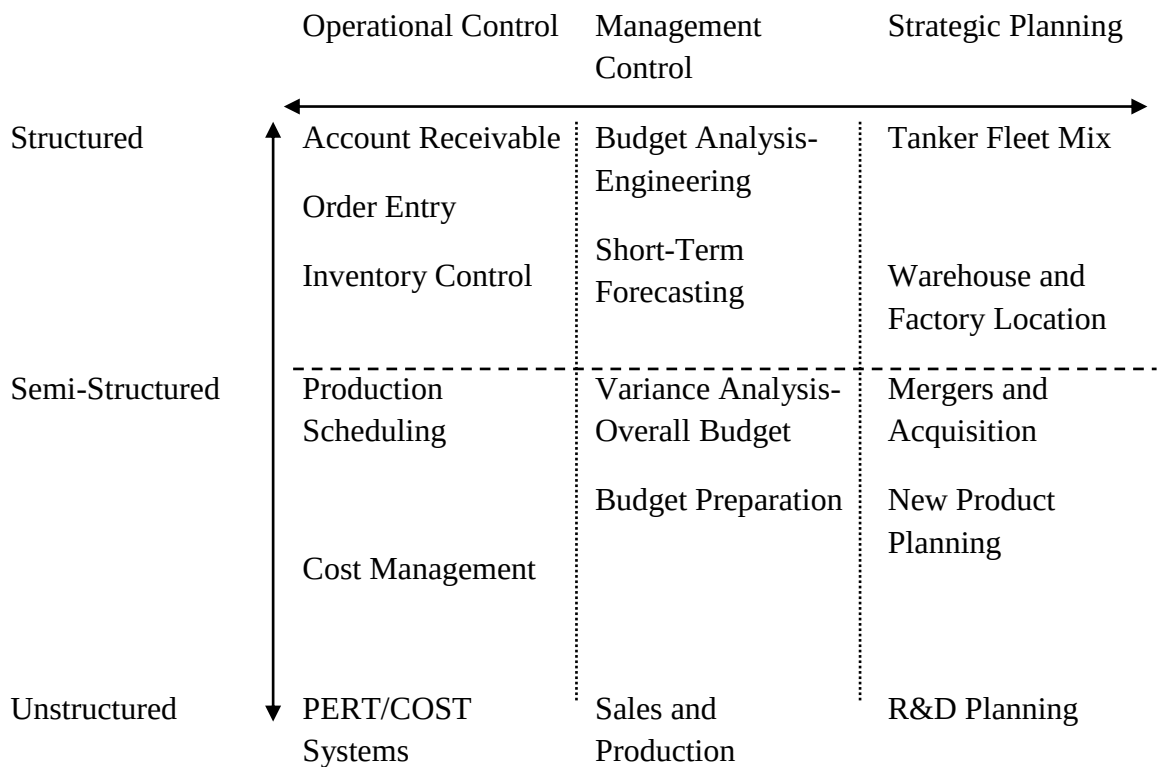


Fig. 2. Information System: A Framework (Gorry and Scott-Morton, 1971)

DeLone and McLean, (1992) propose an IS success model. The initial model consist of six major categories; System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. The categories in the model are multidimensional and interdependent. The figure shows the model proposed (Figure 3).

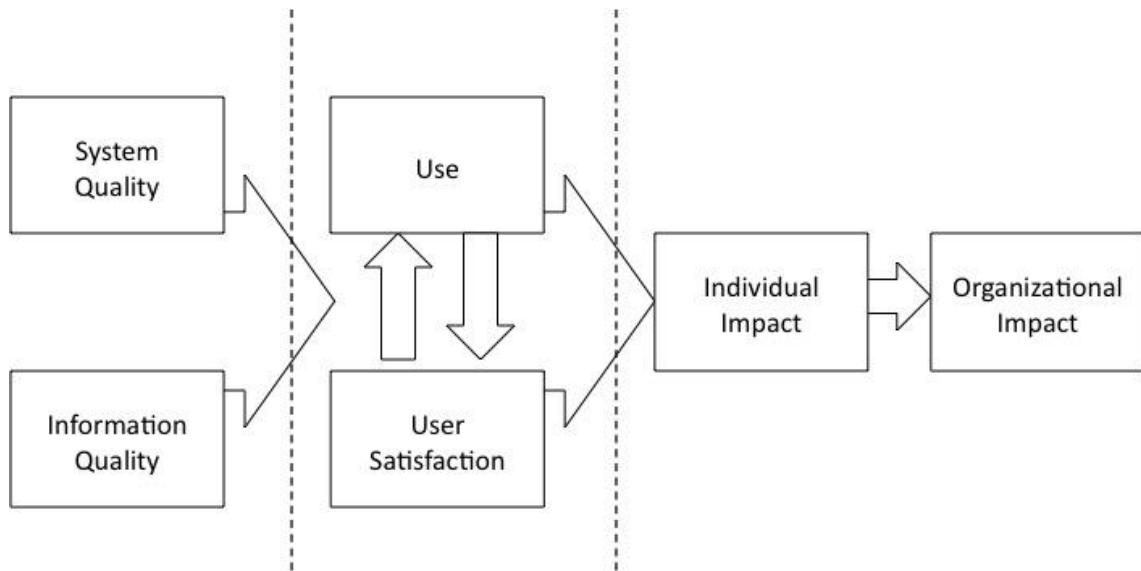


Fig. 3. Depiction of the Information Systems Success Model (DeLone and McLean, 1992)

The Information Quality category of the model cited empirical measures.

Accuracy, precision, currency, timeliness, reliability, completeness, conciseness, format, relevance, sufficiency, understandability, freedom from bias, relevance to decisions, comparability, quantitateness, and usefulness of information are nominated in the paper. These characteristics of information are mostly used to define the outputs of an information system.

The model has been further revisited and improved to include Information Quality, System Quality and Service Quality as driving categories in IS success. They affected User Satisfaction and Intention to Use and actual Use. The last two categories are interdependent and both influenced Net Benefits, which in return is affecting user satisfaction and intention to use (DeLone and McLean 2002, 2003). The model Updated Information Systems Success Factors is shown in Figure 4.

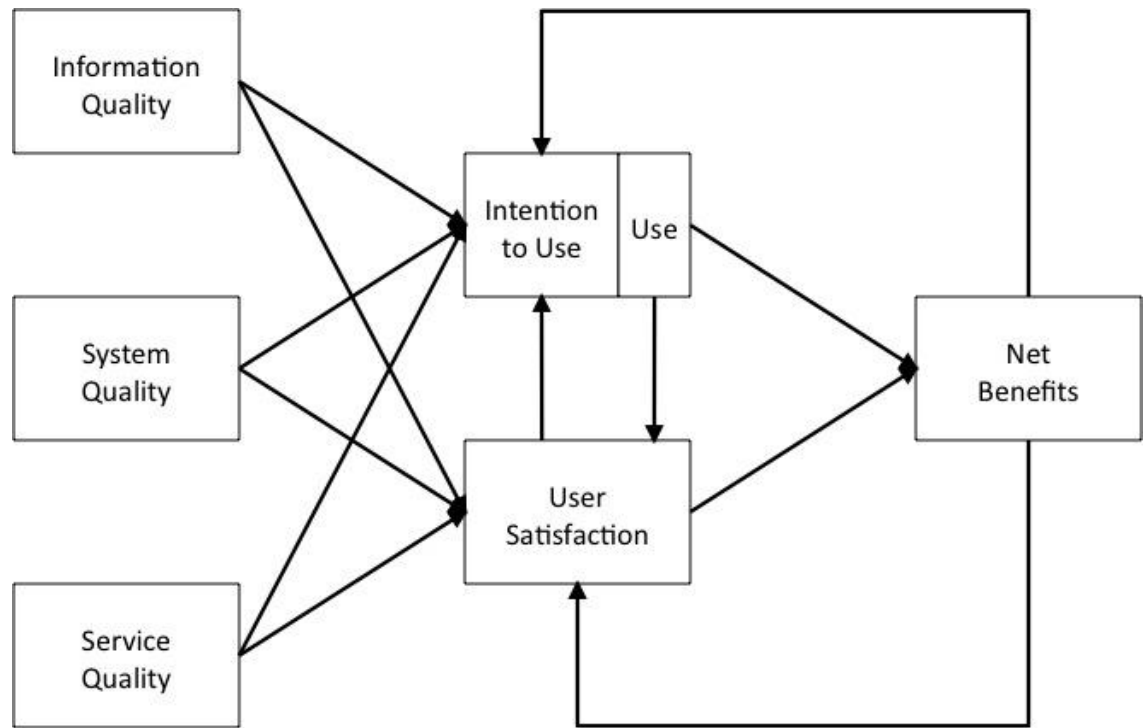


Fig. 4. Depiction of the Updated Information Systems Success Model (DeLone & McLean 2002, 2003)

The dimensions of information quality are defined as relevance, accuracy, timeliness, completeness, coherence, format, accessibility, compatibility, security and validity by Miller (1996). He also notes that the real quality aspects of the information are based on the way it is perceived and used by its customer. The way the chosen dimensions reflect to the customer depends on how business strategy utilizes the information.

Information is the major input in managerial decisions. Quality of information will determine the success of the given decisions. Sauter (1997) in her book describes timeliness, sufficiency, level of detail and aggregation, redundancy, understandability, freedom from bias, reliability, decision relevance, cost efficiency, comparability, quantifiability, and appropriateness as dimensions of information required in managerial

decision support. Shankaranarayanan and Cai (2006) discuss the incorporation of contextual concerns to assess information quality. They propose a methodology to measure completeness of information. The quality of information is not straight for all cases. A certain bit of information might be very useful in one case, whereas it might be inadequate for another depending on the context. Data accuracy and completeness are prescribed as the important dimensions of information quality (Parssian, 2006). Result of relational aggregate functions as Count, Sum, Average, Max and Min may result with errors leading to wrong managerial decisions. Thus, the system should provide a means either for the correction or the indicators of error probability. Schulte and Grüner (2007) discuss the effectiveness of organizational hierarchical designs based on decentralized information processing for better decision cost, decision delay, and decision quality. All these dimensions refer to information cost, information timeliness and information quality, respectively.

The study of information quality was concern in MIS research for years. The AIMQ methodology foresee information quality under intrinsic, contextual, representational, and accessibility categories (Lee et. al., 2002). The methodology consists of three basic components: product, service, and information quality model, information quality assessment (IQA) instrument, and finally information gap analysis techniques. The first collects information characteristics into four quadrants of sound, dependable, useful, and usable information. The IQA instrument consists of several questions for each dimension. IQ gap analysis tries to find out the gaps in each quadrant.

The concept of “fitness for use” emphasizes the data consumers’ point of view. Users views’ about data quality are grouped major aspects to be considered in data

quality include intrinsic, contextual, representational, and accessibility concerns (Wang and Strong, 1996). Believability, accuracy, objectivity, and reputation are categorized as intrinsic data quality (IDQ) characteristics. IDQ is used to define inherent characteristics of information. Contextual data quality (CDQ) is about information characteristics that vary based on time, task, place, and person. Value-added, relevancy, timeliness, completeness, and appropriate amount of data are grouped under CDQ. On the contrary the last two aspects emphasize system characteristics. Interpretability, ease of understanding, representational consistency, and concise representation are the characteristics under Representational DQ. Accessibility data quality aspect relates to accessibility and access security issues. The research is different from others by its approach based on user views and their attempt to build a hierarchy of information attributes.

Information Characteristics and Applications

Information characteristics were studied in a general manner. At this section information characteristics will be examined based on various cases studied in the literature.

Alter (2004) in his work criticizes the classical Decision Support System model and offer Decision Support Model instead. In the case study of two banks loan management systems the most important information characteristic stand to be accuracy as the key leading to better sale decision. Thus the system shall support loan officers by offering most accurate data for the banks approval process.

Hoo and Lee (2007) propose an e-travel assessment scale to evaluate service quality. The scale is a composition of information, service, interactivity, responsiveness, customer relationships and security measures. The information side of the scale gives emphasis on reliability, relevance, reputation and security, structure, accuracy, timeliness, relevance, completeness, privacy, aggregation dimensions.

There is also a sound research on the effect of information systems in the field of e-procurement and supply chain management. The current study points to the increasing importance of timeliness rather than the accuracy of information in supply chain management (Vaidyanathan and Devaraj, 2008). The overall procurement process quality heavily relies on information flow quality throughout the entire system. The information interoperability between buyers and suppliers decreases the shipping discrepancies and significantly reduces the mistakes.

Interoperability plays a key role in telemedicine services. Schooley and Horan (2007) question the inter-organizational information sharing in the public domain. Information sharing between organizations is done for improving public services. Their

special emphasis is on cooperation between private and governmental health organizations providing emergence medical services (EMS) to the public. They construct a time-critical information services (TCIS) framework that uses technical, organizational and governance dimensions with several underlying sub dimensions. Interoperability is a challenge to construct Health Information Services (HIS) in heterogeneous environments. Raghupathi and Umar (2007) research the potential of model-driven architecture (MDA) in a health care information system development. They develop a health clinic system to track patient information based MDA approach. The findings note out the positive effect of open systems and standards used in the development. Mykkanen et al. (2007) propose a HIS based on service oriented architectures (SOA) and service technologies. They argue that a HIS integration project can be constructed based on one of the following approaches depending on the business needs: process-oriented, user-oriented, information oriented, and service oriented. They examine service oriented approach on three levels: process, application and platform. Javitt et al. (2008) make a research study particularly to expose the benefits in the use of information technologies in healthcare. This is an experimental study. They use information system for one group of physicians and use another group as a control one. They propose that IT systems may provide more concise information targeting the right patient in a timely manner. This would lead to reduction in professional charges to the patients.

Elst and Abecker (2002) point to construct a model for capturing organizational memory based on a three dimensional ontology: stability, sharing and formality. Here stability refers to the different levels of change in critical information, sharing scope

discuss the access levels to the information; formality refers to the readability and usability level of information by machines. The last concept can be perceived as meta-level information of business documents.

Androutsos et al. (2000) use Common Object Request Broker Architecture (CORBA) to develop a distributed Network Management tool that analyzes the changes in the network over the time. The emphasis of the tool is in the use of temporal information with a time stamp on it. So the extracted dimensions of information in the interoperable system are state (as temporal, quasi-static and dynamic) and time.

Bhattacharya et. al. (2002) points on the issues of privacy and ease of use in governmental interoperability applications including wide range of applications mainly for public use. Nurmilaakso et al. (2006) suggest an e-business framework involving three main aspects: business documents, business processes, and messaging. When they are viewed from point of interoperability, the business documents refer to the information to be exchanged, business processes set the scene of information sharing between business partners, and messaging puts in place the technological constraints of information exchange.

Egyedi (2007) points out the need for correct standardization to achieve better interoperability. She highlights the mistakes in standardization such as being too comprehensive, too loose, using non compliant terminology, or being too expensive to be implemented. Green et al. (2007) compare different interoperability standards with regard to the well-established ontology models. They point out the importance of Meta information (the information about information) in interoperability. Chen and Doumeingts (2003) summarize interoperability projects developed under European

initiatives. They evaluate interoperability concept from best practices, user requirements and international points of view. Road mapping methodologies to foster interoperability project implementations are also covered.

Papazoglou et al. (2000) call attention to the importance of information flow in integrated value chains. The interoperability serves as the glue between contemporary manufacturers and their suppliers and customers. The information flow in supply chains is upstream to the suppliers and downstream to the customers. It is clear that source and target of the relevant information to be shared is important. E-procurement has large scale interoperability requirements to achieve extensive effectiveness in business processes. Angappa and Ngai (2008) study the perceived benefits, perceived barriers, critical success factors and organizational performance metrics in e-procurement systems applications in Hong Kong. The assessment of e-procurement system should be made based on the gain ratio of e-procurement processes compared to legacy processes. Direct, indirect, and strategic benefits of e-procurement may also affect the implementation decisions. Interoperability is also the key leading to enterprise integration of e-government solutions. Cheng and Wu (2007) propose architecture to improve the quality of e-government services by increasing the vertical interoperability between context, semantics, service, and data components of information systems. The solution is achieved through deployment of vertical metadata integration service bus across different levels and applications.

Gunes et al. (2003) state the quality of information provided by IT is one of the factors affecting overall organizational performance. Their findings conclude that the information provided by Information Technologies should be sufficient and consistent,

accurate and precise, up-to-date and delivered in a timely manner, clear and understandable, relevant, and adequately detailed. These can be summed up as relevance, timeliness, format, relevance and level of detail provided by IT services.

The power of ERP system implementation depends on the level of organizational functions covered and the level of information exchange between those parts (Basoglu et al., 2007). ERP solutions are good but hard to implement for reasons such as cost, requirements for organizational change, inappropriateness. In order to grasp the problem of enterprise integration some models shall be studied. In general ERP systems provide lead workers (i.e. managers) with information needed for better decision making by creating a central database and regulating corporate information flow (Mandal and Gunasekaran, 2003). In one case study considering implementation of ERP projects it was found out that after implementation was complete the system did not produced all the information expected from managers and they still needed to deploy yet another IS to produce the report required. Another study on ERP II systems points out the importance of reliable and concurrent flow of information within and between diverse and dissimilar systems (Weston, 2003). The study projects end-to-end integration of information between and within companies to form a real ERP II system. A methodology for ERP misfit analysis is proposed based on task technology fit (TTF) model for measuring misfit (Wu et al., 2007). The study addresses the information content and format output of ERP systems as a point of misfit.

Information and Task Characteristics in Literature

In a study of the user satisfaction and actual use related to participation of users on the system design of accounting information system shows interesting patterns (Choe, 1988). Satisfaction and use are positively related. In a task environment with high uncertainty, timely information with broad scope is positively related to performance. On the contrary in well defined procedural tasks usually information with narrow scope delivered periodically increases productivity. Scope, timeliness, and aggregation were chosen as information domain research variables. Task difficulty, task variability, centralization, formalization were chosen as task domain research variables.

Another approach to IS success is the model proposed by Wixom and Todd (2005). The model combines the user satisfaction variables with technology acceptance variables. The model builds on two main streams of information and system quality. Where, system quality is measured by reliability, flexibility, integration, accessibility, and timeliness and information quality is measured by completeness, accuracy, format, and currency. System quality drives system satisfaction, information quality and system satisfaction drive information satisfaction. System satisfaction determines ease of use, information satisfaction and ease of use determine usefulness. Usefulness and ease of use drive attitude that drives intention. In the model completeness stands for level of necessary information provided, accuracy stands for user's perception of correctness of information, format stands for user's perception of information presentation level, currency stands for user's perception of information being up to date. The model separates system factors from information factors. On the contrary they are interdependent.

The effect of information sharing in the supply chains between retailers and manufacturers were researched (Lee et. al., 2000). Findings indicate that information sharing reduces manufacturers' costs. The retailer may benefit when the lead time is reduced due to information sharing. The manufacturer can reach larger reductions in terms of cost when the demand is correlated over time, the pattern of demand is variable or lead time is long. These points shall be considered when designing information sharing systems between retailers and manufacturers. The concept of Vendor Managed Inventory (VMI) was developed to address the cost reduction by information sharing. Wal-Mart and Home Depot are two examples implementing VMI approach to reduce costs and improve replenishment.

The effect of exceptions on information based process performance and their relation to IS has been studied (Strong, 1997). Information quality was defined as fitness for use based on definition for product quality. In the model incorporating exception detection and handling capabilities to an Information System would improve information quality and reduce process flow time. Another side effect would be that the quality required of human resources required to handle exceptions would not be as high as before.

Concept Development: Which is the Best?

One of the basic questions of this research is to decide on which approach to follow regarding the relation between two domains; work and information. As examined previously the information domain constitute of data, information, knowledge, and wisdom. The work domain constitute of work, job, action, activity, task, process, procedure, and function. They were discussed in detail.

Some proposals would be; Activity Information Fit, Task Information Fit, Process Information Fit, Procedure Information Fit, Job Information Fit, Task Data Fit, Process Knowledge Fit, and etc. The point is to decide which one has which approach is the best regarding Information System design.

The information domain dimension of wisdom is omitted. Since if a system is not specifically designed does not target wisdom generation as defined by terms in previous section.

Knowledge Management Systems are known for a decade and they target generation and preservation of corporate information and accumulation of it. The target is to collect data and information, make it available for today's and tomorrow's operations and decisions in the form of knowledge. It can be thought as larger Information System with specific long term targets.

Information Management Systems or simply Information Systems can be defined as combination of hardware, software, infrastructure and personnel organized to facilitate business needs as planning, operation, control, and decision making.

Another definition states IS as interaction between business processes and technology. The underlying technology is identified as Information Technology (IT). IT constitutes of two major parts: software and hardware. Information Systems define Information Technologies as basic parts that interact with the business process parts. Two companies would use the same Information Technologies but the interaction of those technologies with the business processes would be completely different, and thus the resulting products and efficiency would be different. So the question asked is not solely the selection of information technologies but also the design of the processes that will rely on them.

In this study Information System will be defined as a basic component. Knowledge Management Systems will be considered as a subcomponent of an IS or specifically designed IS.

CHAPTER III

FRAMEWORK

The framework, and research hypotheses developed are covered in this chapter.

Task Information Fit Model Environment

Firstly Task Information Fit model environment will be introduced. The model is result of in depth literature survey and previous qualitative studies. The major constructs of the model are task, information, system and self related beliefs about work. The general model is summarized in Figure 5.

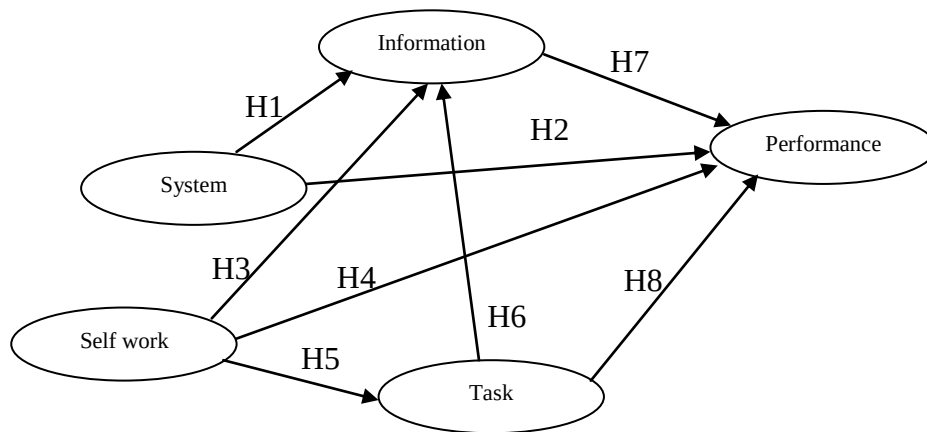


Fig. 5. Task Information Fit Model Environment

Research hypotheses for the model of the framework are given in Table 3.1.

Finding the relations between the major constructs is one of the main objectives of the research. Statements of the hypotheses,

- H1: System characteristics have an impact on information characteristics of the model.
- H2: System characteristics have an impact on performance.
- H3: Self work characteristics have an impact on information characteristics of the model.

- H4: Self work characteristics have an impact on performance.
- H5: Self work characteristics have an impact on task characteristics of the model.
- H6: Task characteristics have an impact on information characteristics of the model.
- H7: Information characteristics have an impact on performance.
- H8: Task characteristics have an impact on performance.

Table 1. Task Information Fit Model Hypotheses

Hypotheses	Dependant	Independent	Relationship
H1	Information	System	Positive
H2	Performance	System	Positive
H3	Information	Self Work	Positive
H4	Performance	Self Work	Positive
H5	Task	Self Work	Positive
H6	Information	Task	Positive
H7	Performance	Information	Positive
H8	Performance	Task	Positive

Task Information Fit Model

Another model developed at the study was the model based on information characteristics. The relation between different information characteristics driven by tasks being defined and leading to business performance was the core of this model. Research hypotheses for the model of the framework are given in Table 2 and Figure 6.

Table 2. Task Information Fit Model Propositions

Hypotheses	Dep. Var.	Ind. Var.	Relationship	Condition
Pa	Relevant Info	Task defined	Positive	Stable environment
Pb1	Relevant Info	Consistency	Positive	
Pb2	Relevant Info	Consistency	Negative	Fast changing environment
Pc	Currency	Availability	Positive	
Pd	Relevant Info	Currency	Positive	
Pe	Relevant Info	Accuracy	Positive	
Pf	Relevant Info	Right level	Positive	
Pg	Relevant Info	Scope	Positive	
Ph	Performance	Relevant Info	Positive	

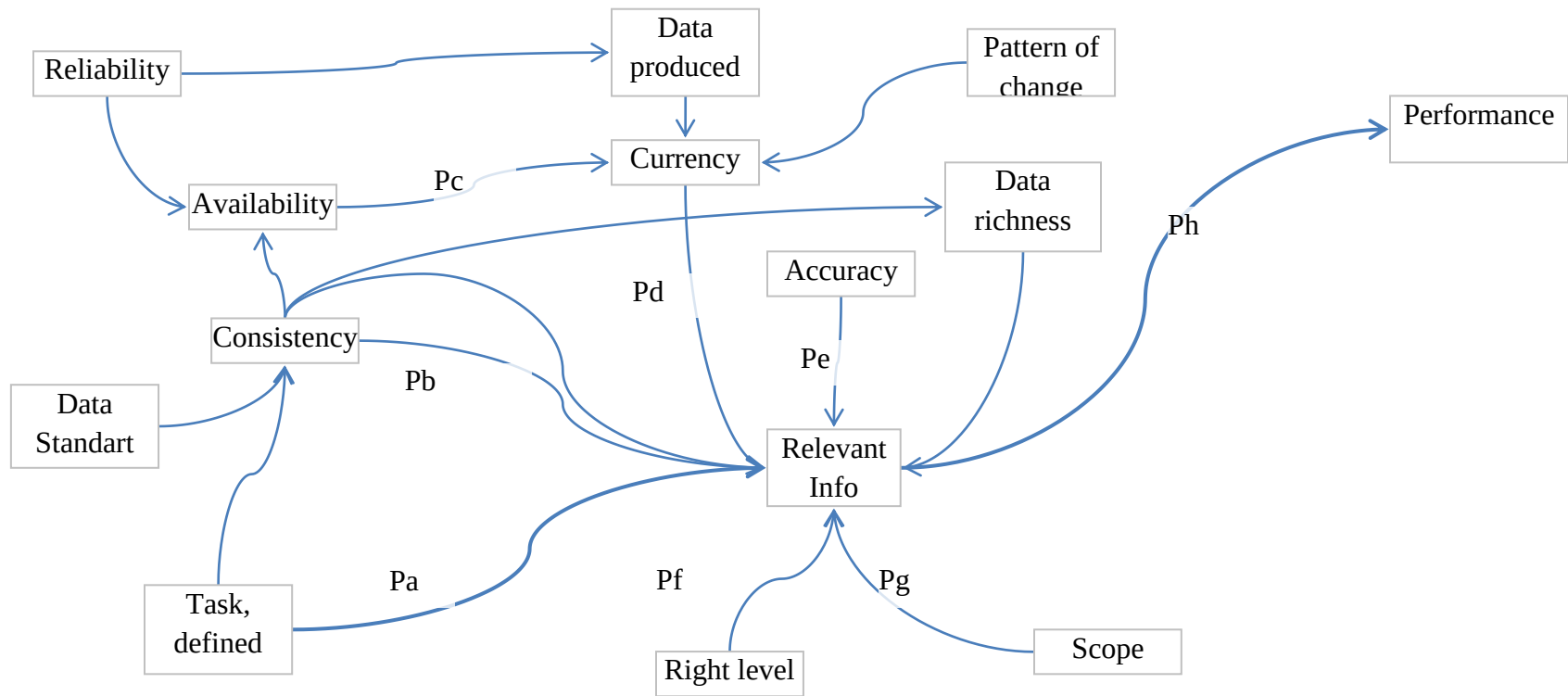


Fig. 6. Task Information Fit Model

Statements of the propositions,

- Pa: Defined tasks have an impact on relevant information.
- Pb1: Consistency has positive effect on relevant information under stable environment by means of information change.
- Pb2: Consistency has negative effect on relevant information a fast changing environment.
- Pc: Availability has an impact on Currency.
- Pd: Currency has an impact on relevant information.
- Pe: Accuracy has an impact on relevant information.
- Pf: Right level of information has an impact on relevant information.
- Pg: Scope has an impact on relevant information.
- Ph: Relevant information has an impact on performance.

CHAPTER IV

METHODOLOGY

The research in this study started in September, 2007. The first step was to make in depth Literature Review on the topics of information, interoperability, user acceptance and decision making. Then the first qualitative study about building an information taxonomy model was conducted. The second wave of literature study was on topics of work, task, activity, information collection, and decision making approaches. The second qualitative study thus concentrated on the characteristics of task and information in a given environment, course registration system of a university. In both of the studies observations, face to face interviews were used to verify the research propositions. Finally the experimental study was performed with total of 130 participants. The major steps of methodology are summarized in the Table 3.

Table 3. Research Chronicle

Study	Date	Sample	Publication
First Qualitative Study	Jan. 2008	12	PICMET '08
Second Qualitative Study	Mar. 2009	14	PICMET '09
Expert Focus Group Study	Apr. 2010	10	
Pilot Study	May, 2010	11	
Final Questionnaire	May, 2010	130	

Qualitative Study on Information Characteristics

The first qualitative study was conducted to gain a more detailed taxonomy of information characteristics based on business needs. Face to face semi-structured in depth interviews were conducted with employees from different companies. The data for the research was extracted from interviews of the information system users in small and medium companies. The aspects of age, gender, position, experience were

considered in interviewee selection. The interviewees were given a prescript of the simplified version of the questions in advance to ensure preparedness. All of the interviews were recorded and deciphered after the meetings.

The subjects were asked for the most important information dimensions. Those responses were evaluated based on a weighted scale. Another assessment was conducted based on users' comments. Then both of the results were combined on a weighted scale. The users' first choice was rated with 1.5, the second choice was rated with 1, the third was rated with 0.5, and all of the other mentioned or extracted dimensions were rated with 0.4.

The information collected from users was extracted and classified based on categories. Then the derived information was used to calculate the percentage of each item compared to the total. Analyses based on the groups were conducted. Users were categorized as system users, system developers and administrators.

The other aspects based on business motives were derived from users' comments based on situational context, what if analysis, "as is" and "is to be" questions. The subjects were asked for interoperable information systems requirements in their jobs. The subjects were asked for the current information systems they use at job from interoperability point of view. The need for such a system was questioned. Also the advantages and motivations for using interoperable systems were discussed. All of the ideas expressed from users were used for identifying the business driving factors for the adoption of interoperable systems.

Complete list of the questions used in the semi structured study are included in Appendix A.

Qualitative Study on Task Information Fit

The second qualitative study was conducted to make a preliminary study on the relation between business tasks and information characteristics. Face-to-face semi-structured in depth interviews with college students from two different universities which has registration information system, were conducted. The research data were extracted from the interviews.

The research questions are grouped as personal information, task measures, information characteristics, and generalized IS properties. Personal information contains questions about system usage experience, grade average, technology affection, and decision tendency. Task measures concentrate on the perception of task complexity, task difficulties and critical tasks, as well as user support. Then information properties of relevance, integrity, reliability, completeness, scope, timeliness, time dependency, format and shared data related to course registration are matched against task requirements. And finally, the information systems are questioned by means of task completeness, speed and task order compliance.

In this study, the content produced during iterations have been examined and throughout the analysis attributional coding has been used (Stratton, 1997). The sample was chosen from two different universities. Gender and number equilibrium have been considered. An interview guide was prepared in advance. The interviews were recorded. The raw material was extracted from the recordings. In advance an index of information and task characteristics was extracted from literature review. The index was further improved by users' comments on iterative review stages. Competition task is an example of attributional properties mentioned by users. Each statement was coded with

regard of attributional characteristics of information and task. The coding process was first conducted on information attributions and then on task attributions separately.

Interviewee comments were analyzed per item (i.e. Part B, Question 1 for all interviewees) of the tool to improve internal consistency. Some items were double checked to improve consistency. Analyses were further improved to drill the relations between properties and sample demographics. Users' comments also contributed to research by mentioning the use of assistant applications used at the registration process, which were developed by their peers.

Complete list of the questions used in the semi structured study are included in Appendix B.

Expert Focus Group Study

The expert group study was performed to get experts comments on characteristics of information and business activities. The feedback was used to further refine the final characteristics under research.

Ten experts participated in this study. The participants mostly were experts on their fields with five to ten or more years of experience.

The questionnaire was prepared in Excel and distributed via e-mail to the participants. The terminology names' of characteristics was given both in English and Turkish. The list also contained an explanation of the construct. Experts were asked to select most important 20 characteristics out of 54. Experts were asked to make free comments on any of the items. Expert focus group questionnaire that was sent to the experts is included in Appendix C.

Pilot Study

Pilot study was committed to improve the quality of the final experimental study. It formed of two parts; observed experiment and web based pilot.

The observed experiment had three participants. They were chosen between experienced professional and were observed one by one. Participants were asked to make verbal comments about the questionnaire. Those comments were used further to improve the expression power of the questionnaire. The final web based questionnaire was prepared on that feedback.

In the web based questionnaire eleven participants were invited via an invitation e-mail which included link to the web site. The responses from the pilot were used as input data set for reliability and factor analysis using SPSS (Statistical Package for the Social Sciences). The results of the reliability analysis were used to reduce the number of irrelevant items in the questionnaire. The factor analyses were used to reduce the items per factor.

Experimental Study

The final experimental study was conducted to research the propositions of the framework. The target audience was people with some work experience and profound use of Information Technologies in business environment. The questionnaire was send to more than 200 people and to 14 corporations via an invitation e-mail invitation. There were 148 responses in total of which 130 were valid. The questionnaire of the experimental study is included at Appendix D.

CHAPTER V

FINDINGS

This chapter summarizes the findings of the first and second qualitative studies and the final experimental studies.

Findings of the Qualitative Study on Information Characteristics

Profile of Interviewees

The interviewees were all chosen from full time company employees. Their ages range between 23 and 50. The gender distribution of the subjects in the group was 60% females and 40% males. Subjects were further categorized based on their roles as system developers or managers and system users. The details are covered in Table 4.

The profile of different groups is as follows,

- 8 system users: Average age of this group is 37. They have 13 years of work experience on average.
- 4 system developers and system managers: Average age of the group is 26 and they have 6 years of work experience on average.

Another categorization was made based on the subjects' role as employee or middle level manager.

- 8 employees: Average age of the employees is 34 years. They have 10 years of experience on average.
- 4 middle level managers: Average age of the middle level managers is 32. They have 11 years of experience.

Table 4. Profile of Interviewees Based on Groups

	By User Type		By Employment Type	
	System User	System Developer - Manager	Employee	Middle Level Manager
Age (in years)	37	26	34	32
Experience (in years)	13	6	10	11
Numbers	4	8	8	4

All of the interviews worked for middle and large organizations. Two third of the subjects worked for organizations with 3 000 employees in total. The rest were employed in middle sized organizations with employee number ranging between 50 and 200. All of them used information systems in their work. The group participants consisted of 70% of university degree holders and 30% of high school graduates. All of the interviewees had to use more than one information system to do their defined job tasks. Four of them were from a finance department. They used an in house developed finance application; office applications, different e-mail clients, file sharing and other applications as information sources. It was observed that the main finance application was not enough interoperable with the other personnel software and finance software used in the organizations. Another four were from an IT department. They also used development tools, e-mail client applications, office applications, and various information sources. It was observed that the main development tool used by the team does not cover the software project management phases and does not allow for high level of collaboration.

Users' Information Characteristics

In this part the information aspect of the model will be examined in more detail. The dimensions of information are categorized under four categories of content, form, organizational and time. The composition of these dimensions is given in Table 5.

Table 5. Composition of Information Categories

Category	Dimensions	Weight
Content	Accuracy, Completeness, Detail, Relevance, Reliability, Scope, Validity	59%
Form	Clarity, Compatibility, Format	8%
Organizational	Coherence, Source, Target	20%
Time	Timeliness	13%
	Total	100%

Users' comments point out reliability, source, timeliness, and relevance as the most important information dimensions. Reliability stands for users' trust on the information supplied. Source of information plays a critical role on the users perception about the information provided. It is related to information reliability. Timeliness is stated by users as important dimension in job environments. Since most of the jobs are time bound and information is needed on a timely manner. Relevance is stated for the right information at the right place. Table 6 gives the detailed list of dimension mentioned by users and their importance weight calculated as described in the methodology section.

Users' statements about information are as follows,

“In our job any mistake may cause to lose the trust of our customers. So we try hard not to make any mistakes, we even triple check our documents. We check the relevance of information based on accuracy and reliability from trusted sources.” – (Female, System user, 39)

“In my work, I check every bit of information on the documents. I check the accuracy, the source on the documents. I also check the figures if they are within the budget or

not. Sometimes, I have to check against for the current rates available from the EU commissions' web site.” – (Female, System user, 25)

Table 6. Weights of Information Categories

Category	Dimension	Weight
Content	Reliability	15%
Organizational	Source	13%
Time	Timeliness	13%
Content	Relevance	11%
Content	Accuracy	10%
Content	Scope	10%
Content	Detail	7%
Content	Completeness	4%
Organizational	Coherence	4%
Form	Format	3%
Form	Compatibility	3%
Organizational	Target	3%
Content	Validity	2%
Form	Clarity	2%
	Total	100%

Information Characteristics Related to Interoperability

Literature was analyzed for the key dimensions or constructs of information which are important for interoperability (Vernadat, 2007; Mykkänen et al., 2007; Mykkänen and Tuomainen, 2008; Bhattacharya et. al., 2002; Nurmilaakso et al., 2006; Egyedi, 2007; Green et al., 2007; Chen and Doumeingts, 2003; Papazoglou, 2000; Angappa and Ngai, 2008; Cheng and Wu, 2007). Table IV shows the important information dimensions. Security, relevance, and timeliness are the mostly mentioned dimensions. They are followed by behavioral aspect, format, and level of detail aspect of information. The most outer shell of importance is given to the shared information, accuracy, Meta information, reliability, aggregation, compatibility, reusability, and source of information. The three dimensions that come into prominence are security, relevance and timeliness. The first one security is a parameter related to the nature of

interoperability and sharing of information. Most of the system users want to share the information in a secure way. Security also covers issues as accessibility, privacy, reputation of the information provider and the trust between exchanging parties. The second dimension relevance; covers appropriateness, conformance, context dependency and situational fit of the information. Users expect the information provided by systems to be relevant. This is more crucial if the information is exchanged and the cost is potentially higher. The third concept; timeliness is one of the main motivations to build interoperable systems. Users want the information to be processed in timely manner.

The exchanged information between systems is expected to have a certain level of behavioral properties. Since the supplicant usually wants the provider to compute, distribute or aggregate information in response to the supplied one. The information supplied must possess some behavioral properties or the service provider should grasp the actions expected. It is necessary to point that most of the interoperable systems take actions based on predefined processes without any user intervention. Level of detail and format of information provided are also important. The former defines the level of detail of the exchanged information. The latter includes appropriateness of the format; structure of data exchanged and has direct effect on the ease of use. Aggregation is part of interoperable systems, since most of the information is exchanged in smaller pieces. Reusability is an essential attribute given that the information is transferred from one system to another. The information to be transferred must be reusable and meaningful to both of the systems. The supplicant of information waits for assured level of accuracy from the provider. Meta information can be defined as the information about information. Meta information can be used to search of relevant information or can be

used to classify the available information. Source of information points the source or provider of information. It is related to reliability and security of information. The relative weights of the characteristics are summarized in Table 7.

Table 7. Important Information Characteristics Related to Interoperability

Characteristic	Importance
Security	13%
Relevance	12%
Timeliness	10%
Data behavior	6%
Format	6%
Level of detail	6%
Shared	5%
Accuracy	4%
Meta	4%
Reliability	4%
Aggregation	4%
Compatibility	4%
Reusability	4%
Source	4%
Others	14%
Total	100%

Users' View Compared to Literature

When those findings are compared with literature on interoperability it is seen that the dimension of timeliness (Vernadat, 2007; Vaidyanathan and Devaraj, 2008; Raghupathi and Umar, 2007; Mykkänen et al., 2007; Javitt et al., 2008; Androutsos et al., 2000; Mykkänen and Tuomainen, 2008; Papazoglou, 2000; Angappa and Ngai, 2008; Cheng and Wu, 2007) and relevance (Vernadat, 2007; Mykkänen and Tuomainen, 2008; Egyedi, 2007; Green et al., 2007; Chen and Doumeingts, 2003; Papazoglou, 2000; Angappa and Ngai, 2008; Cheng and Wu, 2007) coincide. It is useful to take into consideration other information dimensions that are critical for interoperable systems; security, data behavior, shared components, aggregation, and reusability. Security is critical because it takes into account integrity, confidentiality, as well as senders and

receivers authorities on shared information and establishes the trust to the system.

Security gains a higher degree of importance if the sharing of information is between two or more different organizations. Data behavior aspects such as expected functionality, actions to be performed, and aggregation of data or components have to be taken into account. Most of the interoperable systems exchange information on purpose. It is also important to expose reusable information or expose it on a reusable manner. Reusability of information is related with the format of the information by means of measures, degrees, etc.

When users' comments and literature survey results are compared it is observed that users do not mention about security, data behavior, shared properties, Meta information, aggregation, and reusability dimensions of information. All of them are proprietary for the interoperable information systems. On the other hand users gave higher importance about reliability, scope, completeness, and accuracy dimensions of information. The categorical ratio of users' information needs and information requirements based on literature are given Table 8. While users put higher importance on content, the literature on interoperability emphasizes organizational, form and time dimensions. Especially security dimension is in prominence within organizational category. Flexibility and compatibility are outstanding form dimensions for interoperable systems.

Table 8. Comparing Information Categories

Category	Users' Needs	Literature
Content	59%	49%
Form	8%	11%
Organizational	20%	25%
Time	13%	15%
Total	100%	100%

Attitude to Use

Attitude to use have two sub constructs; the performance expectancy and effort change expectancy. They all have direct impact on the user acceptance of interoperable information systems. Table 9 presents the relative weight, along with social and organizational motives.

Table 9. Weights of Major Constructs

Aspect	Weight
Performance Expectancy	40%
Effort Change Expectancy	22%
Social and Organizational Motives	38%
Total	100%

The first and most weighted aspect of the model have 40% of weight, followed by the effort change expectancy with 22%.

The sub categories of performance expectancy, facilitating job execution expectancy and job fit expectancy have weights of 32% and 8% respectively. The facilitating job execution focuses on increase in productivity, increase in effectiveness, decrease in errors, and increase in timely responses to the events. Some of the users' views on the subject are as follows,

“Such a system would increase our productivity by freeing some valuable time to concentrate more on product development than procurement of SMS messages, ...” – (Male, System Developer, 26)

“Such an integrated system accessed by our customers would cut off the phone calls to 90%. That would allow valuable time for us. ...” – (Male, System User and Middle Level Manager, 50)

The job fit expectancy of the model wraps the match of the interoperable information system to the job tasks. It means that the system would support the job, thus

resulting in higher performance. Those findings support literature on the field (Davis, 1989; Venkatesh and Davis, 2000).

The effort change expectancy has two main sub categories of short term effort and long term effort with respective weights' of 16% and 6%. The short term effort stands for the effect of interoperable systems on jobs usually completed on shorter terms. Short term effort has direct impact on employee morale and on organizational motives. The long term effort stands for jobs completed on longer term. Both of the type may be affected negatively or positively by an interoperable information system depending on the context. Users mostly stated that such systems would decrease the effort expectancy in long term jobs. Though for some short term jobs it may have reverse effects.

“I think that such a system would complicate my job. I will have to spend more time on my routine daily jobs.” – (Female, System user, 31)

Social and Organizational Motives

The social and organizational motives constitute of 25% organizational motives and 13% of peer support motives. The organizational motives stand for the value of the system to the business by means of improving control, facilitating management, improving satisfaction and motivation of employees, lowering the costs, delivering more value to the customers. It is interesting to note that 20% out 25% of organizational motives were given by the middle level managers. In literature there is no sound research to note about the organizational motives. In integrated information systems, middle level managers are as effective system users as employees. Usually they are given wider access rights to the system. So a taxonomy model shall take into account the organizational motives. Peer support motives are in any form of support from

colleagues, managers and advisers. Some of the users' views on the subject are as follows,

“Such a system would allow us to see the big picture with smaller details underneath. It would support our job environment and the motivation of our employees.” – (Male, System Developer and Middle Level Manager, 23)

“I think that such a system would support the institutionalization. Finally the overall performance of the organization and the satisfaction of employees would increase.” – (Female, System Developer and Middle Level Manager, 25)

The social and organizational motives behind implementing and using information systems are usually overlooked. As stated by users' they may have remarkable affect both on the users' acceptance, overall performance, overall employee satisfaction and managerial implementation success.

The Proposed Information Characteristics Taxonomy for Successful IS

The final taxonomy for successful implementation of interoperable information system is derived from the users' critical information needs, information dimensions required by interoperable systems, factors affecting users attitude to use the systems, and social and organization motives toward such systems.

The first aspect has four sub items. They are reliability, source, timeliness, and relevance dimensions of information. The final listing given in Table III pointed to the four dimensions listed above. The other dimensions accounted to be important were accuracy, scope, level of detail, completeness, coherence and format of the information.

The second aspect is derived from literature on interoperability (Vernadat, 2007; Mykkänen et al., 2007; Mykkänen and Tuomainen, 2008; Bhattacharya et. al., 2002; Nurmilaakso et al., 2006; Egyedi, 2007; Green et al., 2007; Chen and Doumeingts,

2003; Papazoglou, 2000; Angappa and Ngai, 2008; Cheng and Wu, 2007). They were briefed in Table I. From those dimensions security, relevance, timeliness, behavioral aspect, and format aspect are the most significant ones. The users also specified timeliness and relevance as important dimensions. So the other three; security, behavioral aspect, and format are extracted as key information dimensions affecting interoperability. Though they are overlooked by users, they point to the necessary dimensions in a successful interoperability information system implementation. Findings of the study are summarized in Figure 7.

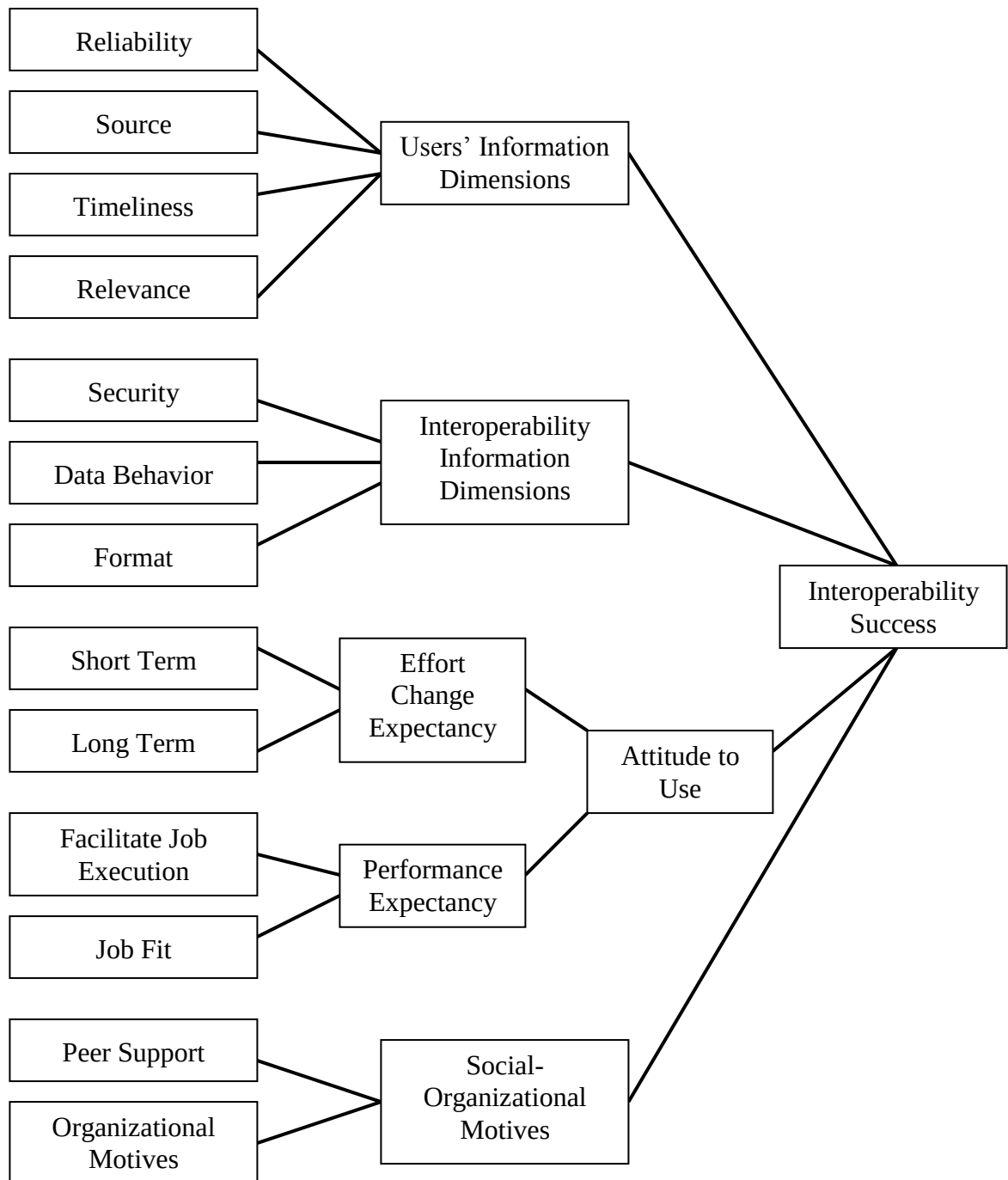


Fig. 7. Information Characteristics Business Success Taxonomy

The factors affecting users' attitude to use the systems were derived from users' views. The aspect of performance expectancy has two main categories, facilitating job

execution and job fit. The aspect of effort change expectancy has two main sub categories; short term effort and long term effort.

The aspect of social and organizational motives has two main sub categories, peer support on performance and organizational motives. The former one addresses the users' need for peer support in the act of using the systems. The latter one emphasizes the expectations from an IS system to increase the overall organizational efficiency by means of improving management and motivation.

Findings of the Qualitative Study on Task Information Fit

The findings about challenging tasks in the entire process of course selection, registration and add/drop periods are as follows,

- Searching relevant information about content, exams, homework, and delivery style of a course
- Searching information about the teacher of the course
- Preparing a course list for registration
- Preparing alternatives using the main course list in case of unsuccessful registration
- Choosing between two or more instructors delivering the same lecture at the same time
- Students from university B have to wait in front of their computers for quota increase of a specific course
- Uncertainty at the day, time and place of some courses

Students from both universities mark that the selection and submission of the course list at the first day of course registration as the most critical task one. Students denote two tasks as the most complex ones,

- Preparing the course list and alternatives in advance is the one that demand most information gathering activity at all
- Deciding between two or more instructors; requires collection of relevant in depth information about instructors and their match to students self characteristics

Students from both universities get advice from their friends to mitigate the above mentioned complexity. They also form a kind of team and usually select all electives together. Students from university A heavily apply to and share views with their advisors, where as students from university B rarely apply to their advisors for course list preparation, except for dropping some courses. Students from university A usually communicate to their advisors via e-mail and arrange meeting in that period. The details of the study are covered in Cayir and Basoglu, 2008.

Findings about Task Based Information Properties

Task Information Fit concentrates on discrepancies, overlaps and missing information on order to complete given information based task. The Task Technology Fit (TTF) model focus on technology in general and embraces computers systems including hardware, software, and data, as well as user support systems by means of training and other facilitating conditions (Goodhue, 1995; Goodhue and Thompson, 1995). The TIF

model is more restrained by focusing only on the fit of information requirements to complete a task and the information provided by the system.

Students' comments about the information properties of relevance, integrity, reliability, completeness, scope, timeliness, time dependency, format, and shared data related to course registration are matched against task requirements are as follows,

“Information provided by the registration system is open to change. There are dismissed courses. There are also courses with schedule changed. Changes may even occur after the course registration.”

“The system does not inform affected students about the changes.”

In university A the students are usually informed by their advisors, faculty administrative staff or course teachers. The students at university B have to follow web based announcements from their registration office without regarding relevance, importance and timeliness.

- Students develop some sort of strategy to relieve uncertainty and elaborate chance factor. They prepare backup scenarios for the courses that would not be chosen because of the race circumstance.
- The factors affecting the selection of electives courses are based on course content, course instructor and course hours. In case they do not like the content they try to select the less risky in terms of instructor grades.
- The information about courses in the registration system is not enough. They lack detail, and the presentation of data is usually disorganized.
- The students apply to Web 2.0 type of web sites for comments about teachers, courses and grades. But they do not give decisions relying entirely on them.

Task and Information Domain Level Findings

Findings show that information characteristics required to support strategic tasks are not covered by the IS. In order to support strategic tasks the system shall support long term planning, allow production of alternative plans, and ease evaluation of information. These refer to time horizon, redundancy and evaluated information characteristics respectively.

Planning and decision making information to support the decision making process is not provided by neither of the university systems. The decision making and planning tasks can be supported by providing decision relevant information in a timely manner. The system shall ease aggregation of information from different sources based on users' requirements. In order to make successful decisions and plans the systems shall deliver information consistent with what is really expected. In case information is updated on the systems it shall be delivered by means of efficient channels to anyone directly or indirectly affected by the change. Collecting and formatting information from different sources is another important aspect to be addressed by the system. As mentioned by previous study difficult tasks usually have multiple goals or multiple paths (Campbell, 1988; Byström & Järvelin, 1995). Those decisions indeed require gathering information from multiple sources with different formats and content type. The data extracted from the interviews is summarized in Table 10.

User' comments show that the scope, level of detail, and relevance of information provided by the system is not enough for operational tasks. This technically corresponds to user help. A study performed on user interface interaction characteristics states system help as a major factor on user acceptance behavior along with menu types, panes

and ergonomics (Seneler et al., 2009). Findings on the study are in parallel with this study; system help is not adequate and they are not able to find information they search for.

Table 10. Information Characteristics

Level	Information Characteristics and Relevant Importance		Comments
Strategic Information	Time horizon	4.5%	Information characteristics required to support strategic tasks are not covered by the IS.
Planning and Decision Making Information	Source	16.5%	Planning and decision making information to support the decision making process is not provided by the system. The decision making and planning tasks can be supported by providing decision relevant information in a timely manner.
	Aggregation	8%	
	Time dependent	7%	
	Decision relevance	6%	
	Reliability	4%	
	Timeliness of information	3.5%	
	Consistent	2%	
	Multidimensional	5.5%	
	Trusted	2%	
	Shared	1,5%	
Operational Information	Availability	1%	Operational tasks are supported by the system. But the level of details, scope and relevance of information provided do not meet the users' expectations.
	Scope	17%	
	Details	10%	
	Relevance	5%	
	Iterative action	2%	
Others		4.5%	
Total		100%	

Operational tasks are mostly supported by the system. But the level of details, scope and relevance of information provided do not meet the users' expectations. In order to meet those expectations the scope of the information and details shall be adjusted to meet the expectations.

The course registration system is mainly operational. Users' comments indicate that the system does not support long term strategies as carrier planning.

Most of comments concentrate on planning and decision making constructs.

Source of information is the mostly nominated characteristic. Students get comments from their advisors, peers and web sites. They actually trust mostly to their peers, but also use other sources.

“I ask to my friends, I also speak to former students of the course. If the information I gather is not enough, I would go and speak with course instructor.” – (female, master student, technical sciences)

Aggregation is used to define the cases where a student collects and combines information from multiple sources into more usable one. Preparing a schedule is an example for such activity. Students collect information about course day, time, and places and combine them to prepare a schedule in advance for easy registration. Some students prepare multiple schedules in case of being unable to select one or more courses. This type of approach requires multidimensional information gathering. Timeliness of information and time dependent nature of information are two supporting constructs. The system is expected to provide information in a timely manner. But sometimes there are changes on schedule which results in time dependent information. Decision relevance is used to define the cases where information provided is usable in decision making process. Reliability is correlated with characteristics as source, timeliness, time dependency, consistent, and trusted properties of information. The students indicated the examples where information provided was not reliable. Students also indicated that not all of the information required was shared in an open manner through the web pages. Information availability was mentioned due the not given information as abbreviations used in the registration system.

Scope is used to define the topics covered or uncovered by the registration system. Details of information on the contrary is used to define the level of details each topic is covered. Students mostly expressed the operational information provided by the system to be enough, whereas decision relevant information was not enough. Relevance stands for the right operational information to be given at the right place. Iterative action information is used to define the case at one of the universities where users frequently had to check the system web site for quota increase.

The analysis results on the task domain are grouped under the three categories; strategic, planning and decision making and operational tasks (Table 11). The two outstanding characteristics are fuzzy tasks and strategic performance tasks. The first one was mentioned due to fuzzy progress during the registration process as change of course time, instructor, closing and opening of courses, etc. The system shall allow the users to be informed about the changes in a timely manner. Strategic performance includes comments on long term goals of the users. The system shall be developed by including information about future term courses or strategic value of the courses as field application properties or links to other courses.

Planning and decision making tasks constitute of information seeking, decision making, judgment, collaboration and iterative tasks. Information seeking and collaboration tasks are interrelated in order to find the right scope of information to support judgment and decision making tasks. Information seeking is used to define different approaches by users to reach desired information.

Planning and decision making tasks constitute of information seeking, decision making, judgment, collaboration and iterative tasks. Information seeking and

collaboration tasks are interrelated in order to find the right scope of information to support judgment and decision making tasks. Information seeking is used to define different approaches by users to reach desired information.

“The most difficult is to select the best instructor. It would be good to have info sources about course delivery style, grading.” – (female, master student, social sciences).

Collaborative task define task performed with peers.

“I get advice from my friends in course selection. We are used to select common electives. I also get advice from upper level classes.” - (female, bachelor, and social sciences).

Table 11. Task Characteristics

Level	Task Characteristics and Importance			Comments
Strategic Tasks	Strategic task	performance	4%	Long term tasks.
Planning and Decision Making Tasks	Information seeking task		41%	Planning and decision making tasks require extensive information seeking and searching behavior.
	Decision making task		12%	
	Judgment task		8%	
	Collaborative task		7%	
	Fuzzy task		6%	
	Iterative check task		2%	
Operational Tasks	Competition task		16%	Support operational level information.
	Simple task		2%	
Others			2%	
Total			100%	

This type of comments coincides with the profile of interviewees as being mostly dependent in personality. Fuzzy task refers to tasks with frequent change and need for adoption. They usually require additional steps to be taken after a change occurs. Changes in course time, place or instructor are typical examples. Decision making task is used to define the moment(s) of decision making. Here the students have a clear cut

vision of what to do and how to do it. Judgment task is the pre-step of decision making. At this point students are still unaware of what to do and how to do it.

“It is not difficult to decide when there is no option, but when there are more than one option it is difficult to choose” – (female, bachelor, social sciences).

Iterative tasks as periodically checking course information updates from the IS's web site is due to wrong design of the information delivery to the users. Those factors actually show how the system shall be further developed.

Competition task is the operational bottleneck on the systems of both universities. Students race to get a course with limited quota that is usually wanted by most of their peers. This jamming is a result due to students choosing among instructors and course hours suitable to their schedule. Just one of the master level students commented the system to be simple, considering the moment of submitting course codes prior to registration. Naturally there is no race condition for master level courses.

It is important to note the relation between three levels of tasks. For a student to have a smooth registration experience she/he has to seek information from different source with one or more short term or long term goals, judge on which instructor to select, prepare alternative schedules in case of being unable to register to one or more of the courses and finally at the time registration is opened login and select the preplanned courses. All of those activities clearly illustrate the relation between operational, planning and decision making, and strategic levels of tasks. The information system shall support all of those steps by providing the necessary information and tools within the right context.

Findings about Information Systems

Students' comments and expectations about course registration Information Systems are as follows,

- The system speed is not enough at the first day of registration.
- The system functionality can be further extended by making some registrations tasks in advance, thus ease the process.
- The system should provide more information to support registration process.
- The system should provide the necessary information in a well organized manner.
- The system supports the registration process in an orderly manner.

Applying the TIF Model on Findings

The students' views on difficulties regarding the registration system from the basis of functionality are not provided by the Information Systems in place. The functions not supported by the systems are usually information intensive tasks;

- Search relevant information about course content, exams, homework, and delivery style of a course
- Search information about instructors, their delivery style and grading policy
- Form a complete list of courses in advance
- Prepare backup courses
- Follow up the changes in the course day, time and place
- Mitigate the race circumstance at the first day of the registration to select the most wanted courses

The administrators of Course Registration systems under consideration shall easily apply to the factors to improve their systems.

Effect of Super Users and Relation to TIF Model

Some students from university B has adopted and developed tools to mitigate the problem of race circumstance and increase chance to select the most wanted courses.

There are currently three different assistant software applications (Assistant Application 1, Assistant Application 2, and Assistant Application 3). Below follows the more complete list of their capabilities,

- All of the three applications get students user id, password and selected course IDs and imitate user behavior on web based registration system. They are much faster than human peers and thus provide enormous speed gain above ones that do not deploy the application. They are able to complete the entire course selection procedure in just one minute. But in case all the students start using the assistant applications it is clear that the race condition will cause the same result of slow performance and being unable to get the wanted courses. So the system requires revision to remove the race condition at all if possible.
- Assistant Application 2 in addition provides facilities as; visual course list preparation, automatic course list preparation based on rules, get comments about instructors from online communities, file export support.
- Assistant Application 3 also provides the ability to parse online announcements and inform the student

The details about assistant applications are included at Appendix E.

Discussion on the Results of the Case Study

This case illustrates how users' requirements are perceived and addressed by their peers. Actually this case clearly demonstrates in which directions and how the Course Registration system in place could be further improved. Though improvement is up to the system administrators, the example shows how perceived usefulness affects the attitude of users (i.e. students) to use the untrustworthy, but targeted third party solutions.

There are both theoretical and practical contributions. The analysis of information and task characteristics resulted in the creation of the following hypotheses:

1. Planning and decision making tasks have the highest importance from both information and task perspectives
2. Source and scope are the top important information characteristics.
3. Information seeking task is the most important characteristic in the model

These propositions can be further tested with further data collection.

From a practical perspective, involvement of users in product development can offer opportunities to create original, valuable and realizable ideas leading to successful innovation (Kristensson, et. al., 2004). The motivation behind open source development is mentioned and proposed to be applied in other fields as well (Shah, 2005). For a user to be able to involve in the development activity two sets of information are required. The former is awareness about the need and use context. The latter is information about the solution environment. Typical users usually has ideas about the need and use context. What super or power users provide is their ability to develop a solution. In the case of assistant applications super users clearly address the needs mentioned by their

peers. Even one them is made open source to be modified further to meet emerging user demand and requirements.

It will be good practice for companies to provide tools and environment for super users' involvement in the innovation process. An example of involving users in the development of their own products as in the case of watch market was studied (Franke and Piller, 2004). The result is wide range of designs with higher level of acceptance by their developers. Another study on creative support of lead users on new product development in Kite Surfing industry was conducted (Franke et al., 2006). The group experimented in that study shows similar patterns as the case of university students. Some surfers who met application problem with their kite surfs managed to develop custom solutions as modifying the original product to a more usable one. This small modification led to better commercial products. Just like the case of Assistant Application developers targeting their own and their peers needs. Even if not directly involved, the user communities shall be followed as external network and source to improve product development and corporate learning (Ozman, 2008). User innovation can be organized and seized by the companies to develop commercial products. One or more of the system users recognize new ways to design and begin to innovate. Then, they join efforts and follow some semi structured methodologies to stabilize the product. This approach allows a low cost methodology for development of commercial products (Baldwin et al., 2006). Another advantage is that the companies may extend its product portfolio on areas already accepted and tested by the users. Some companies have seen the advantage of releasing information and tools freely to end users. As a result they received valuable feedback and new directions for development of commercial products

(Harhoff et al., 2003). The case of assistant applications is a clear cut for the situation. The assistant application developers recognize the need from their peers and firstly address the competition task and develop tool for quick registration. Then they improve the solution by addressing planning and decision making tasks as adding visual course list preparation, getting comments about course instructors from online communities. Even one of them targets the strategic task of producing redundant course schedules in case of fail to register to some courses. The details of the study are covered in Basoglu and Cayir, 2009.

Findings of the Expert Focus Group Study

In the expert group study 10 experts replied to the invitation. Table 12 shows the characteristics that were chosen to be important by at least 8 of the experts.

Findings of the Pilot Study

There were eleven participants in the pilot study. Reliability analysis on per construct basis was computed. The results of the analysis were used to eliminate redundant items. Table 13 shows the number of items under each construct after the reduction.

Table 12. Most Important Characteristics Selected by Experts

Construct	Grade
Education	9
Job Experience	8
Self Efficacy	8
Current Information	9
Ease of Use	9
Efficiency	9
Effectiveness	8

Table 13. Most Important Characteristics Selected by Experts

Construct	Before	After
Demographic	9	7
Self Work	7	3
Information	29	19
Task	19	13
System	11	11
Performance	12	12
Total	87	65

Findings of the Experimental Study

Profile of the Respondents

Only 21% of the respondents were female and 79% were male indicating high rate of male participants. Most of the respondents were at age of 25-30 and 31-40. The education level of the respondents was 89% of university or graduates. Most of the participants worked in IT or Finance departments. 53% of the respondents worked for finance sector, while 37% worked for ICT sector. The detailed profile is given in Table 14.

Table 14. Profile of the Respondents

Item	Range	Frequency	Percentage
Gender	Female	27	21
	Male	103	79
Age	<25	20	15
	25-30	65	50
	31-40	39	30
	>40	6	5
Education	Basic Education	1	1
	High School	3	2
	Hgher School	3	2
	University Student	8	6
	Bachelor	74	57
	Graduate	41	32
Department	Accounting	1	1
	Finance	35	27
	IT	58	45
	Other	36	28
Position	Accounting, Finance Specialist	12	9
	Accounting, Finance Manager	2	2
	Software Developer	27	21
	Software Project Manager	11	8
	Analyst	9	7
	Other	69	53
Sector	Finance	69	53
	ICT	48	37
	Education and Consulting	4	3
	Construction	3	2
	Production	2	2
	Health	1	1
	Tourism and Catering	3	2
	Other		
Work Experience	<1	14	11
	2-3	37	28
	4-5	26	20
	6-10	37	28
	>10	16	12

The results of the questionnaire were evaluated in terms of reliability and construct validity. Reliability and factor analysis were used to test them. All super constructs were analyzed by means of reliability analysis and the results are presented at Table 15. Super constructs have Cronbach's alphas of values 0.70 and more. These results indicate high internal consistency of the constructs.

Table 15. Reliability of the Major Constructs

Major Construct	Items	Cronbach's alpha
Self Work	3	0.70
Task	13	0.74
Information	19	0.88
System	12	0.88
Performance	12	0.96

Other multi-item variables' reliability was also analyzed. Their results include values with lower Cronbach's alpha values. The results are summarized in Table 16. Task uncertainty and ease of use have medium level of internal consistency. On the contrary defined task, task sophistication, information validity, system interoperability, system flexibility, and user interface have rather higher level of internal consistencies.

Table 16. Reliability of Multi Item Constructs

Multi-item Construct	Items	Cronbach's alpha
Task Defined	3	0.79
Task Sophistication	2	0.71
Task Uncertainty	2	0.59
Information Validity	2	0.75
System Interoperability	2	0.94
System Flexibility	2	0.79
System User Interface	2	0.83
System Ease of Use	2	0.66

Factor analyses were used to analyze underlying relations between variables. First study was conducted on all of the variables. Then one by one analyzes based on major

constructs were computed. The results are included in Appendix F. The results of the all constructs indicate five factors explaining %100 of the variance. Interesting grouping of task variable indicate three factors explain %54.05 of the variance. The factors can be grouped as general task characteristics, defined task characteristics, and task complexity characteristics. The outcome factors of information can be grouped under subjective perception based items, fact based items, post action based items, and change based items. The first factor is composed of items like trust in information, validity of information, relevance of information that are merely based on subjective perception. Level of detail, completeness, accuracy, and currency form the second fact based factor. The third factor is composed of items like dealing with reach information that require further actions to be purified. The last factor is composed of items related to change of information over time.

Descriptive Statistics

The results of the descriptive statistics show off participants' intention to value most personal attitude about their tasks. They think that their job is highly sophisticated and complex in general. The most outstanding characteristics of information are information scope and information validity. Defined tasks, system ease of use, information and system flexibility are treated almost equally by users. Participants do not consider system user interface to be highly critical for their jobs. Descriptive statistics of summated constructs are listed in Table 17.

Table 17. Descriptive Statistics of the Questionnaire

Construct	Mean	S.D.	Median	Mode	Min	Max
Self Work	4,31	0,79	4,67	5	1,33	5
Task Sophistication	4,27	0,84	4,5	5	1	5
Task General	3,89	0,53	3,92	3,77	2,08	5
Task Complexity	3,85	0,87	4	3	1	5
Information Scope	3,7	0,77	3,5	3	1	5
Information Validity	3,69	0,94	3,5	4	1	5
Task Uncertainty	3,68	0,97	3,75	3,5	1	5
Performance	3,66	0,96	3,67	5	1	5
Task Defined	3,59	1,01	3,67	5	1	5
System EoU	3,58	0,93	3,5	4	1	5
Information General	3,56	0,63	3,63	3,42	1,26	4,8
System Flexibility	3,54	0,97	3,5	3	1	5
Information Content	3,44	0,9	3,5	3,5	1	5
System	3,42	0,74	3,43	3,29	1,57	5
System UI	1,83	0,54	2	2	0,5	2,5

Anova Statistics

Anova analyses were made based on demographic variables as gender, age, and job experience. The age group of lower than 25 and higher 40 consider that information provided by systems to be reliable. Again the same groups consider that systems are easy to use. The age groups of 26-30 and 31-40 consider both to be less important. Results are summarized in Table 18.

Table 18. Significant Anova Results for Age

Construct	< 25	26-30	30-40	>40	F	Sig.
Information Content 1	4.45	3.74	3.77	4.67	3.39	0.020
Ease of Use 2	3.89	3.26	2.67	4.0	3.02	0.037

Significant Anova results based on work experience are summarized in Table 19. All of the respondent groups think that their job requires high level of collaboration with peers. The rate of perception that the information provided can hold multiple meanings increases with work experience. This can be explained by experience. Another

explanation could be that longer year of work experience brings more responsibility and requires higher level decision making.

Table 19. Significant Anova Results for Work Experience

Construct	< 1	1-3	4-5	6-10	> 10	F	Sig.
Collaborative Task	4.50	4.16	4.27	4.51	4.94	2.58	0.041
Information Content 2	2.13	2.92	3.05	3.27	3.43	2.65	0.036

Significant Anova results based on job positions are summarized in Table 20.

Table 20. Significant Anova Results for Job Positions

Construct	1	2	3	4	5	6	F	Sig.
Task Uncertainty 2	3.75	4.00	4.00	4.09	4.22	4.12	2.34	0.045
Information Complete	3.75	4.50	2.52	3.09	3.00	3.22	2.58	0.030
Detail Level	4.00	4.50	3.07	3.45	3.22	3.70	2.43	0.038
Information Validity 1	4.08	4.50	3.41	3.27	3.33	3.93	2.32	0.047
User Interface 2	3.92	4.50	4.04	4.00	3.33	3.22	3.19	0.010
Performance 2	4.25	4.50	3.81	4.18	2.78	3.96	3.04	0.013
Performance 3	4.17	4.50	3.67	4.27	2.67	3.74	2.34	0.045
Performance 5	4.17	4.50	3.63	4.27	2.67	3.70	2.79	0.020
Performance 12	4.00	4.50	3.15	4.27	2.67	3.62	2.99	0.014

The codes of 1, 2, 3, 4, 5, and 6 correspond to Accounting-Finance Specialist, Accounting-Finance Manager, Software Developer, Software Project Manager, Analyst, and other respectively. Near all of the participants state that, their job tasks can change due work requirements. This is slightly higher for Analysts and Software Project Managers, which is natural for their environment. Finance sector workers state that information is mostly complete in their business environment; nonetheless this is not the case with software business. Again that is the observation for the level of information detail, and information validity. Analysts find that user interfaces of their systems are not as user friendly as they shall be. Financial specialists and software project managers think that systems in use have positive effect on their job performance over all. Software

developers think that systems are fairly good. On the contrary analysts think that systems have neither positive nor negative effect on their business performance.

Analysis of the Framework

Linear regression analyses were used to measure proposed interrelations between dependent and independent constructs on the TIF model environment. The results are summarized in Figure 8. The hypotheses of H3 and H8 were not supported by the findings. All of the other six hypothesizes have significance level smaller than 0.001, which indicates that they are highly significant. According to the results task and system characteristics have similar effect on information. Self work and system have a higher impact on performance than information. An interesting finding is that users do not directly correlate performance and task characteristics. Detailed results of the regression analysis are given in Appendix G.

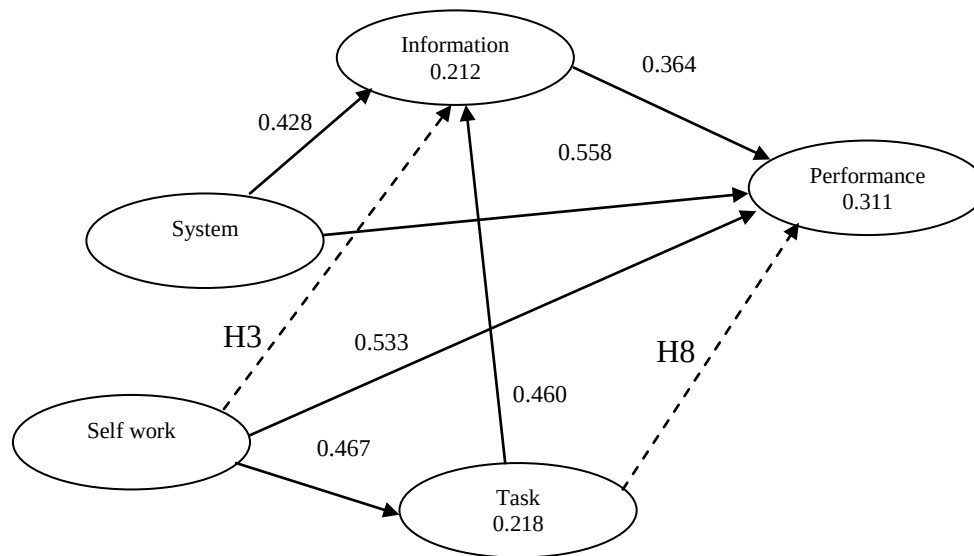


Fig. 8. Results of the TIF Model Environment

Results of the TIF model were derived based on item correlation statistics. The results are shown in Figure 9. The model is build to explain the chain of task,

information and performance. Correlation results support the model. All of the supported propositions are significant. Only there was no evidence for Pb2 proposition. The correlation between items in the model is one of unique contributions of the study. The internal relations between information characteristics, the flow from task to information characteristics, and relation between relevant information characteristic to performance are noteworthy.

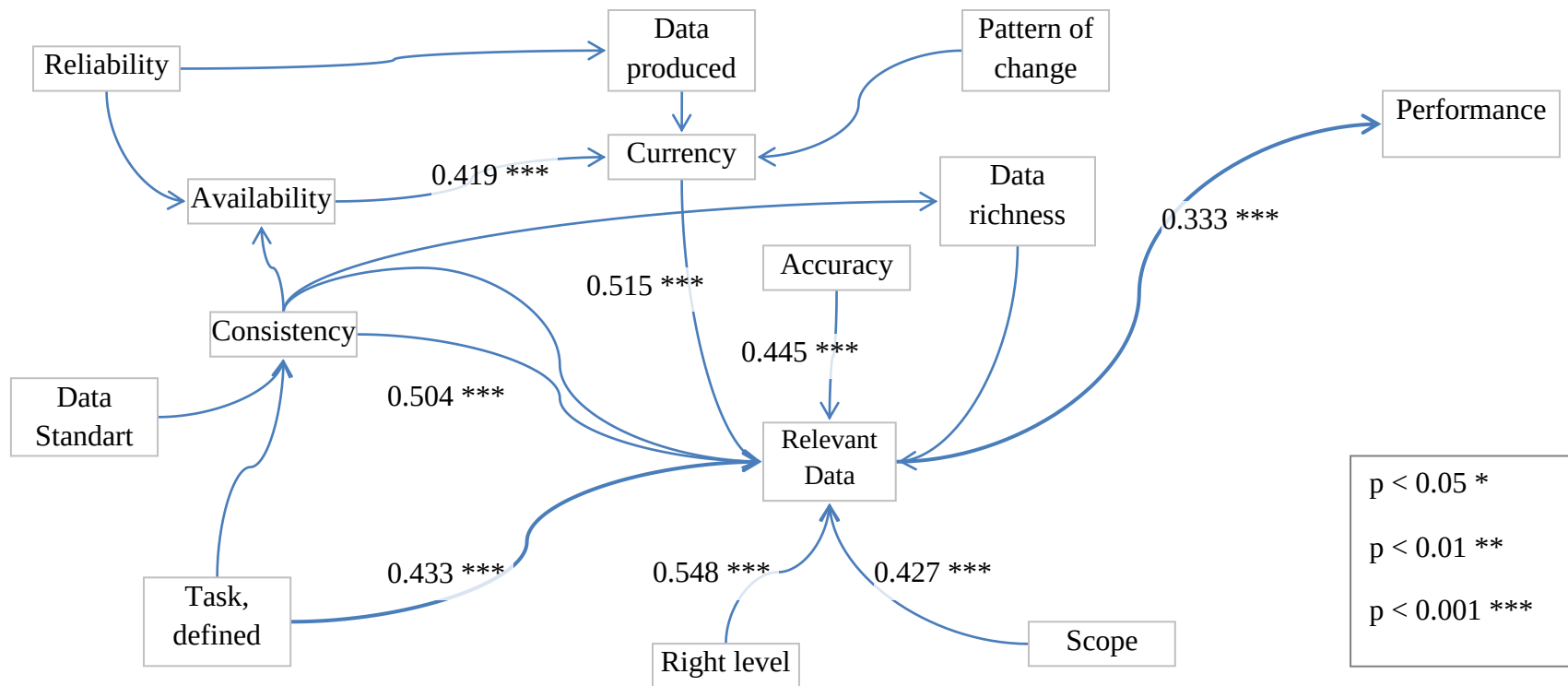


Fig. 9. Results of the TIF Model

Sample Clustering

In addition to the models of the study, sample clustering was applied on summarized constructs of the study. The cluster analyses of two, three and four were applied on summarized constructs. The most remarkable grouping formed with four cluster analysis. Number of cases in each cluster is given in Table 21.

Table 21. Significant Anova Results for Job Positions

Clusters	Number of Cases
Self and Task Oriented	42
Non Technical	10
All Important	38
Moderate	40

The first cluster is self and task oriented. The second one is non technical. They still have attitude toward self and work but are not that interested with system and information. The third one is all important one. They have high attitude of business success, information, task and self. The last one is the more moderate group. They treat most of the items equally. The study with clusters can be further improved by matching groups with demographics, recalculating factor and Anova analysis within the clusters. The details of the cluster analysis can be seen in Figure 10 and Table 22.

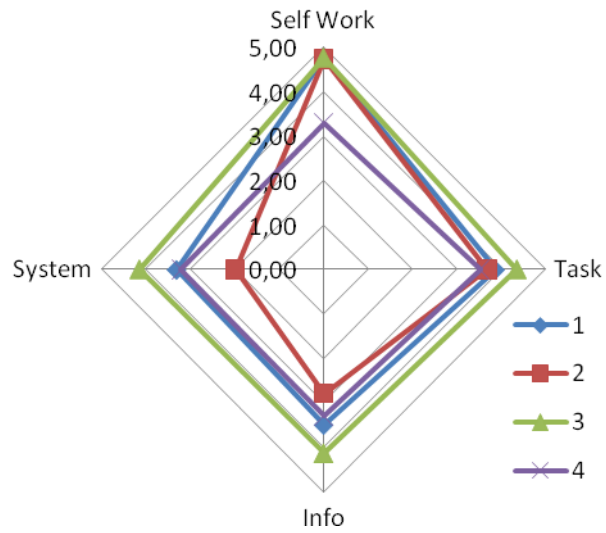


Fig. 10. Cluster analysis result with four clusters

Table 22. Cluster Analysis Results

Clusters	1	2	3	4
Self Work	4,75	4,73	4,76	3,30
Task	3,87	3,67	4,35	3,52
Info	3,49	2,79	4,14	3,29
System	3,32	1,99	4,14	3,21

CHAPTER VI

CONCLUSION

The goal of the study was to develop a model of Task Information Fit. Results indicate that the tool has been successful to model the underlying structure between system characteristics, task characteristics, information characteristics and their impact to perceived business success to some degree. Reduced TIF model targeted to discover the relation between task characteristics, information characteristics and their effect on business performance on per item basis. The correlations between the items supported the proposed relations. One of the unique contributions of this study is to reveal the underlying relations between task and information characteristics.

The frameworks proposed in this research can be used as a basis for further development of a more comprehensive framework. Dimensions from social, psychological, and organizational domains can be added to build a more complete model. The relations within the model on per item basis can be examined.

APPENDICES

A. Qualitative Study on Information Characteristics Questionnaire

1. Do you need certain information in order to carry out your professional activities / tasks?
2. How do you obtain information that you need during your tasks?
3. How do you use computer technologies in your work (e.g. e-mail, web, messenger, etc.)?
4. What are the types of information you use in your daily tasks / activities?
5. How do you use the information at work?
6. Would you list the most vital attributes of information you use at work?
7. Would you please explain the importance of the most important three attributes of information you mentioned? Beyond that what would be the effect of having the correctly unified information as a separate attribute for you?
8. What is the current situation in your work place in terms of the most important three attributes of information you mentioned and correctly unified information?
9. What should be the ideal situation at a work place about these?
10. What would be the advantages of submitting properly combined information from different sources to you?
11. What should be done in order to improve the situation at the work?

B. Qualitative Study on Task Information Fit Questionnaire

Part A: Demographic Info

1. Can you introduce yourself?
 - a. Year: (freshman, sophomore etc.)
 - b. Did you attend language preparation class? How many semesters?
 - c. Did you use leave of absence for the duration of one term?
 - d. How many times did you use the online registration system?
 - e. Gender:
 - f. GPA: (can be asked at the end)
2. Do you feel that you are more experienced on the registration process?
3. How do you feel towards using technology, especially new technologies? What type of technology and innovations do you follow most
4. If you are about to make an important decision about your life such as career, profession, which of the following explains your decision making rationale.
 - My decision making process is more systematic and logical
 - My decision making process is more intuitive
 - Before making a decision, I ask suggestions of my friends and of the beloved ones
 - I spontaneously make decisions without thinking too much
 - I usually avoid making decisions till the last minute

Part B: Task

1. What criteria determine your decision during course selection process?
2. What are the most difficult stages in the course registration?
3. What is the most critical stage in the course selection process? What information is missing regarding this stage?
4. Do you ask for help from your peers and your advisor during the course selection period? In what areas you ask for help?
5. If you want to ask something to your advisor, which communication channel do you use?
6. According to you, what stage is the most complicated one in the course selection process? Why?
7. In order to make the course selection process easier, what must be included in the registration system?

Part C: Task Specific Information Attributes

1. Is the list of offered courses always definite? Are there any changes in the list of offered courses at the beginning of semester? If yes, how important are these changes?
2. Does the system warn you about the changes regarding the registration process? Do you think such a service is important? If such services exist, do you think timeliness of them is important?
3. If you have schedule conflicts in two or more courses, how do decide on which course to choose and which to eliminate? How do you determine your priorities? Which is the leading/dominant one?
4. Is the available information on the registration system is sufficient? Are there any areas that you think the information given is insufficient?
5. Do you find enough details in the given information? What do you think about the format of the given information? How important are the details and format of the information for you?
6. Do you consider student blogs about the lessons? (Forums, blogs etc.) What other resources do you use? Which of these do you consider to be important?
7. Is the messaging available on the system practical?

Part D: Information System

1. Does the system have extensive information that is necessary for registrar office? If any, what is missing?
2. Do you consider the system fast enough? According to you, is there a problem caused by the system's speed?
3. Is the order of information and presentation about registration relevant? How does this influence the registration process?

C. Experimental Study Questionnaire

1 Yaşınız:

2 Cinsiyetiniz:

Kadın	
Erkek	

3 Eğitim durumunuz nedir?

İlk öğretim	
Lise	
Yüksek Okul	
Üniversite öğrencisi	
Lisans (Üniversite)	
Lisans üstü	

4 Hangi departmanda çalışmaktasınız?

Muhasebe	
Finans	
Bilgi Teknolojileri	
Diğer :.....	

5 Hangi pozisyonda çalışmaktasınız?

Muhasebe-Finans Uzmanı	
Muhasebe-Finans Müdürü	
Yazılım Geliştirme Uzmanı	
Yazılım Proje Yöneticisi	
Analist	
Diğer :	

6 Kurumunuz hangi sektörde faaliyet göstermektedir?

Finans	
Bilgi Teknolojileri, Telekomünikasyon	
Eğitim ve Danışmanlık	
İnşaat, Emlak	
Üretim	
Sağlık	
Turizm ve Yiyecek İçecek Hizmet Sektörü	
Diğer :	

7 İş tecrübeniz kaç yıldır?

1'den az	
1 – 3	
4 – 5	
6 – 10	
10'dan fazla	

8	Aşağıdaki cümleler size ne ölçüde uymaktadır?	Katılmıyorum				Katılıyorum
	İşimde yaptığım faaliyetler beni mesleki olarak geliştirir.	1	2	3	4	5
	İşim verdiğim emeğe değer.	1	2	3	4	5
	Bazen bana verilen görev ve çalışmalardan daha fazlasını yaparım.	1	2	3	4	5
9	İşiniz ile ilgili düşüncelerinizi ifade ediniz	Katılmıyorum				Katılıyorum
	faaliyetlerin sonucunda oluşması gereken bilgiler, ürünler, raporlar, vb. tanımlıdır.	1	2	3	4	5
	süreçler iyi tanımlanmıştır.	1	2	3	4	5
	başarı kıstasları belirlidir.	1	2	3	4	5
	faaliyetleri gerçekleştirmek için başka faaliyetlerden sağlanan bilgileri kullanmam gerekiyor.	1	2	3	4	5
	karmaşıktırlar.	1	2	3	4	5
	tamamlamak birden fazla aşama geçmek gerekir.	1	2	3	4	5
	çok yönlü düşünmeyi gerektirir.	1	2	3	4	5
	derinlemesine uzmanlaşma gerektirir.	1	2	3	4	5
	çoğu zaman yapılma, icra süresi önceden belirlenemez.	1	2	3	4	5
	çoğu zaman yapılma, icra anında gelen taleplere göre işin akışı değişebilir.	1	2	3	4	5
	kurum için stratejik değere sahiptir.	1	2	3	4	5
	yüksek seviyede risk barındırır.	1	2	3	4	5
	diğer insanlarla bir arada çalışmayı gerektirir.	1	2	3	4	5
10	İşinizi gerçekleştirirken ihtiyaç duyduğunuz bilgiler ile ilgili düşüncelerinizi ifade ediniz	Katılmıyorum				Katılıyorum
	gerekli her türlü bilgi (elektronik veya basılı) erişilebilir şekilde mevcuttur .	1	2	3	4	5
	bilgiler gerçeği yansıtmaktadır.	1	2	3	4	5
	sağlanan bilgilerden çok sayıda farklı anlam çıkarılabilir.	1	2	3	4	5

sistemde sağlanan bilgilerin yanı sıra sıklıkla başka kaynaklara da başvuruyordum.	1	2	3	4	5
bilgilerin kapsamı ihtiyacı karşılayacak genişliktedir.	1	2	3	4	5
bilgiler eksiksiz ve tamdır.	1	2	3	4	5
aynı konuya ilişkin farklı kaynaklardan aldığım bilgiler (içerik, biçim vb.) uyumsuzdur.	1	2	3	4	5
bilgiler tutarlıdır.	1	2	3	4	5
bilgiler kesindir.	1	2	3	4	5
bilgilerin detay seviyesi ihtiyaçlarıma uygundur.	1	2	3	4	5
topladığım bilgilerin yapısı sürekli değişmektedir.	1	2	3	4	5
bilgiler günceldir.	1	2	3	4	5
bilgilerin zamanla değeri azalmaktadır.	1	2	3	4	5
bilgilerin biçimi kullanıma uygundur.	1	2	3	4	5
bilgiler geçerlidir.	1	2	3	4	5
bilgiler temsil etmesi hedeflenen kavramı ölçmektedir.	1	2	3	4	5
gerekli bilgiler paylaşılmaktadır.	1	2	3	4	5
sağlanan bilgilere güvenirim.	1	2	3	4	5
gerekli yerde ve zamanda işime uygun içerik ve biçimde bilgilere erişebiliyorum.	1	2	3	4	5

- 11 Kullandığınız bilgi işlem sistemleri (yazılım, donanım, vb.) ile ilgili görüşlerinizi ifade ediniz

	Katılmıyorum				Katılıyorum
yazılımlarımız birbiri ile uyumlu değildir.	1	2	3	4	5
anahtar göstergeler kurumsal amaçlarınızı takip edebilmenize olanak tanıyor	1	2	3	4	5
bilgilerin birden çok perspektiften analiz edilmesine olanak tanıyor	1	2	3	4	5

kişisel rapor formatları üretmeme olanak tanıyor	1	2	3	4	5
sistemlerin arayüzlerinin ürünün kullanılabilirliğini arttırdığını düşünüyorum	1	2	3	4	5
ara yüzler kullanıcı dostudur.	1	2	3	4	5
sistemler yeterince hızlı değildir.	1	2	3	4	5
kullanımları konusunda eğitim ve yeterince destek alabiliyoruz.	1	2	3	4	5
kullanımı zor değildir.	1	2	3	4	5
Bu sistemde yapmak istediğim şeyi yaptırmak çok kolay oluyor	1	2	3	4	5
Bu sistemleri ve araçlarını kullanırken kendime ve bilgime güvenirim	1	2	3	4	5

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İşlerimi gerçekleştirmek için sağlanan bilgilere ilişkin düşüncelerime göre	Katılmıyorum				Katılıyorum
daha az hata yapmamı sağlamaktadır	1	2	3	4	5
işlerimi daha kolay yapmama yardımcı olmaktadır	1	2	3	4	5
işleri daha hızlı yapmamı sağlamaktadırlar.	1	2	3	4	5
performansımı olumlu yönde etkilemektedirler.	1	2	3	4	5
işte başarılı olmamı sağlamaktadırlar.	1	2	3	4	5
yakın geleceği görmemi sağlamaktadırlar.	1	2	3	4	5
stratejik analizler yapmamda destek olurlar.	1	2	3	4	5
riskleri önceden teşhis etmemde etkindirler.	1	2	3	4	5
belirsizliği azaltmamı sağlarlar.	1	2	3	4	5
geniş bakış açısıyla bakmamı sağlamaktadırlar.	1	2	3	4	5
kararlı davranmamda destek olurlar.	1	2	3	4	5
Bu sistemleri kullanılarak yöneticilerin etkili ve isabetli kararları alabilecekleri çözümlere ulaşabildiklerini düşünüyorum	1	2	3	4	5

13 Düşünceleriniz?

Teşekkür ederiz ...

D. Expert Focus Group Study Questionnaire

Özellikler	Anlam	x	Yorum	Açıklama
Demographics	Demografik			Kişinin demografik özellikleri
Age	Yaş			Kişinin yaşı
Education	Eğitim Düzeyi			Kişinin eğitim düzeyi
Gender	Cinsiyet			Kişinin cinsiyeti
Job	Meslek			Kişinin mesleği
Job Experience	İş tecrübesi			Kişinin iş tecrübesi
Job Experience at Work	Kurumdaki İş Tecrübesi			Kişinin en son çalıştığı kurumdaki iş tecrübesi
Job Experience at Current Position	Son Konumdaki İş Tecrübesi			Kişinin en son pozisyonundaki iş tecrübesi
Department	Departman			Kişinin çalıştığı departman
Sector-Industry	Sektör			Kurumun ana faaliyet sektörü
Job - Self	İş - Kişi Özellikler			Kişinin işine karşı tutumu ve yetki alanı

Özellikler	Anlam	x	Yorum	Açıklama
Self Efficacy	Öz Yeterlilik			Kişinin işinde kendini yeterli görmesi
Decision Authority	Karar Yetkisi			Kişin iş yerindeki karar yetkisi

Information Variables	Bilgi Özellikleri			İş ortamında kişiye sunulan veya kendisinin erişebileceği bilgilerin özellikleri
Reachability	Erişilebilirlik			Bilgilerin erişilebilir olması
Availability	Bulunabilirlik			Bulunabilir olması
Comprehensibility	Anlaşılabilirlik			Anlaşılır olması
Current	Güncel			Güncel olması
Consistency	Tutarlılık			Tutarlı olması
Compatibility	Uyumluluk			İçerik ve format uyumluluğu
Data standard	Veri standardı			Belirli standartların varlığı
Accuracy	Kesinlik			Bilgilerin kesin olması
Scope	Kapsam			Bilgilerin kapsamı
Level of Detail	Detay seviyesi			Bilgilerin detay seviyesi
Pattern of Data Richness	Zenginlik			Bilgilerin zenginliği, anlam ve kaynak çeşitliliği

Özellikler	Anlam	x	Yorum	Açıklama
Pattern of Change	Değişim Eğilimi			Bilgilerin değişim hızı
Shared	Paylaşılan			Paylaşılan bilgiler
Time Value	Zaman Değeri			Zamanla bilgilerin değerinde oluşan değişim
Completeness	Bütünlük			Bilgilerin eksiksiz, tam olması
Format	Format			Bilgilerin sunum formatı-biçimi
Representation	Görsel Sunum			Bilgilerin görsel sunumu
Validity	Geçerlilik			Bilgilerin geçerliliği
Importance	Önem			Bilgilerin önem durumu
Confidence	Güven			Bilgilere duyduğunuz güven
Content	İçerik			Bilgilerin içerikleri

Work Properties	İş Özellikleri		İşin özellikleri
Difficulty	Zorluk		İşin zorluk derecesi
Verb	Fiil		İşin tanımında olan temel fiil

Özellikler	Anlam	x	Yorum	Açıklama
Inputs	Girdiler			İşin gerçekleşmesi için gereken bilgiler, ham maddeler, vb.
Outputs	Çıktılar			İş faaliyetlerinin sonucunda oluşması gereken bilgiler, ürünler, raporlar, vb
Formal	Resmi			Süreçleri belirli olan faaliyetler
Informal	Gayri resmi			Süreçleri belirsiz olan faaliyetler
Controls	Kontroller			İş kıstasları
Interdependance	Bağımlılık			Farklı iş faaliyetleri ile olan ilişkisi
Complexity	Karmaşıklık			İşin çoklu adımlardan oluşması
Sophistication	Kapsamlılık			İşin derinlemesine bilgi ve uzmanlık gerektirmesi
Uncertainty	Belirsizlik			İşin sürecinde veya doğasında belirsizlikler bulunması
Strategic Level	Stratejik Seviye			İşin stratejik değeri
Risk	Risk			İşin barındırdığı riskler
Collaboration	İşbirliği			İşin diğer insanlarla birlikte çalışmayı gerektirmesi

System Properties	Sistem Özellikleri		İş yerindeki Bilişim Sistemlerinin özellikleri
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Özellikler	Anlam	x	Yorum	Açıklama
User Interface	Arayüz			Sistemin arayüzleri
Speed	Hız			Sistemin hız performansı
Ease of Use	Kolaylık			Sistemin kolay kullanılabilir olması
Support	Destek			Sistem kullanımı konusunda eğitim ve destek alınabilmesi

Performans	Performans			İş yerindeki bilgilerin iş başarısı üzerindeki etkileri
Ease of effort	Kolaylık			İşlerin daha kolay yapılmasını sağlama
Efficiency	Verimlilik			İşleri verimli bir şekilde gerçekleştirmek
Effectiveness	Etkililik			İşleri zamanında ve tam olarak gerçekleştirmek
Success	Başarı			İşte başarılı olma üzerindeki etkisi

E. Assistant Applications

C.1 Assistant Application 1

SIS Auto Registrar

This application is designed for SIS registration system. Use your user name, password and course codes to make your registration. The program utilizes all registration servers one by one and makes your registration without intervention.

The program has two advantages,

1. Utilization of node servers
2. When there is no referral to the main nodes from the main web page

In case all of the servers are open and busy the experience is not different from manual registration. Usually the system allows registration in few seconds.

Notes

- The program is not usable for add/drop period.
- The program does not collect user passwords.
- The program code is open for further development under GPL (General Public License).

For further information: <http://www2.itu.edu.tr/~aygunes/eser/Bilgisayar/ItüSisOtokayıt>

C.2 Assistant Application 2

Programmer's Web Page

What is Programmer?

It is developed in order to ease the registration process. It saves you from scattering around the online system. The user interface was developed based on the Raiser's software. The advantage of Programmer is to support offline working on schedules.

The Properties of Programmer

- One touch access to ITU's all course information.
- It uses its own database so does not require always to be online.
- It places courses selected on visual course scheduler and allows easily viewing of concurrences.
- Programmer automatically prepares course schedule based on criteria as day, hour, instructor and building.
- It restricts access of unavailable courses based on department constraints.
- It gets user comments about a course or instructor from student forum page.

- Support for schedule export to an Excel file.
- It warns you for newer versions of Programmer.
- It is easy to use and deploy.

For further information: <http://www.students.itu.edu.tr/~tek/>

C.3 Assistant Application 3

Course Registration Software

- The program allows easy registration.
- It warns you about overlapping course selections.
- You may export your schedule as an Excel file.
- You may save and reuse your schedule.
- You may use different colors for different courses.

For further information: <http://ituprogram.iscool.net/APPENDIX E>

F. Factor Analyses of the Experimental Study

Table 23. Factor Analyses of All Items

	Factors				
	1	2	3	4	5
Perform12	,987	,069	-,015	-,143	,018
In_Content1	,981	,042	,089	-,160	,035
In_Relevance	,981	,007	,040	,171	-,076
Sis_Person	,981	,007	,040	,171	-,076
Perform05	,981	,007	,040	,171	-,076
Perform06	,981	,007	,040	,171	-,076
TS_SelfWork3	,935	,141	-,312	-,084	-,034
TS_SelfWork1	,935	,141	-,312	-,084	-,034
Perform04	,925	,071	-,197	,280	,149
Ta_Defined3	,925	,071	-,197	,280	,149
Perform03	,925	,071	-,197	,280	,149
In_Avail	,925	,071	-,197	,280	,149
Perform11	,925	,071	-,197	,280	,149
Ta_Inderdep	,923	,080	-,050	-,016	,374
In_Trust	,921	-,067	,227	,295	-,092
Perform08	,921	-,067	,227	,295	-,092
In_Format	,921	-,067	,227	,295	-,092
In_Change	,914	-,058	,272	,041	-,292
In_TimeValue	,914	-,058	,272	,041	-,292
Sis_IOPx	,912	,048	-,145	,113	-,362
Perform02	,857	,031	-,126	,442	,230
Ta_Collaborat	,857	,031	-,126	,442	,230
Sis_Support	,826	-,444	,145	-,286	-,129
In_Accurate	,807	,311	-,078	,458	-,191
Ta_Strategic	,785	-,110	,430	,309	,303
In_Current	,768	-,141	,498	,092	-,366
Sis_Flex2	,768	-,141	,498	,092	-,366
Sis_UI1	,756	,018	,166	,040	,632
Ta_Sophis2	,665	-,379	-,403	,040	,499
In_Valid2	,625	-,170	,391	,465	-,460
Sis_UI2	,604	-,209	,579	,496	-,108
Perform09	,604	-,209	,579	,496	-,108
In_Content2	,011	,993	-,059	-,098	-,019
In_Valid1	,011	,993	-,059	-,098	-,019
In_Shared	-,268	,960	,034	-,074	-,009
In_DetailLevel	,264	,948	-,138	-,112	-,027
Sis_IOP_ORJ	,221	,941	-,183	,140	-,112
Ta_Uncertain2	-,255	,924	-,113	-,106	-,240
Sis_Speed_ORJ	-,028	,900	-,134	,289	,297

	Factors				
	1	2	3	4	5
Ta_Complex2	,063	,898	,127	-,300	,289
In_Consistent	,170	,895	,244	-,177	-,281
Sis_Flex1	,462	,875	-,119	-,065	-,042
Ta_Risk	,018	,846	,438	-,116	,280
Ta_Complex1	,064	,804	,249	-,245	,477
Perform07	-,150	,617	,557	-,245	,477
In_Compat_R	,231	-,261	,932	,063	,080
TS_SelfWork2	,414	-,427	-,801	-,028	-,063
In_Complete	,128	,302	-,778	-,530	,077
Ta_Defined2	,270	-,580	-,756	,021	,141
Ta_Defined1	,039	-,662	-,730	,045	,161
In_Scope2	,312	-,551	-,714	-,207	,216
Perform10	,582	-,172	,615	-,049	-,500
In_Scope1	,301	-,090	-,044	,944	,095
Perform01	,301	-,090	-,044	,944	,095
Ta_Uncertain1	,153	-,174	,162	,918	-,278
Sis_EoU1	,318	-,198	,316	,838	-,239
Sis_EoU2	,448	-,172	,267	,687	-,476
Sis_SelfEf	,554	-,108	,156	,367	-,723
Ta_Sophis1	,453	-,434	-,274	-,267	,678

* Variance explained:100

Table 24. Factor Analyses of Task Items

	Factor		
	1	2	3
Ta_Collaborat	,696		
Ta_Sophis1	,681		
Ta_Sophis2	,641		
Ta_Uncertain2	,634		
Ta_Strategic	,622		
Ta_Uncertain1	,619		
Ta_Risk	,513		
Ta_Defined2		,900	
Ta_Defined1		,811	
Ta_Defined3		,719	
Ta_Inderdep			,698
Ta_Complex1			,694
Ta_Complex2			,647

Table 25. Factor Analyses of Information Items

	Component			
	1	2	3	4
In_Avail	,808			
In_Content1	,782			
In_Relevance	,776			
In_Trust	,753			
In_Valid2	,688			
In_Valid1	,609			
In_Format	,574			
In_Consistent	,533			
In_Shared	,507			
In_DetailLevel		,765		
In_Complete		,751		
In_Accurate		,651		
In_Current		,567		
In_Scope2		,563		
In_Scope1			,398	
In_Content2			,786	
In_Compat_R			-,659	
In_TimeValue				,841
In_Change				,611

Table 26. Factor Analyses of System Items

	Component		
	1	2	3
Sis_EoU2	,988		
Sis_EoU1	,941		
Sis_SelfEf	,891		
Sis_UI2	,806		
Sis_Flex2	,684	,652	
Sis_Support		,885	
Sis_Person		,833	
Sis_UI1		,800	
Sis_IOPx		,723	
Sis_IOP_ORJ			,986
Sis_Speed_ORJ			,938
Sis_Flex1			,918

G. Regression Analysis Results of the TIF Model Environment

Table 27. Regression Analysis Results

Hypothesis	Dependent Variable	Independent Variables	B	Standardized Beta	Sig	ANOVA F	ANOVA Sig	R ²	Adj R ²
H1	Information	constant	2,32		0,000	28,729	0,000	0,183	0,177
		System	0,36	0,428	0,000				
H7	Performance	constant	1,67		0,000	19,563	0,000	0,133	0,126
		Information	0,56	0,364	0,000				
H2	Performance	constant	1,17		0,001	57,891	0,000	0,311	0,306
		System	0,73	0,558	0,000				
H4	Performance	constant	1,12		0,034	23,759	0,000	0,284	0,272
		Self work	0,57	0,533	0,000				
H5	Task	constant	2,52		0,000	35,75	0,000	0,218	0,212
		Self work	0,32	0,467	0,000				
H6	Info	constant	1,47		0,000	34,430	0,000	0,212	0,206
		Task	0,54	0,460	0,000				

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