

# ER<sub>ee</sub>R<sub>isk</sub>- EFFICIENT RISK IMPACT MEASUREMENT TOOL FOR REENGINEERING PROCESS OF LEGACY SOFTWARE SYSTEM

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## ABSTRACT

**ER<sub>ee</sub>R<sub>isk</sub>** (*Efficient Reengineering Risk*) is a risk impact measurement tool which automatically identifies and measure impact of various risk components involve in reengineering process of legacy software system. **ER<sub>ee</sub>R<sub>isk</sub>** takes data directly from users of legacy system and establishes various risk measurement metrics according to different risk measurement scheme of ReeRisk framework [1]. Furthermore ER<sub>ee</sub>R<sub>isk</sub> present a variety of statistical quantities for project management to obtain decision concerning at what time evolution of a legacy system through reengineering is successful. Its enhanced user interface greatly simplifies the risk assessment procedures and the usage reaming time. The tool can perform the following tasks to support decision concern with the selection of reengineering as a system evolution strategy.

- [1] To establish promising risk measurement models for legacy system under evaluation.
- [2] To measure risk impact of specific risk component of legacy system under evaluation
- [3] To identify& establish various risk measurement index for risk impact measurement.
- [4] To establish and measure perspective and domain specific risk impact of legacy system.
- [5] To identify the source of risks and indicates how they affect impact of particular risk component.
- [6] To determine the validity of risk measurement models from field data.

## KEYWORDS

ReeRisk, Risk engineering, Reengineering

## 1. INTRODUCTION

Now a day's legacy systems [2-5] are continuously maintained to accommodate changing business and user requirements. Legacy systems and the data they process are vital assets for the organization that use them. On the other side most of the legacy systems we use have difficult design structure have unproductive coding and imperfect documentation. All over the world software organizations are facing tremendous pressure to evolve their legacy systems to satisfy current market needs and rapidly changing technologies [6].

Maintenance of legacy system to satisfy changing user and business requirement is difficult. However many organizations are planning to modernize their legacy system to remain viable. Legacy system evolution strategy depends on some important factors such as its technical condition, its managerial significance and the type of the organization involved in maintaining and operating the system. Many solutions are available for legacy system modernization. Continued maintenance, reengineering [7] and replacement are the common modernization

strategies of which one or a combination may be an appropriate way to modernize a legacy system [8]. Reaching a decision about how to evolve a legacy system cannot be made impulsively; rather it requires understanding the strengths and weaknesses of each evolution technique. Over the past few years reengineering emerged as a popular modernization technique.

Software re-engineering is gaining attention as the base of installed software ages and need replacement. Software re-engineering takes a legacy software system and generates from it a new system that has the same quality as software created by modern software engineering practices. software re-engineering is defined by Chikofsky and Cross as the assessment and modification of a software system to reconstitute it in a new form and the subsequent implementation of the new form [9]. Empirical results of reengineering shows that re-engineering can really improve existing software [10]. Reengineering analyze, design and implement existing legacy system and apply modern techniques and methods to redesign and reshape that system into more suitable software.

On the other hand software re-engineering process is complex because many variations of the reengineering process are possible. A broad range of issues and concerns must be considered to understand and model the re-engineering process. Just as engineering implies a disciplined process supported by engineering methods and automated tools, reengineering practice also requires a disciplined process supported by methods and tools. We can define reengineering as an engineering problem that requires a quantitative analysis of the problem and consideration of reengineering risk in its solution. Effective redevelopment of legacy systems through reengineering requires attention to various aspects of reengineering process. Reengineering of legacy system into new improved target system is a challenge due to the various risk components and their impact on software quality. Successful reengineering process requires to identify and measure various risk components emerged from three distinctive but connected areas of interest i.e. system domain, managerial domain and technical domain. [11]

The goal of software risk management [12] [13] focuses on identification and controlling of cost, schedule and quality risk within the software development process. Now a day's certain goals such as risk identification and risk assessment of legacy system to support system modernization activities have gained importance recently. Decision concerning when to evolve a legacy system through reengineering requires risk assessment of legacy application from system, managerial and technical point of view.

In this paper we give emphasis on design and development of an EReeRisk tool to support outline process of ReeRisk framework [14-16]. ReeRisk framework is a risk assessment modal that shows links between domains, perspectives, risk components and factors of legacy system by considering required state of target system. The ReeRisk framework illustrates important risk issues involve in the development cycle. Framework provide developing and implanting risk engineering mechanism focussed on system, managerial and technical aspects of legacy and target system and support to achieve successful reengineering effort.

Proposed EReeRisk tool helps to identify and measure impact of system, managerial and technical risk components of legacy system in concern with requirements of target system. EReeRisk result can be used to take decision about reengineering of legacy system. The main focus is to identify and categories various risk components for system, managerial and technical domain of legacy system to support decision making process. The purpose is to identify important risk factors and develop an efficient set of risk measurement metrics for planning and evaluating various risk components from three different aspects of legacy system.

## **2. EReeRisk (EFFICIENT REENGINEERING RISK IMPACT MEASUREMENT TOOL)**

This section presents the main objectives, features, architecture, and the information content of the EReeRisk tool.

### **2.1 Objective of EReeRisk Tool**

Following are the key objectives of EReeRisk tool to support decision concern with the selection of reengineering as a system evolution strategy.

1. To access and compute legacy software data deem pertinent to reengineering characteristics. EReeRisk accesses three major dimensions of legacy application: System dimension, managerial dimension and technical dimensions.
2. To measure risk impact automatically whenever possible by measuring the various measures related to particular risk component of legacy system.
3. To perform risk assessment in a user-friendly and user-flexible fashion
4. To display specific as well as comprehensive risk impact of legacy application.

### **2.2 EReeRisk Context**

To date there is a lake of automated software risk measurement tools and systematic approaches to measure specific and comprehensive impact of different risk components. EReeRisk is a risk measurement tool which automatically measure overall impact of different reengineering risk emerged from system, managerial and technical domain of legacy system.

The EReeRisk application has been developed to support the use of the ReeRisk framework by project manager to take decision about evolution of legacy system. It is an Internet browser-based application that supports users in all steps of the ReeRisk framework by computing specific and overall impact of different reengineering risk emerged from system, managerial and technical domain of legacy system.

The EReeRisk tool provides support to understand different measurement metrics used to measure risk impact of legacy application. The EReeRisk has been developed to run on the Intranet and support standard Internet browser. The user interface metaphor is similar to web pages and users can access the application without installing any special software on their workstation.

EReeRisk measurement tool takes data from existing stakeholders of legacy system, calculate impact of each risk components according to established risk measurement metrics of ReeRisk framework and display various options using established mean opinion score board for project manager to take decision about when evolution of legacy system through reengineering is successful.

Enhanced user interface of EReeRisk make simpler the risk measurement process and support management decision about legacy system evolution through reengineering.

### **2.3 Functional Overview of EReeRisk**

The EReeRisk, risk measurement tool can perform the following task to support the evolution process of legacy system.

- Establish ReeRisk pentagram model to measure overall impact of all risk components emerged from system managerial and technical domain of legacy system.
- Measure specific and comprehensive impact of all risk components of system domain.
- Measure specific and comprehensive impact of all risk components of managerial domain.
- Measure specific and comprehensive impact of all risk components of technical domain.
- Identify sources of risk components using Rcause model [17]
- Provide help for the measurement of individual risk components using established risk measurement metrics.

The EReeRisk allows the tracking status of risk impact information. Summary reports for specific and comprehensive status of risk impact for system managerial and technical domain can be printed or viewed as required. The EReeRisk tool has functionality to measure risk impact of individual risk component, risk impact of specific perspective of each domain of ReeRisk framework, risk impact of each domain of ReeRisk framework and finally a comprehensive risk impact of all the domain of ReeRisk framework.

## **2.4 Selecting Scope of EReeRisk tool**

Users have available to them three Scope operations which allow them to determine the scope to which risk impact measurement is performed. These are:

- Domain  
We characterize domain as a field of study which includes a set of common perspectives, risk cluster, and relative risk factors to identify and measure cumulative risk impact in reengineering process of legacy system. Domain represents a subset of ReeRisk framework.
- Perspective Model  
Perspective can be express as a viewpoint to which different risk clusters are identified and measured using different risk measurement model.
- Risk Component  
We define risk component to incorporate different types of negative outcomes from system, managerial and technical domain of legacy system.

### **2.4.1 Select Domain criterion of ReeRisk Framework**

The screen in Figure 1 shows the selection of domain of ReeRisk framework. ReeRisk framework is a risk impact assessment modal that shows links between different domains, perspectives, risk components and factors of legacy system.

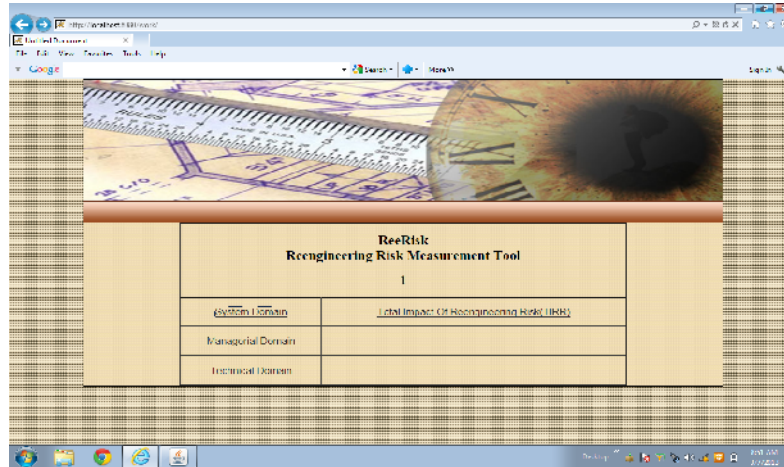


Figure: 1 Domain criterion of ReeRisk

ReeRisk Framework gives focus on developing and implanting risk engineering by concentrating system, managerial and technical area of legacy and target system to realize successful reengineering effort. The enterprise ReeRisk framework represents a starting point for assessing risk components for a synergistic set of system, managerial and technical aspects of legacy system and achieving a disciplined and successful reengineering approach for system evolution. A link is appears for the users to choose the specific as well as comprehensive impact measurement of reengineering risk. The selections of ReeRisk domain criteria are easily controlled by separate link buttons.

#### 2.4.2 Select Perspective Criteria of ReeRisk Framework

The screen in Figure 2, 3 and 4 shows the selection of various perspectives for different domain of ReeRisk framework. The purpose is to identify important risk factors and develop an efficient set of risk measurement metrics for planning and evaluating various risk components from three different aspects of legacy system.

##### ➤ System Domain

In ReeRisk framework risk engineering begins with system domain. The term “System domain” denotes a structural unit that is responsible for maintaining a system that provides products and services to its customers. In system domain two types of perspective model i.e. infrastructure perspective model and stakeholder perspective model is developed by analyzing existing states of legacy system and desired state of target system.[14]

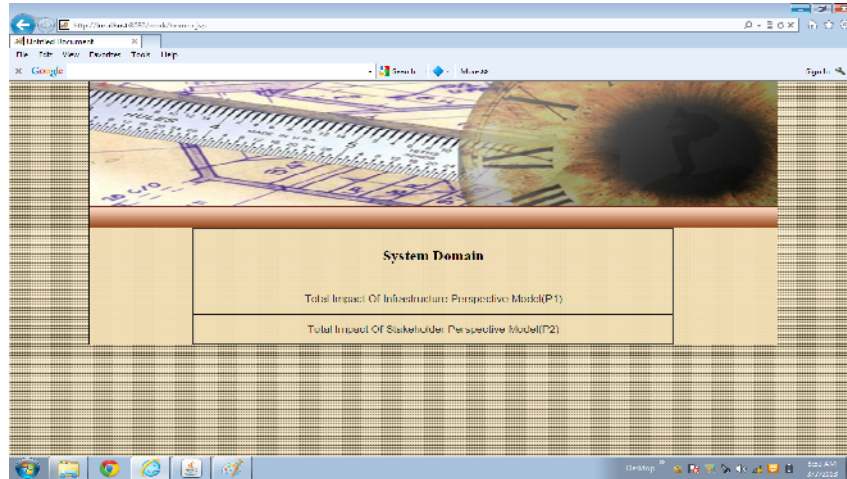


Figure: 2 Perspective criterion of ReeRisk System Domain

### ➤ Managerial Domain

Managerial domain of ReeRisk framework covers managerial issues related to system evolution process .Impact of market factors and effect of competitive products, on quality [16] & cost of target system are measured within the context of managerial domain. The elements of managerial domain consist of business perspective model and economic perspective model. [15]

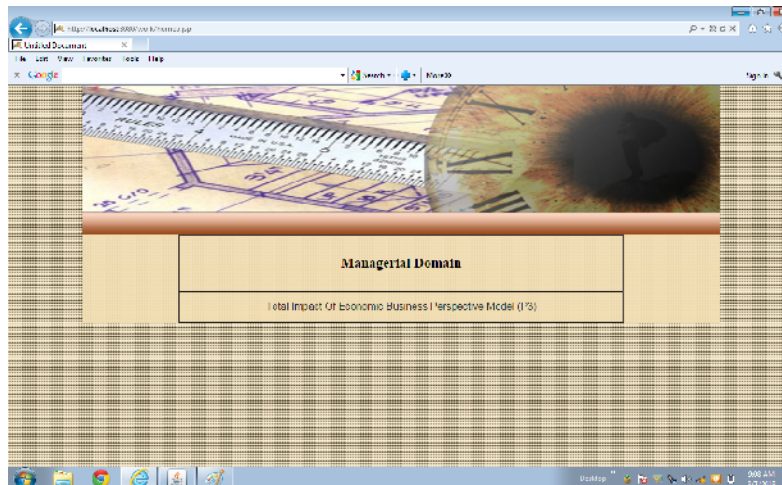


Figure: 3 Perspective criterion of ReeRisk Managerial Domain

### ➤ Technical Domain

Technical domain of ReeRisk framework has a significant impact on software functionality and software quality. The elements of the technical domain consist of functional perspective model and quality perspective model. [16]



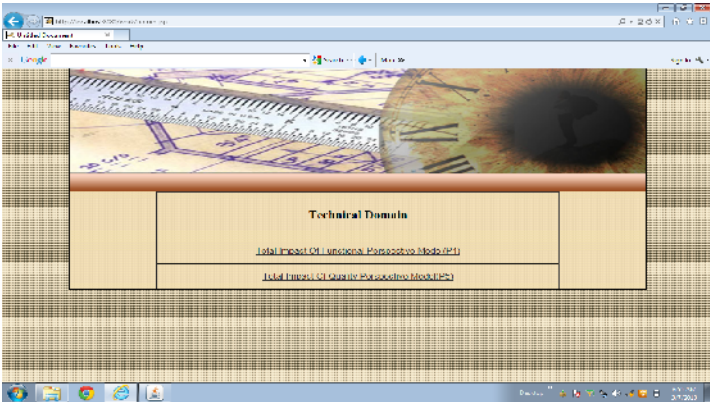


Figure: 4 Perspective criterion of ReeRisk Technical Domain

2.4.3 Select Risk components Criteria of ReeRisk Framework

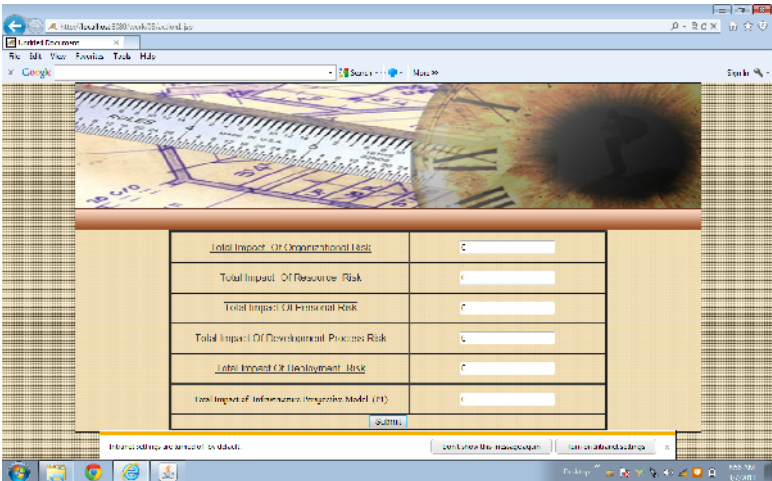


Figure: 5 Infrastructure Perspective Risk Components

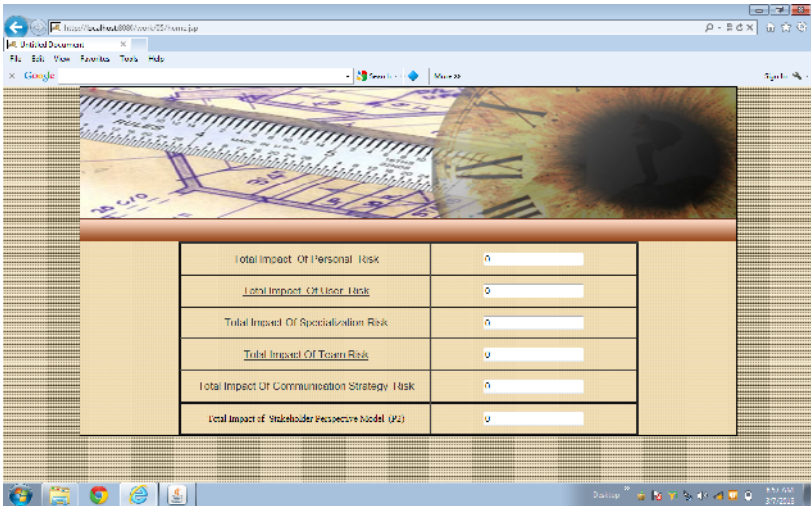


Figure: 6 Stakeholder Perspective Risk Components

Welcome...	
Total Impact Of Development Process Risk	<input type="text"/>
Total Impact Of Marketing Strategy Risk	<input type="text"/>
Total Impact Of Product Usability Risk	<input type="text"/>
Total Impact Of Financial Risk	<input type="text"/>
Total Impact Of Operational Risk	<input type="text"/>
Total Impact Of Economic & Business Perspective Model (P3)	<input type="text"/>
<input type="button" value="Submit"/>	

Figure: 7 Business & Economic Perspective Risk Components

Total Impact Of Project Complexity Risk	<input type="text"/>
Total Impact Of Technology Risk	<input type="text"/>
Total Impact Of User Risk	<input type="text"/>
Total Impact Of Performance Risk	<input type="text"/>
Total Impact Of Resumption Risk	<input type="text"/>
Total Impact Of Functional Perspective Model (P1)	<input type="text"/>

Figure: 8 Functional Perspective Risk Components

Total Impact of Quality Perspective Model (P3.1)	<input type="text"/>
Total Impact of Quality Perspective Model (P3.2)	<input type="text"/>
Total Impact of Quality Perspective Model (P3)	<input type="text"/>
<input type="button" value="Submit"/>	

Figure: 9 Quality Perspective Risk Components



Total Impact of Availability Risk	<input type="text"/>
Total Impact of Reliability Risk	<input type="text"/>
Total Impact of Modularity Risk	<input type="text"/>
Total Impact of Usability Risk (TIUR)	<input type="text"/>
Total Impact of Performance Risk	<input type="text"/>
Total Impact of Quality Perspective Model (P 5.1)	<input type="text"/>
<input type="button" value="Submit"/>	

Figure: 10 Quality Perspective Risk Components

Total Impact of Maintainability Risk	<input type="text"/>
Total Impact of Project complexity Risk	<input type="text"/>
Total Impact of Software Architecture Risk	<input type="text"/>
Total Impact of Training Risk	<input type="text"/>
Total Impact of Security Risk	<input type="text"/>
Total Impact of Quality Perspective Model (P 5.2)	<input type="text"/>
<input type="button" value="Submit"/>	

Figure: 11 Quality Perspective Risk Components

The screens in Figure 5-10 show the selection of various risk components for different perspectives from system, managerial and technical domain of ReeRisk framework. The enterprise ReeRisk framework consists of three domains that are building blocks for a successful decision making process to select reengineering as a system modernization technique. Each domain covers different perspectives of software development process that are essential for developing risk engineering framework. For each perspective one or more risk components are identified .The perspective models and respective risk components of ReeRisk framework to measure total risk impact (TRI) are presented in Table 7.1.

**Table 1 ReeRisk framework Total Risk Impact (TRI) Index**

	Perspective Model	Pentagram Model	Risk Components	Total Risk Impact Index
System Domain	Infrastructure Perspective Model	P1	1. Organizational Risk component	TIOR
			2. Resource Risk component	TIRR
			3. Deployment Risk component	TIDR
			4. Development Process Risk component	TIDPR
			5. Personal Risk component	TIPR
	Stakeholder Perspective Model	P2	1. Communication Strategy Risk component	TICSR
			2. Personal Risk component	TIPR
			3. Specialization Risk component	TISR
			4. User Risk component	TIUR
			5. Team Risk component	TITR
Managerial Domain	Economic Perspective Model & Business Perspective Model	P3	1. Development Process Risk component	TIDPR
			2. Marketing strategy Risk component	TIMR
			3. Product competition Risk component	TIPCR
			4. Financial Risk component	TIFR
			5. Operational Risk component	TIOR
			1. Availability Risk component	TIAR

Technical Domain	Quality Perspective Model	P4 $P_{4.1} + P_{4.2}$	2. Reliability component Risk	TIRR
			3. Modular component Risk	TIMR
			4. Usability component Risk	TIUR
			5. Performance component Risk	TIPR
			6. Software Architecture component Risk	TISAR
			7. Project complexity Risk component	TIPCR
			8. Maintainability Risk component	TIMR
			9. Training component Risk	TITR
			10. Security component Risk	TISR
	Functional Perspective Model	P5	1. User component Risk	TIUR
			2. Technology component Risk	TITR
			3. Performance component Risk	TIPR
			4. Project complexity Risk component	TIPCR
			5. Resource component Risk	TIRR

### 3 TECHNOLOGY USED

Development of EReeRisk measurement tool use NetbeansIDE7.2 to produce the output with the help of tomcat server7.0 version and for the design of pages in the tool used JSP and CSS code .All the experiments of tools will be performed on a 2.40GHz Intel(R) Core(TM) i5-2430 MB memory, 4GB RAM running on the Windows XP Professional OS. Programs will be coded in java.

Technologies used in EReeRisk measurement tool are:

- **Tomcat server:** - Tomcat application server provides services such as security, data services, transaction support, load balancing, and management of large distributed systems. Apache Tomcat is an open source web server. Tomcat implements the Java Servlet and the Java Server Pages (JSP) specifications from Oracle Corporation, and provides a "pure Java" HTTP web server environment for Java code to run.
- **JSP:** - Java Server Pages (JSP) is a technology that helps software developers create dynamically generated web pages based on HTML, XML, or other document types. Deployment of Java Server Pages requires a compatible web server with a server container, such as Apache Tomcat or Jetty.
- **CSS:** - Cascading Style Sheets (CSS) is a style sheet language used for describing the presentation semantics (the look and formatting) of a document written in a markup

language. It's most common application is to style web pages written in HTML and XHTML, but the language can also be applied to any kind of XML document, including plain XML, SVG and XUL.

- **JAVA SCRIPT:** - JavaScript is a prototype-based scripting language that is dynamic, weakly typed and has first-class functions. JavaScript copies many names and naming conventions from Java, but the two languages are otherwise unrelated and have very different semantics. The key design principles within JavaScript are taken from the self and Scheme programming languages. It is a multi-paradigm language, supporting object-oriented, imperative, and functional programming styles.

## 4 CONCLUSION

In order to assist managers to take decision about when evolution of a legacy system through reengineering are likely to succeed and when they are likely to fail a quantitative risk-assessment tool is needed. Since managers have limited tools to assess risks and no formal tools are available to measure impact of various risk components. Developed tool can be used by any organization contemplating reengineering and estimate the impact of various risks associated with system managerial and technical domain of legacy system. The Three domain section of EReeRisk has been applied to any legacy software system for the impact measurement of various risk components from system, managerial and technical domain of legacy system.

Upon its full implementation, EReeRisk will provide extensive support to risk measurement in a flexible and friendly user interface. EReeRisk is designed as a tool that is easy to learn and to use. In addition, EReeRisk display various statistical quantities for project management to support decision with reference to the evolution of a legacy system through reengineering.

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