Soft Computing Based Framework for Risk Assessment in Global Software Engineering

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Abstract: Global Software Engineering (GSE) is still an immature field, with palpable shortage of systematic guidelines and best practices in various contexts. This paper presents an approach that uses Soft Computing paradigm for evaluating risks in GSE context. The paper first presents a systematic hierarchical organization of the risk categories in GSE. Then, with help of empirical data, an Adaptive Neuro-Fuzzy Inference System (ANFIS) is developed to accurately assess risk for a particular GSE project. Results indicate that the framework is reliable enough to be adopted by project managers working on globally distributed projects.
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1. Introduction

Global Software Engineering (GSE) encompasses conduct of software development life cycle at distributed level, either outsourcing the employees of the same organization or as a collaborative venture of different organizations, requiring innovation and effectiveness of followed practices and techniques for achieving desired quality of the resulting product.

With the emergence of era of globalization, many new trends flourished in software industry along with all other disciplines. GSE is a newly adopted but a rapidly growing phenomenon of Software Engineering, which is not only gaining acceptance by IT professionals, but also achieving a vigorous attention of researchers due to its huge impact on global IT environment. Outsourcing with global IT services and software development has been ranked as one of the top business ideas of the past 100 years according to Harvard Business Manager (Ebert, 2012). It is perhaps due to the reason that in spite of being highly complicated and risk involving approach, GSE brings many benefits to its practitioners, providing them with reason to be adopted and undoubtedly serves as a key to competitive environment. Some of the core benefits of GSE include:

- **Versatility of expertise from various locations-** Since various geographical areas have different professional and technical practices followed, they develop unique expertise as compared to other areas. Thus, hiring human resource from more than one location makes variety of specialties available to the team and helps them in achieving excellence in the competitive development environment.
- **Better intellectuality and novelty of ideas-** When minds from various locations / different backgrounds are involved, it broadens the scope of intellect and vision, consequently becoming a great help to add creativity to the product.
- **Better Time Management-** GSE involves round-the-clock working of team in case of locations in different time zones.
- **Better Hardware Resource Management-** This refers to round-the-clock usage of hardware resources by various members; due to the rising concept of cloud computing, hardware resources present at one location can be used by teams of distant locations as well. This concept, when incorporated in GSE prevents vendors/ developers from purchasing high amount of hardware devices and making them available to the other team members.
- **Less requirement of in house arrangements / equipment-** GSE provides an opportunity to run business without huge buildings along with furniture requirements, IT equipment requirements, utility bills and many small, unnoticed expenditure, saving owners from huge mess and financial strains.
- **Cost Effectiveness**- It helps due to the difference of labor cost and currency differences.
- **Huge opportunities for IT Professionals-** Besides its contributions for development firms, GSE provides promising opportunities to IT individuals all over the world for their career boost and financial strength.

As the number of outsourcing ventures carrying out software development through globally distributed and temporally or culturally diverse human resource increased heavily in last two decades, GSE has been highlighted as a specific research area. However, studies show that still many relevant areas and their details are left uncovered by GSE researchers. Amongst these, GSE project management is the major point of concern for researchers, and if we narrow down various aspects of management we come to the conclusion that Risk Management in GSE is a field that needs much more exploration than paid before and needs to be addressed and sorted out on priority basis keeping in view the number of failed projects and consequently the ultimate financial loss to the software industry. The purpose of this work is to present a comprehensive framework for risk assessment in GSE which involves the following contributions:

i. The paper presents taxonomy of major risks in GSE.

ii. It presents a Soft Computing approach for risk assessment in GSE based on the proposed risk taxonomy

iii. It also introduces a prototype software tool that implements the proposed framework. that for GSE risk assessment.

Rest of this paper is organized as follows. Section 2 presents literature review of GSE risk assessment. Section 3 describes the proposed GSE risk assessment framework. Section 4 presents experimental validation of the approach. Finally, section 5 concludes the paper.

2. Literature Review

In the past few years, many studies appeared to envisage solid solutions towards issues pertaining to GSE. However, looking at the number of challenged projects and untapped potential the industry still feels that the area of Risk assessment in GSE is yet to be addressed with more efforts. Some studies like (Ebert et al, 2008) discuss various risks and mitigation practices in GSE. (Prikladnicki et al, 2004) discussed the factors urging software business personnel to move towards GSE and lessons learned from GSE practices. (Smite et al, 2010) evaluated recent state of the art in GSE by systematically reviewing empirical research related to the field. Researchers concluded their results by declaring GSE as an immature field with lack of empirical evaluation of techniques and methods in industrial context and emphasized on the need of in-depth analysis of the same. (Babar and Zahedi, 2012) presented a review aimed to identify the state of the art in research pertaining to GSE challenges, benefits and related issues along with identifying the areas being focused and existing gaps in literature regarding the same. (Raza et al, 2013) analyzed the issues currently being addressed in research regarding GSE. The researchers used new Systematic Snapshot Mapping (SSM) technique for this purpose and offered their conclusion that managerial and infrastructure matters are currently being focused in literature addressing the topic, instead of distance or human related factors. (Parviainen, and Tihinen, 2011) analyzed knowledge related challenges of GSE and presented knowledge engineering as a key player in GSE. The authors worked on 50 case studies from cognitive perspective and presented example solutions to mitigate GSE challenges. (Nurdiani et al, 2011) presented a checklist for risks involved in GSE and their mitigation through systematic literature review. (Šmite and Borzovs, 2008) devised a probabilistic framework comprising a knowledge base and a risk barometer for GSE, intended for managers inexperienced in global development. (Qadeem and Ghayyur, 2010) presented a taxonomy of GSE risks and also suggested guidelines for mitigating these risks. (Herbsleb, 2007) described distant coordination as key phenomena in GSE and emphasized on the need to develop better understanding of the required kinds of coordination. (Beecham et al, 2011) introduced the Global Teaming Decision Support System - GTDSS for GSE for managers. (Magnusson and Chou, 2010) presented a GSE risk and compliance management system by combining COSO-ERM, ISO 20000 and ISO 27001 standards for ERP systems. (Lamersdorf et al, 2010) presented a rule-based model for early assessment of risks in GSE. The system can adapt itself in light of experience to work appropriately for different project characteristics. (Jabangwey, 2011) presented a survey on prominent risk management approaches in GSE. (Takacs, 2011) presented Fuzzy Logic based decision making system for risk assessment.

Literature review clearly ratifies the significant requirement to dig out quantitative risk assessment in GSE, since there is very little work found worldwide compared to other domains, especially in case of risk assessment in GSE.

3. Theoretical Background

3.1. Fuzzy Inference Systems (FIS)

Fuzzy Logic is an approximate reasoning approach which supports truth values ranging between 0 and 1 unlike typical crisp Boolean logic, therefore it offers support for linguistic variables as well. Fuzzy Logic was presented by Lotfi Zadeh, in 1965, based on the theory of Fuzzy Sets and its initial application was in the field of control systems. Initial research showed that more precise results can be generated in control systems if they are not bound to produce output in rigid true or false values. Fuzzy Logic is commonly used in various dimensions including artificial intelligence, embedded/ real time applications, security decision systems, variety of electronic appliances used for both commercial as well as domestic purposes and analytical projects. However, significance of FIS is not limited to control systems, rather another aspect of its popularity lies in its utilization as expert systems with the capability of analyzing the information and produce results/ suggestions simulating human reasoning. The inference in FIS comprises three (3) main steps: fuzzification, inference and defuzzification. Fuzzification refers to the conversion of real valued variables into linguistic variables. Inference is processing of the fuzzified input on the basis of predefined rules to generate output. Usually, generalized modus ponens is used as inference mechanism. Finally, defuzzification refers to the conversion of fuzzy results into crisp output variables.

FIS and Fuzzy Logic has a lot of potential application in the field of risk management where algorithmic decision making is difficult due to versatility of the projects undertaken. This variance becomes even more unwieldy when it comes to software-focused projects due to intangible nature of the product. GSE can clearly take advantage of Fuzzy Logic in addressing the issue of risk assessment.

3.2. Artificial Neural Networks (ANN)

ANN's incorporate mimicry of biological neurons and are devised for intelligent or Expert systems to simulate human decision making. Unlike conventional algorithmic systems ANN's learn to tune their behavior from experiential data. This makes ANN's much more flexible and proximate to human decision making patterns in the real world. ANN's may be of two types of structure: feedforward or feedback. In case of feedforward network, signals in the network travel only in the forward direction, whereas signals may move in backward as well as forward direction in feedback networks introducing loops in the network (Nunes and Marques, 2012).

Since Neural Networks provide flexibility to achieve results on the basis of trained data, it helps a lot in risk assessment as we can gain much learning of the risk behavior and their effects from historical data of similar projects. ANN's have been used for risk assessment in business domain for analysis and risk calculation, however no adequate approaches are yet proposed in the field of Software Engineering and specially GSE.

3.3. Adaptive Neuro-Fuzzy Inference Systems (ANFIS)

ANFIS integrates both approaches FIS and ANN; therefore it enjoys the potential to attain the benefits of both above mentioned approaches in a single framework. The FIS provides facilitation in knowledge elicitation from experts and specifying it in an easily interpretable form. However, generally the structure of an FIS is chosen arbitrarily depending on intuition of the expert. An ANN provides capabilities to optimize the FIS structure on the basis of actual data. An ANFIS is created by combining a Takagi-Sugeno (TS) FIS with an ANN to optimally combine learning and knowledge.

Since risk assessments have more to do with experience than calculations especially in case of software projects therefore idea of ANFIS as a risk assessment approach sounds promising.

4. Proposed Approach

4.1. Basic Concepts

Proposed approach for risk assessment in GSE includes several elements which are Risk Factors, Risk Categories, Probability of Risk occurrence, Severity if they occur, and Risk Impact, all depicted and assessed in the form of Risk Matrix. The relationship between these risk elements is depicted in Figure 1.

For identification of these elements in GSE context, we have resorted to the technique of grounded theorizing, wherein we have collected qualitative data from various sources including surveys, questionnaires, interviews, and research literature to conceptualize and categorize important risk factors and risk categories along with their inter-relationship. Below we describe each element in detail:

4.1. 1. Risk Factors

Risk factors refer to the attributes of the project which can suffer from various kinds of risks or threats. These factors are meant for classification of the project so that it is evaluated as to how much risk is involved in a specific type of project with given criteria.

4.1.2. Risk Categories

We studied various papers and case studies regarding GSE projects and after scrutinizing the suggestions / classification of many authors we filtered common risks involved in GSE projects. These were further enhanced on the basis of interviews with experts actually involved in the business. The list was then refined to combine similar risks into groups which we call risk categories. The whole process resulted in taxonomy of GSE risks as shown in Figure 2. At the highest level, risks are classified into internal and external risks, which are further elaborated next.

A. Internal risks represent the risks emerging from internal factors of development e.g. immediate stakeholders, team members, contractors / purchasers or technology related issues. Internal risks are further divided into Technical and Managerial threads.

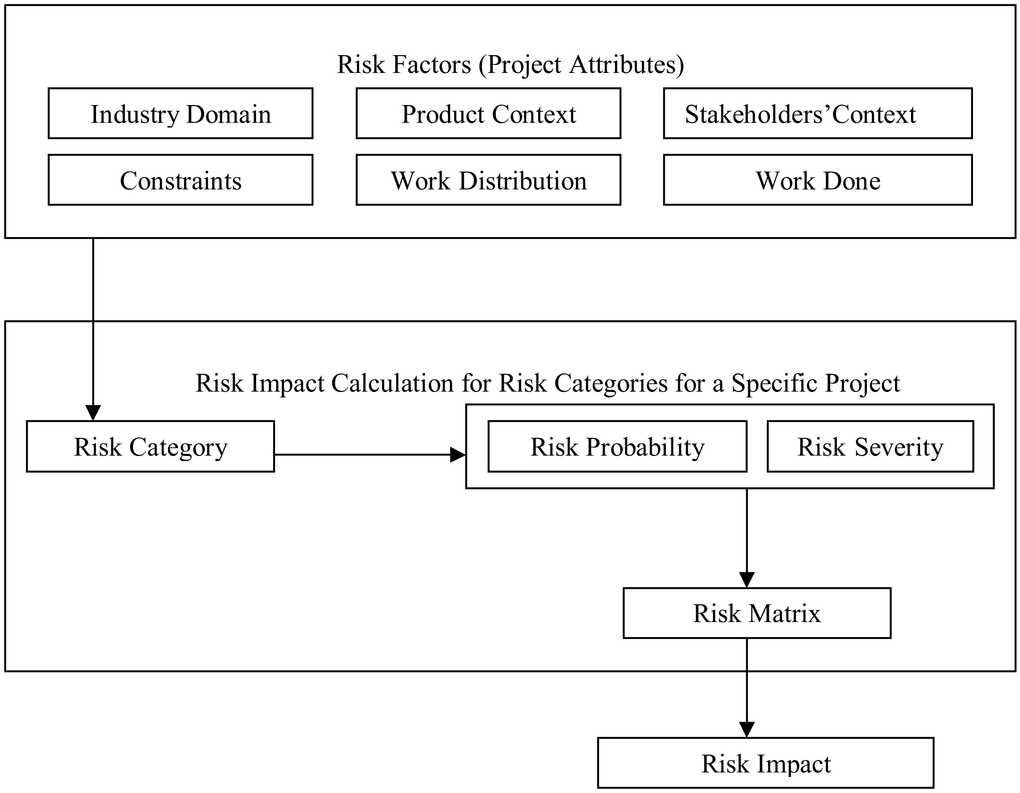

Figure 1. Risk Elements

Technical aspects give rise to three types of risks namely bleeding edge/ Cutting edge technology risks, compatibility risks and integration risks.

- **Bleeding Edge Technology Risk** refers to the criticality of using emerging technology since new technologies does not possess surety of success until experienced. IT technology offers the fastest evolution rate proffering more and more challenges to developers.
- **Compatibility issues** can arise in context of development being carried out at more than one location due to versions of the software / hardware used.
- **Integration issues** are related to modular development and can take drastic proportions when development is done in geographically separate locations.

Managerial issues include financial risks, poor supplier service risks, human resource risks, inadequate Intellectual Property Rights (IPR) management risks, project delivery risks and inadaptability with overly high change rate.

- **Financial Risks** arise due to insufficient budget planning and overlooking inflation rates in accordance with the timelines of the project. These can be controlled if careful estimation and trend analysis of market rates is done. These are further classified into wage inflation, cost inflation, and lock-in risks. Wage inflation refers to increase in wages with the passage of time which is aggravated if timelines are not followed. Cost inflation refers to cost of equipment / software used and lock-in risks refer to the seized amounts idea.
- **Poor Supplier Services Risks** have high probability of occurrence in projects where third party is involved for provision of any kind of services/ hardware/software.
- **Human Resource risk** is one of the major and most influential risks in GSE projects. However, same can become the strongest factor in success of any project if managed carefully. Human resource aspect is categorized into two areas: staff turnover and insufficient competencies. Staff turnover refers to the rate of change of staff which can prove itself to be highly critical if occurs during the course of project as it takes time for new members to fully cope with the details and requirements and acquire understating of the ongoing work. This usually happens due to wages issues and thus the two risks are interrelated with each other. Another human resource issue is insufficient competencies. Competencies of resources is a challenge in present era of ever evolving technology since GSE involve resources from

more than one location as their level of understanding and their competencies may vary and if so, consequences can take the form of lack of understanding thus creating loop holes in the activities.

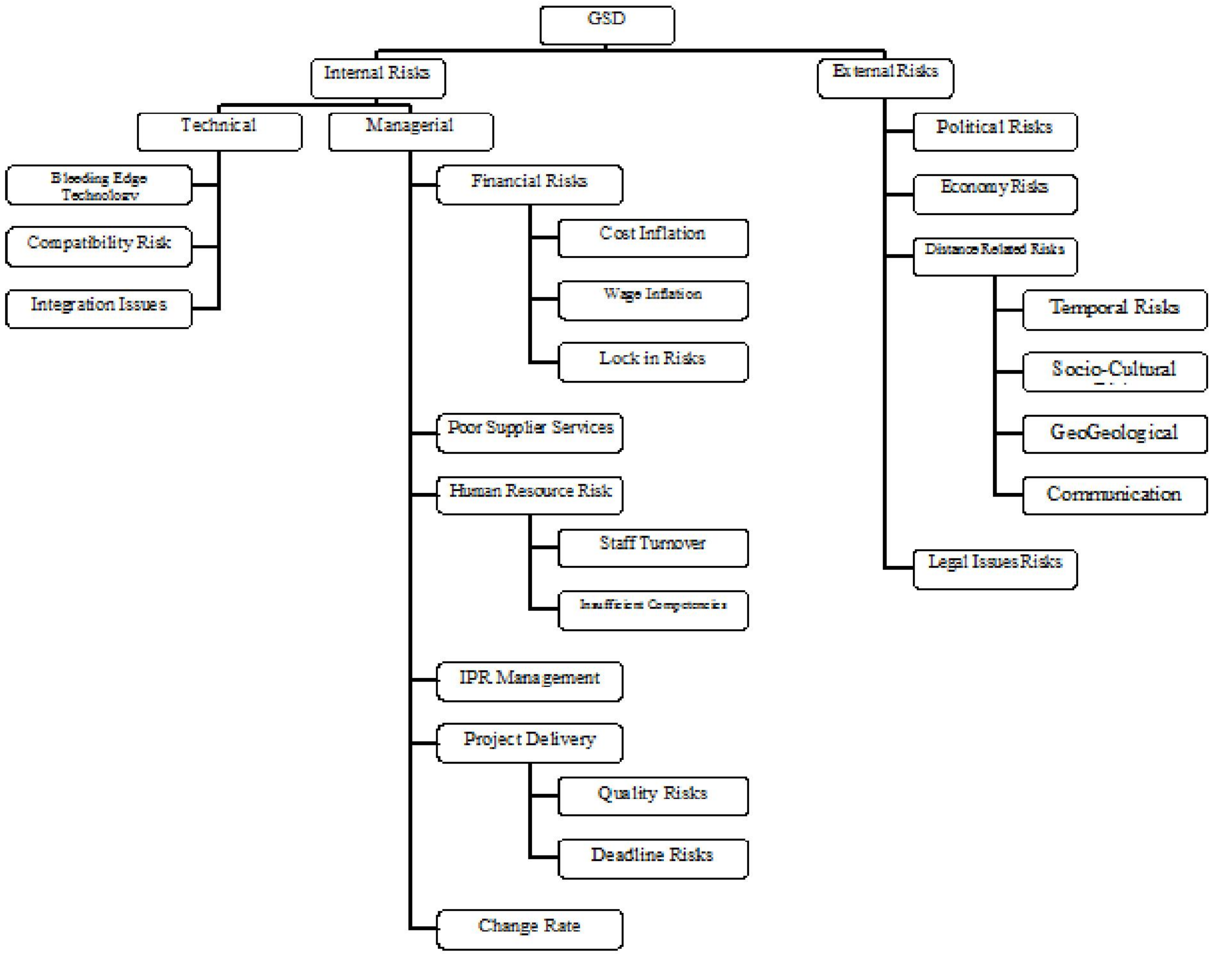

Figure 2. GSE

- **Inadequate IPR Management** is a huge issue since Intellectual Property Rights (IPR) management becomes very complex in GSE.
- **Project Delivery Risks** deal with quality and deadline risks of the product delivery. As discussed earlier in cost and wage inflation that they are directly proportional to the time delays therefore time is very critical in project delivery and same is the case with quality which is sometimes unintentionally compromised by the project managers in order to meet the deadlines. However, poor quality has long term effects on the business in the form of reputation loss of the firm.
- **Instability with high change rate** encompasses the matters related to changes proposed by stakeholders from time to time. This risk falls under the aspects of change control management. Project managers should carefully mechanize the process of incorporating changes and monitor them, since uncontrolled change incorporation may bring expansion in the scope of project, consequently disturbing the whole budget and time planning.

External Risks are risks caused by external agents like global market trends, government policies, political instability, temporal differences etc. These risks are extremely impactful in case of GSE since it involves more than one government, society and may be different time zones. Risks falling under the umbrella of external risks are more general than internal risks but proffer very thin margin to deal with. External risks involve political, economy related, distance related and legal issues risks details of which are mentioned below:-

- **Political Risks** involve the political situation of the locations in which developers / team members / contractor or purchasers are located.
- **Economy Risks** arise due to global market trends and economic situation of the involved states.
- **Distance Related Risks** comprise the most typical risks of GSE which include Temporal Risks,

Geological Risks, Socio-Cultural Risks and Communication Risks. All of these risks are crucial and very hard to be eliminated in case of GSE. Temporal Risks refer to the time differences of the working hour due to different time zones especially when this difference is of 12 hours or more. However same is considered a strong point as well since this difference ensures round-the-clock continuous work on the project, but still it may cause inconvenience of communication. Geological and socio-cultural risks are related to language, values and cultural differences of geographical locations due to which working environment and work practices also differ thus giving way to communication gap.

- **Legal Risks** involve the risks related to contracts and governments policies of the involved states.

4.1.3. Risk Probability, Severity, and Impact

By Risk probability we mean the chances of occurrence of risk in the specific project. In the proposed framework risk probability is measured in context of a term-set of linguistic values: *{Nil, Unlikely, Even, Likely, Highly Possible}*.

Severity of Risk is evaluated in context of the linguistic term-set: *{Very Low, Low, Medium, High, Very High}*.

Risk impact is calculated on the basis of risk probability and severity in each type of risk for a specific project. Term-set for Risk Impact is: *{Negligible, Low, Medium, High, Catastrophic}*.

Risk probability and severity are combined in PMBOK-defined Risk Matrix to specify overall risk impact.

Table 1: Risk Matrix

	Very Low	**Low**	**Medium**	**High**	**Very High**
Nil	Negligible	Negligible	Low	Low	Medium
Unlikely	Negligible	Low	Low	Medium	High
Even	Low	Low	Medium	High	High
Likely	Low	Medium	High	High	Catastrophic
Highly Possible	Medium	High	High	Catastrophic	Catastrophic

4.2. Risk Assessment Framework:

The proposed framework for risk assessment uses Adaptive Neuro-fuzzy Inference System (ANFIS) to cater the risk taxonomy introduced above. The trained system takes risk category as input. It then works on this category information to estimate probability and severity of various risk factors. On the basis of these probabilities and severities it generates an estimate of overall risk impact for the given project.

ANFIS Structure

Structure of the ANFIS, as shown in Figure 3 is described below:

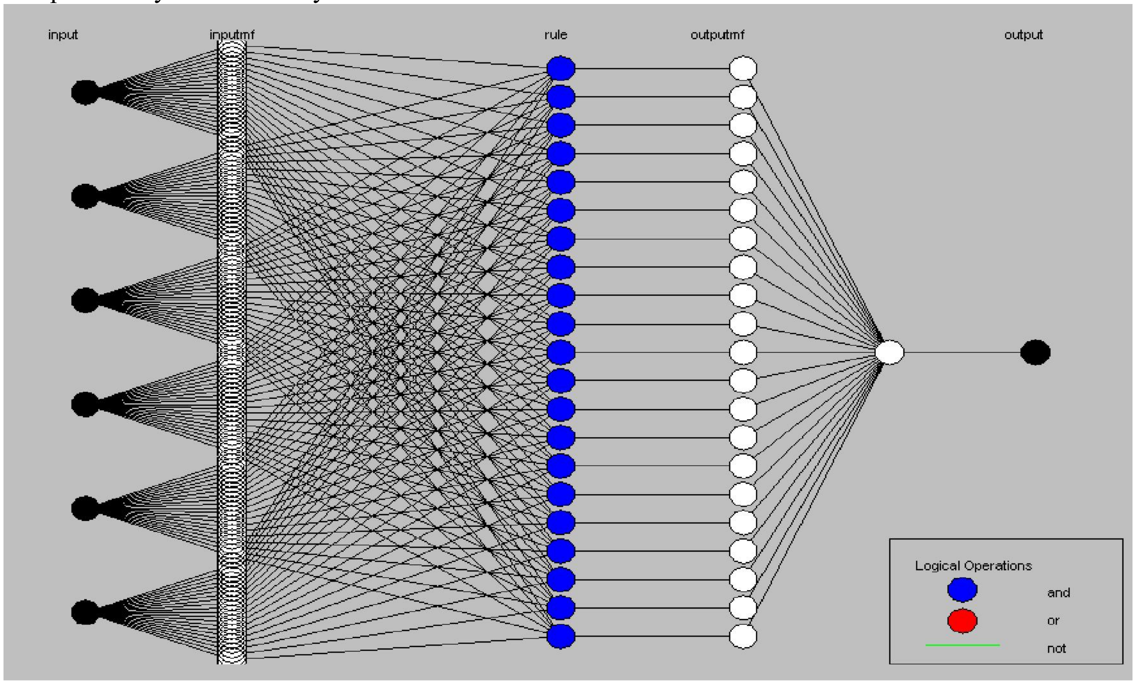

Figure 3. ANFIS Structure

- **Layer 0 (Input):**
- Each of the risk factors will be input of the system. Possible values of each input are mentioned below which will become membership functions in the system.
- **Domain**: Business, Education, Health, Defense, Research, Game, Tool.
- **Product**: Web Application, Desktop Application, Mobile Application, ERP system, Real Time System.
- **Stakeholders**: Large, Medium, Small.
- **Constraints**: Budget, Time
- **Work Distribution**: 2-3 Locations, 3-4 Locations, 4-5 Locations
- **Work Done**: 0-20%, 20-40%, 40-60%, 60-80%, 80-100%

Layer 1 (Fuzzification):

Fuzzification of the input values is the first step which is elaborated in Table 2 in which context type refers to the input variables and linguistic categories to the membership functions of those input variables.

Layer 2 (Rule IF part matching)

Triangular-shaped membership function was used to manipulate the input values with following formula:-

$$f(x;a,b,c) = \max\left(\min\left(\frac{x-a}{b-a},\frac{c-x}{c-b}\right),o\right)$$

where a, b and c are parameters while f is the function of vector x indicating the input variables

Table 2. Fuzzification of Input Variables

Context Type	Linguistic Categories	Fuzzification
Industry Domain	{Business, Education, Health, Defense, Research, Game, Tool}	Singleton
Product Context	{ Web, Desktop App., Mobile App., ERP, Real Time System}	Singleton
Stakeholders Context	{ Large, Medium, Small}	Trapezoidal
Constraints	{Budget, Time}	Singleton
Work Distribution	{2-3 Locations 3-4 Locations 4-5 Locations}	Gaussian
Work Done	{0-20%, 20-40%, 40-60%, 60-80%, 80-100%}	Triangular

Each input in layer 2 provides strength to the rules by means of multiplication. This uses the fuzzy AND operation and can be depicted in formula as (Senvar, 2013):

$$W_i = \mu_{A_i} \times \mu_{B_i}$$

where Wi is the strength of the rule while Ai, Bi refer to input membership functions.

Layer 3 (Normalization):

This layer normalizes the firing strength of rules according to the formula (Senvar, 2013):-

$$\bar{W}_i = \frac{W_i}{\Sigma_{j=1}^{R} W_j}$$

where i presents the rule number. and Wi depicts its strength.

Layer 4 (Rule Aggregation)

Aggregation of rule output is done using the following formula (Senvar, 2013):-

$$\bar{W}_i f_i = \bar{W}_i \left(p_0 x_0 + p_1 x_1 + p_2\right)$$

where p refers to input parameters.

Layer 5 (Defuzzification):

In the end fuzzy output is transformed into a crisp output through defuzzification using the formula:

$$\text{Final Output} = \frac{\sum_{i=1}^{N} w_i z_i}{\sum_{i=1}^{N} w_i}$$

where i presents the rule , Wi presents its strength and Zi is the output level of each rule

5. Evaluation and Results

5.1 Test Setup

The proposed system was implemented in MATLAB version 7.0 environment. The type of network used in ANFIS is feedforward Neural Network. Since it is a knowledge based evaluation, field survey was conducted in which software professionals working in the concerned field (GSE) were interviewed and data was collected from them. The concerned software organizations were located in six cities of Pakistan (including Islamabad, Rawalpindi, Faisalabad, Peshawar, Wah, Bahawalpur) and Dubai. Total 30 samples were acquired. Their input was used to train and test data. 70% of the data collected was used to train the system while 30% of data was used to test the generated ANFIS. The system was trained using hybrid method and 10 epochs. Error tolerance was set to be zero.

For evaluation purpose, three measures were used, including RMSE (Root Mean Square Error), MAPE (Mean Absolute Percentage Error) and R

(Correlation Coefficient). Datasets were both trained and tested for variety of membership functions against each risk category; however, it was observed that the type of membership functions did not have any effect on the results. As seen in Table 3 convergence of test and trained data was attained. This supported the accuracy and likeliness of success of the proposed model. The results of Table 3 are discussed in following sections:

5.2. RMSE

Root Mean Square Error (RMSE) is a measure of the differences between values predicted by a model or an estimator and the values actually observed from the thing being modeled or estimated. Since the RMSE is a good measure of accuracy, therefore, it is ideal if it has a small value. It is calculated as:

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (X_{obs,i} - X_{model,i})^2}{n}}$$

In this formula, n refers to the total number of data points, while X refers to observed and model (predicted) values. Using this formula, RMSE for various risk categories was calculated for both training and testing datasets. Different values were found out among which, the lowest error was found to be for communication risk and it was 0.202. However, the highest value of 0.713 was observed for compatibility risk. Values for others lied between these two.

In case of testing data the system produced much better and closer to real estimates with the minimum error value as 0.196 for communication risk and highest error value as 0.582 for compatibility risk.

5.3 MAPE

Mean Absolute Percentage Error (MAPE) refers to the measure of accuracy for continuous output. It calculates the percentage error for the difference of actual and predicted values of the model.

Out of various formulae available for MAPE, the one used here is mentioned below:

$$\text{MAPE} = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{x_i - \hat{x}_i}{x_i}\right| \times 100\%,$$

where n refers to the total number of data points and i and j refer to observed and predicted values respectively.

MAPE for various risk categories was calculated for both training and testing. For training, the lowest error was found to be for bleeding edge technology risk and it was 0.119. However the highest values 0.713 was observed for compatibility risk. Values for others lied between these two extremes. In case of testing data the system produced much better and closer to real estimates with the minimum error value as 0.148 for communication risk and highest error value as 0.502 for integration issues risk.

5.4 Correlation Coefficient R

Table 3. RMSE and MAPE Results of the Proposed Framework.

RISKS TYPES	MFs	RMSE		MAPE %	
		Training	Testing	Training	Testing
Communication Risk	Trimf	0.202	0.196	0.169	0.148
	Guass	0.202	0.196	0.169	0.148
	Trapez	0.202	0.196	0.169	0.148
Compatibility Risk	Trimf	0.7137	0.532	0.7131	0.492
	Guass	0.7137	0.532	0.7131	0.492
	Trapez	0.7137	0.532	0.7131	0.492
Bleeding Edge Tech Risk	Trimf	0.384	0.291	0.119	0.201
	Guass	0.384	0.291	0.119	0.201
	Trapez	0.384	0.291	0.119	0.201
Integration Issues	Trimf	0.699	0.519	0.664	0.502
	Guass	0.699	0.519	0.664	0.502
	Trapez	0.699	0.519	0.664	0.502
Wage Inflation	Trimf	0.338	0.216	0.323	0.194
	Guass	0.338	0.216	0.323	0.194
	Trapez	0.338	0.216	0.323	0.194
Staff Turnover	Trimf	0.567	0.551	0.521	0.541
	Guass	0.567	0.551	0.521	0.541
	Trapez	0.567	0.551	0.521	0.541
Insufficient Competencies	Trimf	0.431	0.388	0.399	0.379
	Guass	0.431	0.388	0.399	0.379
	Trapez	0.431	0.388	0.399	0.379
Temporal Risks	Trimf	0.526	0.401	0.499	0.381
	Guass	0.526	0.401	0.499	0.381
	Trapez	0.526	0.401	0.499	0.381

Correlation Coefficient (R) is a degree to indicate how much two separate series of values are related to. Value of R varies from -1 to +1, however, if R value near to 1 indicates strong positive correlation between the values reflecting the consistency and closer relationship.

Formula for correlation coefficient is mentioned below:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})\cdot(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \cdot \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

where x and y series indicate observed and predicted values respectively. Correlation coefficient r for the model was calculated after the completion of training phase. Since the values of r were found to be 0.925 and 0.985 for training and testing respectively, it shows the strong positive correlation revealing the consistency of results.

6. Conclusions and Future Work

The results show that Soft Computing based framework for Risk assessment possesses the desired potential for evaluation of Risks in GSE and it was concluded that system produced much better and closer to real estimates Therefore, system can be adopted in order to fulfill the needs of project managers of GSE projects. However, room is open for further research in the same field in the light of unending challenges faced by the project managers. Few ideas for continuation of this work include:-

- Cause and Effect Calculations which provide details of interdependencies of the risks and input values so that a scenario can be sketched to predict importance of each risk with relevance to others.
- Calculating interdependencies of the risks which are summarized providing the criticality of the risk.
- Mitigation Strategies to overcome the risks.

Thus incorporating all these modules a complete package for risk evaluation in GSE can be obtained.

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