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Quantification of Risks on Technological Innovation using Fuzzy Analytic Hierarchy Process

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Abstract*: Innovation has become the key determinant of any organization in "Staying Relevant", irrespective of the product or service produced. Innovation comprises different concepts based on the application through the product and service Life-Cycle. Technological Innovation has become the governing factor out of all which ensures the successfulness of the Innovation. But Innovation involves great amount of risks which even leads to an organization into a catastrophic situation in the absence of an appropriate Risk Management Strategy. In developing a Risk Management Strategy it is imperative to have a precise knowledge on the impact of Risks related to Technological Innovation, which can be represented by weightages. This paper presents Risks related to Technological Innovation based on the Literature and attempt to establish a relationship among the risks which forms a Hierarchical structure related to Fuzzy – Analytic Hierarchy process (F-AHP). Information unveiled in the literature and the ideas shared by Industry Expertise were the basis for pairwise comparisons. Consistency of the Pairwise comparison has endorsed using the Consistency Ratio. Consistent pair wise matrices were converted into Fuzzy matrices which have been carried out Fuzzy-AHP in obtaining the weightages related to Technological Innovation Risks. The weightages derived, provide a clearer insight on contribution of different risks on Technological Innovation failures and hence giving heads-up on the risks which need prior attention. Furthermore this illuminates the effectiveness of the Risk Management Strategy by providing facts to decide on which risks need to be Ignored, Mitigated, Addressed or Transferred. Thus, precise application of the findings of this research will absolutely help in developing a copy proof Risk Management Strategy which would ultimately offers many opportunities to a business that cannot be realized otherwise.

Keywords: **Different Phases of Innovation, Fuzzy- AHP, Risk Management, Technological Innovation Risks**

I. INTRODUCTION

Innovation has become the main "Philosophy" of the existence of any business organization in a highly volatile Global Market [1]. It is the process of translating an idea or invention into a good or service that creates value or for which customers will pay for. Innovation is crucial for an organization in further satisfying the expectations of its customers [2]. Innovation has been given numerous definitions by researchers. Stephen Shapiro, an American author, has introduced Innovation as "Staying Relevant". In this, gaining competitive advantage and adoption capabilities are of prime importance to any organization in the sustainable growth [3]. Because market strategies which helped to raise the organization on top might no longer be the best strategies in their next move. It could potentially be the main cause of failure in time to come [4]. Among different innovation concepts introduced in Literature; Technological Innovation has become an extended Innovation concept which contributes more in "Staying Relevant" [5]. Researchers from different disciplinary back grounds have given numerous definitions to Technological Innovation. Cagiar Dogru [6] has defined it as Generating new techniques and processes in producing goods and services. OECD Oslo Manual defines Technological Innovation as a new or improved product or process whose technological characteristics are significantly different from before [7]. Technological Innovation happens when there is a need of a new product or shaping out an available product to match with the present needs. It creates opportunities in being competitive in the current market as well as entering into new market segments. Further new technologies are introduced to the economic system through the process of Technological Innovation [7]. Moreover technological advancements play a crucial role in enhancing the living standards of human kind during the journey of evolution [7]. Technological innovation has connected the world together enhancing the efficiency and effectiveness, breaking all the physical boundaries and language barriers, which have changed the ways and means of doing the businesses [8]. One of the most important contributions of Technological Innovation is enhancing the competitiveness among international economies [9]. Autonomous cars, Artificial Intelligence, Crypto currencies, Personalized Medicines, Advanced Automation and Robotics are among some of the disruptive Technological breakthroughs which changed the world [10]. However, Technological Innovation involves great amount of risk which jeopardize the economic benefits received by the innovators for their efforts [7]. The main cause for this risk is the gap between the newly introduced technology and the reaction of the market towards the innovation [10].

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Hence identifying and managing risk involved in Technological Innovation is crucial in making it a success. Impact of the risks comes in different degrees [11]. Some of the risks are acceptable while others are either unacceptable or need to be mitigated to a tolerable level [12]. Thus defining a risk criterion in determining the acceptable or tolerable risk levels is essential during the process of decision making. Therefore the knowledge of the impact of different risks associated with Technological Innovation, and the contribution of each risk is of prime importance [13]. This will help to decide whether the risk is to be ignored, mitigated, addressed or transferred according to the probability and the impact of the risk. This is crucial in taking necessary actions in managing the risks involved in Technological Innovation and making it a success. Current literature depicts a gap in this area highlighting the necessity of the knowledge on contribution of different risks to a final outcome of the Technological Innovation.

Through this paper authors attempted to find out the "Contribution" of different risks related to Technological Innovation in a quantifiable aspect.

II. METHODOLOGY

1. Literature review to find out risks shared by researchers related to Technological Innovation common to multiple industries.
2. Investigate the risk measurement techniques and evaluate them to select the appropriate techniques.
3. Analyzing the Risk factors related to risks identified in literature
4. Distribution of a questionnaire to get the industry feed backs on Risk priorities.
5. Analyzing the risks and decomposed into a hierarchy of criteria to be used in determining the weightages of risks related to Technological Innovation
6. Prove the consistency of the results
7. Determine the risk priorities using the weightages

III. RESULTS

From the analysis done on research papers, covering multiple Manufacturing and Service sectors worldwide, 14 different risks, related to Technological Innovation could be identified as illustrated in Table 1, as these are the risks which need to be addressed in managing the risks related to Technological Innovation.

Table – 1: Risks related to Technological Innovation in literature

Risk Number	Risks related to Technological Innovation
C1	Not assessing the innovation idea in terms of Financial, Structural, and Marketing and Technological capabilities [14, 15].
C2	Innovation strategy is not aligned with the company's long term goals [16].
C3	Violating Intellectual rights or Intellectual property stealing done by others [17].
C4	Shortages in the strength of the organization (Including Human Resource, Financial, Leadership, contracts, Brand recognition and skilled supplier base) [17, 18].
C5	Not adopting the better ways of commercialization, inaccurate market positioning [16].
C6	Redundancy (Possibility of a profitable innovation today may be redundant in the near future) and Unprecedented risks - (Risks outside the control of the organization, fluctuations in the customer demand, social and economic environment, national industrial policies) [14].
C7	Risk of information resource including, distorted market information [17].
C8	Not generating the technological idea through customer feedback, basic research and creativity resulted in Innovation not solving pain point of the customer [16, 14].
C9	Risk of material resource [15].
C10	Technological advancements in the market and the Emergence of new technologies [17].
C11	Not properly aligning Development, Implementation and output of the whole process (Project information incompleteness and Communication issues) [17].
C12	Not having a better risk controlling mechanism, which risk management needs to be combined with enterprise's development plan, strategies, investments of man power and funds, including lack of risk supervision and control activity throughout the process and not adopting the process of "learning through Experiment" [16].
C13	Limited Technical Capacity [16].
C14	Issues in R & D process, sample to bulk challenges, Issues in inbound and out bound communication, inconsistency of project organization and management [19]

Contribution of different risks to the final result of Technological Innovation can be measured through finding out weightages related to different risks. In literature, several approaches have been introduced to determine weightages. In-depth analysis of methods has indicated Fuzzy – AHP, which is based on Fuzzy Analytical Hierarchy process with the use of triangular Fuzzy numbers for pairwise comparison. As per Mochammad et al., Combination of Fuzzy set theory with AHP is much closer to the Human thinking pattern [20], which is used in pair wise comparison. Moreover, Fuzzy-AHP is a powerful tool when making decisions in uncertain circumstances, which has been used in substantial applications in recent years [21].

Further, risks related to Technological Innovation has been thoroughly analysed referring to literature and feedback received from the Industry experts. Critical analysis of the risks shows that they represent different phases of Innovation process, i.e. Intra Organizational Innovation phase, which describes structuring the organization for a sustainable innovation,

Peripheral Innovation phase, which represents the information need from outside the organization for a sustainable Innovation and Sustainable Innovation phase which represents the implementation of Innovation [22].

Thus risks were analyzed and decomposed into a hierarchy of criteria to be used in pairwise comparison based on the different phases of innovation process, where these risks come into effect. I.e. Risks C1, C2, C3 and C4 are attached to Intra Organizational Innovation phase, risks C5, C6 and C7 which represent the information related to sustainable Innovation. Furthermore risks, C8, C9, C10, C11, C12, C13 and C14 are attached to Sustainable Innovation phase under Product and process Innovations [22]. Though the Technological Innovation is more attached to the Sustainable Innovation concepts, it is essential to consider some significant risks which involved in other 2 phases of Innovation process as well.

Hence the hierarchy of criteria has developed with Risks, illustrated in Table 1, under Intra Organizational Innovation, Peripheral Innovation and Product, Process innovations which represent the Sustainable Innovation concept.

Pair-wise comparisons have been done in developing AHP matrices for the hierarchy of criteria illustrated in Figure 1, to be used in Fuzzy calculations. Risks were categorized following the numbering sequence of Figure 1, with the main goal to determine the weights of Technological Risks.

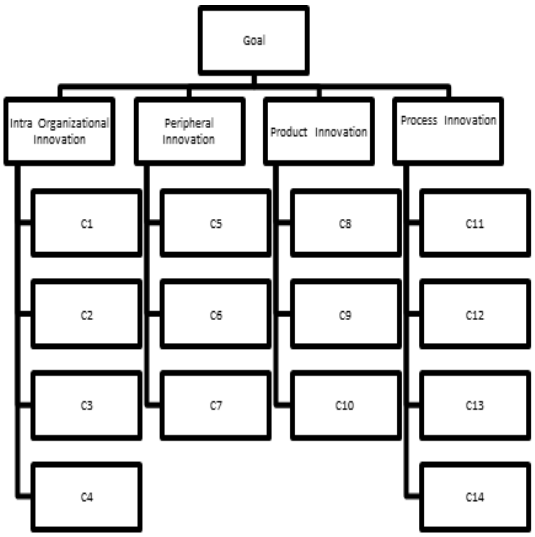

Fig.1. Hierarchy of Criteria for the pairwise Comparison

For the application of AHP, comparison needs to be in ratio scale. Researchers have introduced different scales for AHP including Linear (Saaty, 1977), Power (Harker, Vargas, 1987), Rot Square (Harker, Vargas, 1987), Geometric (Lootsma,1989), Inverse Linear (Ma,Zheng,1991), Asymptotical (Dodd, Donegan, 1995), Balanced (Salhamalainen,1977) and Logarithmic (ishizaka,Balkenborg,Kaplan,2010). Among all introduced scales, the original linear scale has been used most often in applications since this has been identified as the best scale to represent weight ratios [23]. The approach Saaty has proposed in sample pairwise matrix, allocation of priority values, consistency sensitivity and Saaty's scale illustrated in Table 2,has become the default measure serving as a bench mark in AHP [24].

Relative Importance of the Pair wise comparisons have been decided based on the feedback received from different Industry experts and from the literature referring to Saaty's scale illustrated in Table 2.

Table – 2: Saaty's Scale for Pairwise Comparison

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Moderate Importance	Experience and Judgement slightly favour one activity over another
5	Essential Importance	Experience and Judgement strongly favour one activity over another
7	Very Strong Importance	An activity is favoured strongly over another,It is dominance demonstrated in practice
9	Extreme Importance	The evidence favouring one activity over another is of the highest possible order of affirmation
2,4,6,8	Intermediate Values	When compromise is needed between two

Consistency of the pairwise comparison in deriving weightages has been proved with the Consistency Ratio (CR), being smaller than 0.1, referring to Saaty's findings on consistency ratio. The CR is the ratio between Consistency Index (CI) and Random Consistency Index (RI) as given in equation (1).

$$CR = CI/RI \quad (1)$$

Where CI is the Consistency Index and RI is the Random Consistency Index.

The Consistency Index (CI) can be calculated as of equation (2), [24].

$$CI = (\lambda_{max} - n)/(n-1) \quad (2)$$

Where λ_{max} is the Maximum Eigen Value and n is the number of criteria evaluated. Maximum Eigen value (λ_{max}) is calculated by summing the product of each element in the Eigen vector by the respective column total of the original comparison matrix

Table 3 shows the Random Consistency Index (RI) with the dimension of the comparison matrix in Saaty's scale.

Table-3: Random Consistency Index (RI) with matrix size

Number - n	Random Index- RI
1	0
2	0
3	0.58
4	0.9
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

If Consistency ratio (CR) is less than 0.1 or 10%, then the matrix can be considered to be consistent [23].
Consistent matrix was replaced with Fuzzy Numbers to get the Fuzzified pairwise Comparison matrix with the Fuzzy Numbers shown in Table 4. In this case, triangular fuzzy sets have been considered for simplicity of calculation.

Table - 4: Fuzzy sets for relative importance

Definition	Triangular Fuzzy Number	Saaty's Scale
Equal	(1,1,1)	1
Moderate	(2,3,4)	3
Strong	(4,5,6)	5
Very Strong	(6,7,8)	7
Extremely Strong	(9,9,9)	9
Intermediate Values	(1,2,3)	2
	(3,4,5)	4
	(5,6,7)	6
	(7,8,9)	8

The following steps have to be carried out in converting pairwise comparisons of AHP into Fuzzy representations.
As the first step, reciprocal values need to be taken in reverse order as per the equation (3) in order to calculate the $\tilde{A}^{-1}$.

$$\tilde{A}^{-1}=(l,m,u)^{-1}= [1/u,1/m,1/l] \quad (3)$$

Where $\tilde{A}$ is the reciprocal value, l, m and u are the lower value, the middle value and the upper value respectively.
Equation (4) shows the calculation of Fuzzy Geometric Mean Value, $\acute{r}_i$ using the results of Fuzzified pairwise comparison matrix [25].

$$\acute{r}_i = [(l_1+l_2+l_3+...+l_n)^{1/4}, (m_1+m_2+m_3+....+m_n)^{1/4}, (u_1+u_2+u_3+...+u_n)^{1/4}] \quad (4)$$

The normalized Fuzzy Weight, $\hat{w}_i$, has to be calculated using the equation (5), as shown below.

$$W_i = \acute{r}_i * (\acute{r}_1+\acute{r}2+\acute{r}_3+...+\acute{r}_n)^{-1} \quad (5)$$

De-Fuzzification has to be done to the Fuzzy weights obtained, based on the Centre of Area (COA) method, which depicted in equation (6).

$$\text{De-Fuzzified Weight} = (l+m+u)/3 \quad (6)$$

As the final step, Normalized weights were calculated as per the equation (7) given below.

$$\text{Normalized Weight} = \text{De-Fuzzified Weight}/\text{Sum of De-Fuzzified Weight} \quad (7)$$

Local Weight is the value of the Normalized weights of each Category.

Global Weight = (Value of Local Weight within each Innovation Phase) * (Value of Local Weight within each risk) (8)

Pair-wise comparison of Risks related to Technological Innovation categorized under Intra Organizational Innovation concepts are given in Table 5.

Table – 5: Pair-wise comparison of Risks related to Technological Innovation categorized under Intra Organizational Innovation concepts

Risks	C1	C2	C3	C4
C1	1	2	1/5	1/3
C2	1/2	1	1/5	1/4
C3	5	5	1	3
C4	3	4	1/3	1

Weightages of Risks of Technological Innovation related to Intra Organizational Innovation concepts as per AHP method are given in Table 5.

Table - 6: Priority vector of Technological Innovation related to Intra Organizational Innovation concepts

Risks	**Weights**
C1	0.115
C2	0.076
C3	0.544
C4	0.265

In this real valued priority vector calculation, the followings were yielded.
λ_{max} = 4.166296
CI = 0.055432
RI = 0.9 (When n=4)
From equation (1), consistent ratio CR was calculated as CR = CI/RI = 0.0616, which is less than 0.1. Therefore the results are consistent.
Representation of Table 5 with Fuzzy Numbers referring to Fuzzy scale was done and the resultant Fuzzified pairwise comparison matrix is shown in Table 7.

Table – 7: Fuzzified Pairwise comparison matrix

Risks	C1	C2	C3	C4
C1	(1,1,1)	(1,2,3)	(1/6,1/5,1/4)	(1/4,1/3,1/2)
C2	(1/3,1/2,1)	(1,1,1)	(1/6,1/5,1/4)	(1/5,1/4,1/3)
C3	(4,5,6)	(4,5,6)	(1,1,1)	(2,3,4)
C4	(2,3,4)	(3,4,5)	(1/4,1/3,1/2)	(1,1,1)

Using the Equation (4), Fuzzy Geometric Mean Values ($\acute{r}_i$) related to C1, C2, C3 and C4 were calculated and they were denoted by $\acute{r}_1, \acute{r}_2, \acute{r}_3, \acute{r}_4$ respectively.
$\acute{r}_1$ = (0.452, 0.604, 0.783)
$\acute{r}_2$ = (0.325, 0.398, 0.537)
$\acute{r}_3$ = (2.378, 2.943, 3.464)
$\acute{r}_4$ = (1.107, 1.414, 1.778)
Using equation (3), reciprocal values of the Table 7, were obtained and shown as the following.
$(\acute{r}_1+ \acute{r}_2+ \acute{r}_3)^{-1}$ = [1/5.638, 1/4.636, 1/ 3.708]
Fuzzy Weights and the weights after De-Fuzzification with respect to fuzzy sets given in Table 5 were calculated using the Equation (5) and Equation (6) respectively and were shown in Table 8.

Table – 8: Fuzzy Weights and the weights after De-Fuzzification

Risks	Fuzzy Weights	Weights After De-Fuzzification)
C1	0.069,0.113,0.184	0.122
C2	0.049,0.074,0.126	0.083
C3	0.361,0.550, 0.814	0.575
C4	0.168,0.264,0.418	0.283

Normalized weights of the Criteria C1, C2, C3 and C4 were calculated as per the equation (7) and depicted in Table 9.**Table – 9: Normalized weights**

Risks	Normalized Weights
C1	**0.115**
C2	**0.078**
C3	**0.541**
C4	**0.266**

Same procedure was repeated for the criteria listed under Peripheral Innovation (C5,C6,C7), Product Innovation (C8,C9,C10), Process Innovation (C11,C12,C13,C14) with the aim of calculating the Normalized weights of the Risks related to Technological Innovation. Priority vectors of Peripheral Innovation, Product Innovation, Process Innovation and Main Goal were consistent with the Consistency Ratio (CR), less than 0.1 in all 3 phases. Further, Main Goal received the highest CR value of 0.073, still being consistent, falling in the range.

Table 10 shows the Summary of weightages of Risks related to Technological Innovation

Table-10: Summary of weightages of Risks related to Technological Innovation

Risk Number	**Risks related to Technological Innovation**	**Normalized Weights related to Innovation Phases**	
		Local weights	**Global Weights**
Intra Organizational Innovation Phase – 0.237			
C1	Not assessing the innovation idea in terms of Financial, Structural, and Marketing and Technological capabilities	0.115	0.028
C2	Innovation strategy is not aligned with the company's long term goals	0.078	0.018
C3	Violating Intellectual rights or Intellectual stealing done by others	0.541	0.128
C4	Shortages in the strength of the organization (Including Human Resource, Financial, Leadership, contracts, Brand recognition and skilled supplier base)	0.266	0.063
Peripheral Innovation Phase – 0.128			
C5	Not adopting the better ways of commercialization, inaccurate market positioning	0.151	0.019
C6	Redundancy (Possibility of a profitable innovation today may be redundant in the near future) and Unprecedented risks - (Risks outside the control of the organization, fluctuations in the customer demand, social and economic environment, national industrial policies)	0.513	0.066
C7	Risk of information resource including, distorted market information	0.336	0.043
Product Innovation related to Sustainable Innovation Phase – 0.432			
C8	Not generating the technological idea through customer feedback, basic research and creativity resulted in Innovation not solving pain point of the customer	0.489	0.211
C9	Risk of material resource	0.148	0.064

C10	Technological advancements in the market and Emergence of new technologies	0.363	0.157
Process Innovation related to Sustainable Innovation Phase - 0.203			
C11	Not properly aligning Development, Implementation and output of the whole process (Project information incompleteness Communication issues)	0.182	0.037
C12	Not having a better risk controlling mechanism, which risk management needs to be combined with enterprise's development plan, strategies, investments of man power and funds, including lack of risk supervision and control activity throughout the process and not adopting the process of "learning through Experiment"	0.266	0.054
C13	Limited Technical Capacity	0.136	0.028
C14	Issues in R & D process, sample to bulk challenges, Issues in inbound and out bound communication, inconsistency of project organization and management	0.416	0.084

IV. DISCUSSION

Innovation has become a Key strategy of Sustainable Growth of any Organization. Among 21 different innovation concepts found in the literature [22], Technological Innovation has become the governing factor, since it is essential in "Staying Relevant" and being one of the few factors which Organization can control within their power. However Technological Innovation involves a great amount of risk, due to potential failures of the Innovations. There are many evidences that suggest this trend of increasing uncertainties and the resulting risk for businesses demands a strategic level attention to risk Management. In achieving this goal, it is essential to identify the Impact of risks on final output in quantifiable terms, which would be incorporated with other parameters in deciding a more precise strategy for managing risks. Here, weightages can be used to identify the contribution of different risk on the end result. Among the methods available in determining weightages, Fuzzy-AHP is selected as the most appropriate method as this is closer to the human thinking pattern. It is more effective when making decisions in uncertain circumstances. This method surpasses the other methods such as "Bottle Neck Analysis" which provides most of the solutions when having a bottle neck rather than analyzing the issue well in advance. However disputes were aroused on using Triangular Fuzzy Numbers in Fuzzy-AHP according to some researchers, but not yet been finalized [26]. In depth analysis of the local weights in each phase, gives a proper understanding on which risks contribute more to the Technological Innovation failures during different phases of the Innovation process. In Intra Organizational Innovation phase, weightage results indicate how crucial is the precise understanding on Intellectual rights, C3 having a weight of 0.541 which implies the importance of securing the innovation, as it is an uncontrollable risk if patents for the innovations are not in place where due attention is of prime importance. Strengths of the organization C4, with a weight of 0.266, plays a significant role in making a technological Innovation a success, Shortages in the strengths as well as not assessing the innovation idea in terms of Financial, Structural, and Marketing and Technological capabilities C1, placing in the third place of the cluster with a weightage of 0.115, which can be turned into a significant risk, unless it is properly controlled. Aligning Innovation Strategy with company's long term goals C2 with 0.078 bears a lower risk in this phase as it is in the hold of the company. In addition, activities related to Peripheral Innovation plays a crucial role in assuring both sustainability and growth of the Technological Innovation. Hence in managing the risks related to this concept, Redundancy, Unprecedented risks which are outside the control of the organization, including fluctuations in the customer demand, social and economic environment and national industrial policies, C6 with a weightage of 0.513, should be given priority as the impact they make can finally lead the organization to a disastrous position that may ended up with bankruptcy. Precise market information, C7 having a weightage of 0.336, is another main decisive criterion, which needs to put a considerable effort during the risk management. Adopting better ways of commercialization C5 having a weightage of 0.151, bears a bit lower contribution to the Technological Innovation risks which organization can decide on a strategic plan in managing risks. Further Technological Innovation reaches to the customer in the form of a product or a service. Hence, identifying customer and satisfying the unfulfilled needs and wants is the primary task in the Product Innovation attached to sustainable Innovation phase. Thus, it is crucial to generate the Technological Innovation idea through customer feedback C8 shows the highest weightage of 0.489; else it ruins all the efforts and resources, due to incapability of finding a proper market segment increasing risk to the organization. Technological advancements in the market and Emergence of new technologies C10 with 0.363, representing the second place in this cluster, contributes significant amount of risks to the Technological Innovation, which is outside the control of any organization and needs quick attention in managing the risk involved. Correct quality materials, C9 with a weightage of 0.148, are a crucial factor in deciding the final quality of the output,

still having less impact as per the weightage shown in the study, since the organization has more power over controlling that risk.

Moreover, Weightages related to Technological Innovation risks, categorized under Process innovation shows Issues in Research and Development (R & D process), C14 bears the highest risk than the other factors under this category with the weightage of 0.416. It is crucial to solve all the issues related to Research and Development of any technological Innovation concept, before proceeding to the bulk, as this might ruin the innovation.

Further, unavailability of a proper risk management system C12, represents the second place with a weightage of 0.266, contributes considerably to the Technological risks, as better risk management system generates better, unique and copy proof product architectures, which ensures the success of the Technological Innovation. Aligning of the whole process C11 and Limited Technical Capacity, C13 having weightages of 0.182 and 0.136 respectively, are the next factors which add risks, but still controllable with better Research and Development (R & D) process and a Risk controlling mechanism. When assessing the main innovation concepts, related to the Technological Innovation, Sustainable innovation is the most critical phase, as offering a product or a service which quenches the customer needs and wants is a prerequisite. In fulfilling this, it is significant to combine a properly structured organization with precise leadership skills and the knowledge required to implement the innovation along with the thorough understanding on outside the organization. Global weights of the 14 risks reflect the contribution of risks to the Technological Innovation as a whole. This highlights the significance of managing the risks outside the control of the organization, which might be the main reasons to keep the innovation out of the market. It is crucial to generate the technological Innovation idea through customer feed backs, as otherwise Innovation will not be able to grab any market segment, regardless of the skills which have been utilized in developing the Innovation. Technological advancements and Immerging of new technologies contributes with a greater amount to the risks, following the intellectual rights violations. Unavailability of a proper risk controlling mechanism and Issues in Research and Development phase have become the most crucial risks with a higher contribution to the Technological Innovation failure. Though the other risks too are influential, they can be manageable to a greater extent with proper identification and intelligent management of risks with an appropriate risk management model.

V. CONCLUSION AND FUTURE SCOPE

14 risks have been found in literature related to Technological Innovation, common to any industry. However, Technological Innovation involves a great amount of risk despite its exigency for the survival of the companies. There are many evidences that suggest the current very high level of volatilities in the business world going to get worse in the years and decades to come. This trend of increasing uncertainties and the resulting risks for businesses demands a strategic level attention has been drawn to risk management. In managing risk, it is essential to have a precise knowledge on the impact of these risks preferably in quantifiable form, as different risks levels contributes to the final output in a different way. Measuring the impact of the risk is one of the critical information needed in developing proper risk management strategy. Thus this helps to take more accurate decisions in deciding whether the risk is to be ignored, mitigated, addressed or transferred according to the strength of the organization. Level of impact can be represented by weightages. Among the methods available in finding the weightages, Fuzzy-AHP has been selected as the best alternative, due to it's a high potentiality of arriving at more accurate results than the other methods, as this is closer to the Human Thinking Patterns. During the Intra organizational innovation phase, it is crucial to analyze the innovation idea with the critical areas as Financial, Structural, Marketing and Technological capabilities as well as the strengths of the organization which provides the insight on the potentiality of the organization to start the process of Innovation. In addition, Redundancy and Unprecedented risks have more impact on the successful outcome of the Technological Innovation during the Peripheral Innovation phase as these risks are ungovernable. This may even lead to bankruptcy of the organization, unless it is properly managed. Further, more emphasis should be placed on generating the Innovative idea through customer feed backs, as this is significant in gaining the market share as well as in expanding the territory of the organization in the Global Market environment. In addition, issues in R & D process, sample to bulk challenges, Issues in inbound and out bound communication, inconsistency of project organization and management have the highest contribution which may hinder the success of any Technological Innovation, during the innovation process.This provides a precise understanding on the impact of risks related to Technological Innovation, which can be incorporated in establishing a better strategy to manage risks while optimizing the resources available within the organization. Hence the findings of this study are indispensable in determining more accurate Risk Management strategy, since this would address the void in the current literature, as no comprehensive studies have been done on this topic.

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