Establishing an Efficient team by Improvising Employees

Selection Process applying Integrated AHP and LP for a Soft Drink Manufacturing Company

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Abstract

To improve efficiency, insure the production of quality products and enhance product development a company must invest in resources. Human resource is of vital importance, especially in the selection and hiring of potential candidates to fill various vacant posts. The major challenge is in the selection of suitable candidates who will provide the company with optimal value for their human resource allocation investments. We seek to illustrate the application of Analytic Hierarchy Process (AHP) and linear programming (LP) in the selection and hiring of candidates to fill vacant posts in carbonated soft drinks manufacturing company located in Dar Es Salaam, Tanzania. AHP is a prominent multi-criteria decision making tool that assists decision makers in the selection and hiring process by disintegrating the candidate selection goal into a hierarchical structure with levels of criteria, sub-criteria and alternatives, and further constructing pair-wise comparison matrices for elements in each hierarchical level. The Additive Normalization (AN) method is employed in the development of priority weights and Linear Programming (LP) is used to ensure optimal solutions for the human resource allocation problem seeking to maximize returns of the company's investment.

Keywords: AHP, linear programming, additive normalization, consistency ratio, consistency index

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1. INTRODUCTION

The science of decision making has evolved over time. For ages it was believed that decision making was a very complex process, and was thus limited in its application and use. It was considered an artistic task due to the absence of proper guidelines and procedures to assist the decision maker. As a result, decision was as good as the process used to obtain it and not its ability to take into consideration the stakeholders' views and interests.

Today, decision making is considered a more systematic task. In a world with increasing complexities, making an appropriate decision is not only complex but also of paramount importance. Although technological discoveries and recent development have helped human beings to reduce uncertainty, randomness, manual effort and time, complexities too have increased at the same time.

The presence of multiple criteria in a decision problem further heightens the level of complexities together with the incorporation of multi-actors and stake holders with conflicting interests and opinions. A good decision must cater to all the objectives, interests and opinions of all its stakeholders and must also have the ability to predict both controlled and uncontrolled criteria and outcomes for a sustainable period of time. Every decision maker avoids making unstructured, ad-hoc decisions based on incomplete information, risks, and non optimal consequences of decisions. Therefore a systematic mathematical tool for problem solving is required. This is because mathematical tools aside from being simple to utilize, provide decision makers with the reliability needed to support or reject their decisions.

2. A COMPANY CASE ILLUSTRATION OF CORPORATE MULTI-CRITERIA DILEMMA.

In this paper we seek to demonstrate a particular case of the application of such a mathematical tool which will assist decision makers in multi-criteria decision making. The application of this mathematical tool will enhance the decision choice's reliability and eradicate potential controversies.

This is a case of a family owned business company that was established in 1970s. Having its main locations in Dar as Salaam, Tanzania the business company deals with the manufacture of carbonated soft drinks among other things and is one of the largest business organizations in the Sub-Saharan part of Africa. Owners of this multi-national establishment boast of about 3 million dollars annual revenue and cannot therefore afford to make wrong decision choices. Within the corporate world, decision making is a process of enormous risk and challenge The Company's day to day activities requires a strategic decision making technique since the stakes are high and have long term consequences. To avoid making bad decisions, top managers must access the weights, ranks and priorities of every activity in relations to the respective outcome.

As the case with many related companies in Africa, decision makers aim to provide their companies with sustainable growth, acquisition of competitive advantage and to ensure longevity of their business practices. They adopt and apply various strategic business practices, methods, models and tools to enhance decision making in problems related to human resource, quality assurance and market and profit expansion.

Of the many human resource related decision making problems, hiring and selection of candidates to fill various vacant posts at production plants is a sensitive one. Decision makers at the company understand the advantage of employing qualified, goal oriented, efficient and effective personnel. More so, they take extra precaution because selecting and hiring of employees is a risky and challenging task. They must ensure the integration the business objectives with the right personnel who possess the required skills and ability to achieve the goals and objectives of the company. Having a budget and position constrictions, they have to select a viable candidate while taking into consideration the company's laid out mission and vision. They must ensure ultimately the employment of qualified candidates who possess qualifications that can be incorporated with the values, culture and goals of the company in one hand and at the same time assist and contribute to the growth and profit attainment of the company in the other.

For these reasons, a reliable tool that is able to measure both tangible and intangible criteria is required. The key task is to find the right scale that can measure all criteria, minimize error and biasness, a tool to assist in the selection of the right kind of personnel to handle the right kind of job-related tasks within the organization and achieve value for their investment simultaneously. AHP (Saaty, Peniwati & Shang, 2007) proves to being one of the best tools to ensure the attainment of their goals for the selection of employees and linear programming (LP) for optimization. Rouyendega & Erkan (2012) has discussed the selection of academic staff using fuzzy analytic hierarchy process. AHP (Dolores & Jose, 2014) has been applied in decomposing the value creation when assessing investments. In the model they consider four criteria as financial capital, human capital, structural capital and relational capital. The development of analytic hierarchy process can be found out in (Ishizaka & Ashraf, 2011) and (Vaidya & kumar, 2006). Our purpose here is to illustrate AHP, and to formulate an LP model which is then solved using EXCEL's solver.

3. AHP AND LP APPROACH

3.1 AHP

Thomas L. Saaty, one of the creators of Operations Research, observed communication difficulties and the absence of a systematic practical tool in setting of key priorities in judgment formulation. He bore witness to the difficulty experienced by decision makers; a perfect motivation for the development of a well structured, systematic approach for the organization and analysis of complex, multi-criteria, multi-person decision making problems to handle complex decisions.

(Saaty, 2003) recognized the value of structuring a complex problem into a hierarchy of unvarying, similar cluster of factors, a common method that has long been used by human beings to handle complexities for generations. He developed a mathematical model that fragments complex decision making problems into a hierarchy. The Analytic Hierarchy Process (AHP) has gained massive popularity over the past three decades emerging as one of the best approaches to solving multi-criteria decision making problems. It is a very popular method of multi-criteria decision making and has been successfully applied in banks (Tien-Chin & Ying-Ling, 2009), government organizations (Vaidya & Kumar, 2006). It is used also in organization performance strategy adoption (Cheng & Heng, 2001), project selection, and ranking (Sinuany-Stern, Mehres & Hadad, 2006).

AHP uses a fundamental scale (Table 1) in the measurement of both tangible and intangible criteria (Saaty, 2003) in terms of their relative importance by taking characteristics that are similar, comparing them and obtaining their ultimate proportions and weights. As a result, the decision maker is able to calculate the total weight of the criteria for candidate selection according to the order of increasing priority to obtain the relative importance.

Table 1: Saaty's fundamental Scale of Relative Comparison

Intensity of Importance	Definition	Explanation
1	Equally Important	Two activities contribute equally to the objective
3	Moderate Importance	Experience and judgments slightly favor one activity over another.
5	Strong Importance	Experiences and judgment strongly favor one activity over another.
7	Very Strong	An activity is favored very strongly over another.
9	Extreme Importance	The evidence favoring one activity over another is of the highest possible order affirmation.
2,4,6,8	For compromise between the above values	Sometimes one needs to interpolate a compromise judgment numerically because there are no good words to describe a unit.

The decision maker wants to compute a vector $w=(w_1,w_2,\ldots,w_n)$ associated with A. If the matrix A is consistent, that is $a_{ij}=a_{ik}*a_{kj}$ *for all i, j,k=1,2,…,n*, then A contains no error and denoted as

$$A=\begin{pmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} \\ \vdots & \vdots & \cdots & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} \end{pmatrix}$$

In AN, the priority vector is obtained by the process as demonstrated below:

$$a'_{ij} = a_{ij}/\sum_{i=1}^{n} a_{ij} \quad i,j = 1,2,\ldots n \qquad (1)$$

$$w_i = \left(\frac{1}{n}\right)\sum_{j=1}^{n} a'_{ij}, \quad i = 1,2,\ldots.,n \qquad (2)$$

The next procedural step is the consistency check. Practically, it is rare to find the criteria having the same unit of measure. AHP is designed to include inconsistency in weighing the relative preferences of choices or alternatives. The reason is some decision problems are of qualitative in nature making it difficult to assign specific weights of preferences between their comparisons and that decision makers are not always capable of logically consistent. While eliciting weights a decision maker is likely to form a reduplication of comparisons due to poor judgments or uncertainty. These reduplications are what cause numerical error. AHP tolerates an inconsistency ratio of less than 10% taking into account the different units of criteria and goals to be compared. To check the inconsistency the consistency index (CI), Consistency Ratio (CR) and largest eigen value are calculated as:

$$\lambda_{max} = \sum_{i=1}^{n}\sum_{j=1}^{n} a_{ij}w_j \qquad (3)$$

$CI = (\lambda_{max} - n)/(n-1)$, $CR = \frac{CI}{RI}$ being the random consistency index is used.

We tolerate the decision as long as. If CR greater than 0.1, the decision maker is to re-evaluate his decision. Having established and obtained all the priority weights, the final process is the global weights synthesis. A global combination of weight is calculated in relations to the goal as per the hierarchical composition. It may be noted that the sum of all global weights in an AHP structure is equal to 1 after the synthesis of all local weights provided under each level of the decision hierarchy.

3.3. Linear Programming

A Linear programming problem is defined as maximization or minimization of a linear objective function subject to a set of linear constraints. The objective is to find a vector

$x=(x_1, x_2,\ldots,x_n)$ such that it maximizes

Maximize $c^T x$

Subject to

$Ax = b$

$x \geq 0$

The objective function coefficients are the priorities of the individual candidates. The decision variables are binary subject to salary constraints, lower and upper bounds, non-negativity constraints.

4. HUMAN RESOURCE REQUIREMENT PROBLEM

4.1 Recruiting of Human Resources

The following is the illustration of the case discussed in section 2. This is a problem of hierarchical disintegration of the hiring and selecting of suitable candidates, development of the pair-wise comparison matrix, priority weights development and the global weights development. Consider the fact that the company is looking to employ a Technical Manager, a Driver and one to three Assistant to fill the vacancy at one of their plants located in the district of Dar as Salaam.

The company has many departments including Human Resource, Production, the General Management, Finance and Sales. For the illustration, we will only focus on the General Management department. The department is headed by a general manager who is assisted by the Deputy General Manager. The General Manager has two subordinates reporting directly to him, the operations manager and the technical manager. Each general management department posts are entitled to a company maintained car, a personal driver and at least one assistant among other job-related entitlements. The company is not considering spending more than 10 million TSH for all the posts as monthly salary. The details and qualifications of the posts and the salary package are given in Table 2.

Table 2: Details of the posts

S/N	Post	Department	Number of Positions	Criteria of selection	Take-Home monthly salary TSH(000,000)*
1	Tech. Manager	General Management	1	Experience; Education; Comm. Skills (CS); Tech. Skills (TS)	6
2	Driver	General Management	1	Experience; Education; Mechanical Skills (MS);	0.8
3	Assistant	General Management	(1-3)	Experience; Education; Office Management. Skills (OMS); Communication Skills (CS)	1.2

TSH= Tanzanian Shillings, 1USD= 1,700 TSH.The problem is disintegrated into a hierarchy with the following levels. The first level (goal) is the selection of candidates. The second level is the requirement purpose. The company is to hire a technical manager to ensure quality of the products, to increase efficiency, to enhance capacity and to facilitate a room for product development. The department level is the third where in this case, the only department with vacancy is the general management. The fourth level is where the organization to fill the post technical manager, driver and assistants.

The hierarchy is further decomposed into a level of criteria for each of the post under the general management department. Under each criterion of every post, a further decomposition is done such that every selection criterion is assigned different values of intensity. The final level is that of the candidates who have applied for each post, these are the alternatives. Due to space constrictions here, we have reduced the hierarchy to include only the first five levels (see Fig 2). In each hierarchical level a pair wise matrix comparison is made using the fundamental scale (Table 1). For example, comparison matrix for the requirement purpose (Level 2) is developed in (Table 3) with the help of partial questionnaire given in Appendix 1.

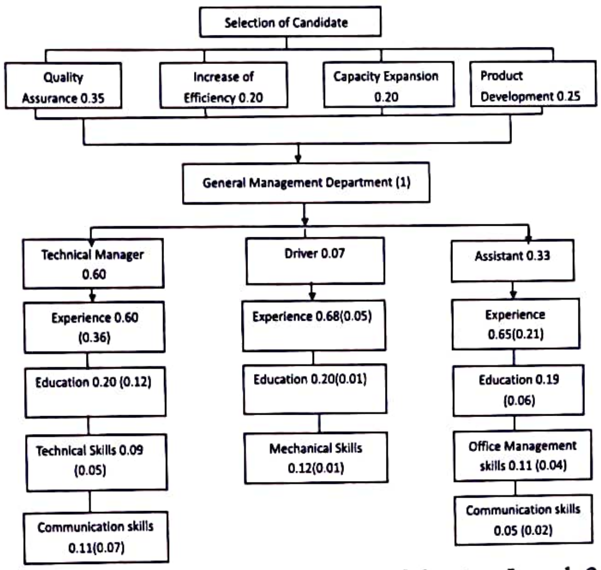

Table 3: Pairwise Comparison Matrix -Level 2 Requirement Purpose

	QA	IE	CE	PD
Quality Assurance (QA)	1	2	2	1
Increase of Efficiency (IE)	1/2	1	1	1
Capacity Expansion (CE)	1/2	1	1	1
Product Development (PD	1	1	1	1

After additive normalization process the priority weights are obtained accordingly (See Table 4-6). These weights are mentioned in Fig-2. Since we have only one department (general management), its priority weight is given as 1.(see Fig 2)

Each post has its specific selection criteria. The technical manager's post has 4 criteria of selection namely; experience, education, technical skills and communication skills. To obtain the weight of each of the criterion a pair-wise matrix comparison is developed and the additive normalization method is further applied (see Table 6). The weights of the criteria are added together and the ratio of the weight corresponding to the weight of the technical position (0.6) is synthesized accordingly. We then obtain (0.36, 0.12, 0.05 and 0.07) (see Table 3).

The entire process is repeated for the remaining two posts. Pair wise comparison matrices for the driver and personal assistant are composed accordingly, given the selection criteria including experience, education level, and technical skills for the driver post and experience, education level, office management skills and communication skills for assistant posts respectively (See Table 7 & 8).

4.2 Intensities and composite scores

To implement absolute measurement mode in AHP, each selection criterion for every post is further sub-divided into different levels of intensity. These intensities should be located at level 6 of Table 3 and the list is found in Table 9. For example, for evaluation of Technical Manager have the following intensities: (i) experience is divided in to three intensities of high (corresponds to 3+ years of experience), medium (1-3 years), and low (less than one year); (ii) education is divided in to master, degree and diploma; (iii) technical skills in to excellent, fair and poor; (iv) communication skills in to high, medium and low. The priorities of the intensities are derived from pair wise comparisons and idealized by dividing each by the largest so that the largest becomes 1 and rest follows proportionally.

After conducting a series of interview on job performance skills, personality traits, communication skills, each candidate was evaluated by a group of experts (minimum 3)according to the posts they applied for and the selection criteria under each post. The comparison matrix is developed after taking the geometric men of the judgments and weights shown in Table 10. The candidate's synthesized score for each level with its corresponding priority weights is shown in Table 11.

Table 4: Additive Normalization- Level 2

Requirement Purpose	QA	IE	CE	PD	Weights
Quality Assurance (QA)	0.333333	0.4	0.4	0.25	0.3458333
Increase of Efficiency(IE)	0.166667	0.2	0.2	0.25	0.2041667
Capacity Expansion (CE)	0.166667	0.2	0.2	0.25	0.2041667
Product Development(PD)	0.333333	0.2	0.2	0.25	0.2458333
				CI=	0.0208333
				CR=	0.0210438

Table 5: Additive Normalization- Level 4

Posts	TM	DRV	Asst	Weights
Technical Manager (TM)	0.615385	0.571429	0.625	0.603938
Driver (DRV)	0.076923	0.071429	0.0625	0.070284
Assistants (Asst)	0.307692	0.357143	0.3125	0.325778
			CI	0.003932
			CR	0.005958

Table 6: Additive Normalization for criteria of- Technical Manager (Level-5)

	Experience.	Education	TS	CS	Weights
Experience	0.627802691	0.68571429	0.5	0.608695652	0.605553157
Education	0.156950673	0.17142857	0.2	0.260869565	0.197312202
Tech. Skills	0.125560538	0.08571429	0.1	0.043478261	0.088688271
Comm. skill	0.089686099	0.05714286	0.2	0.086956522	0.108446369
				CI	0.0326
				CR	0.0049

Table 7: Additive Normalization for criteria of Driver post (Level 5)

	Experience	Education	MS	Weights
Experience	0.689655172	0.727273	0.625	0.680643
Education	0.172413793	0.181818	0.25	0.201411
Mech. kills	0.137931034	0.090909	0.125	0.117947
			CI	0.044
			CR	0.066

Table 8: Additive Normalization for criteria- Assistants (Level 5)

	Experience	Education	Offc.M. skills	Comm. skills	Weights
Experience	0.6728972	0.6956522	0.705882353	0.529411765	0.650961
Education	0.1682243	0.173913	0.176470588	0.235294118	0.188476
Off.M. skills	0.08411215	0.0869565	0.088235294	0.176470588	0.108944
Comm.skills	0.07476636	0.0434783	0.029411765	0.058823529	0.05162
				CI	0.054
				CR	0.055

Table 9: Ideal priorities of the intensities for each post. (Level 6)

Post	Sel. Criteria		Level of intensities and Idealized priorities	
Tech. Mangr	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1yr) (0.27)
	Education	MSc(1)	Degree (0.44)	Diploma(0.11)
	Technical skills	Excellent(1)	Fair(0.32)	Poor(0.10)
	Communication skillls	High(1)	Medium (0.64)	low (0.20)
Driver	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1) (0.27)
	Education	Diploma(1)	Certificate(0.44)	Secondary Level(0.11)
	Mechanical Skills	High(1)	Medium (0.22)	low (0.10)
Assistant	Experience	High(3+yrs)(1)	Medium (1-3yrs)(0.64)	low(<1) (0.27)
	Education	Degree(0.11)	Diploma(1)	Certificate(0.44)
	Office Mgmt. skills	Best(1)	Good(0.30)	Poor(0.18)
	communication skills	High(1)	Medium (0.64)	low (0.20)

Table 10: A list of candidates, their application posts and awarded scores after interviews.

Candidate	post / Sel. Cri.	Technical Manager / Experience	Education	Technical Skills	Communication Skills
	weight	0.36	0.12	0.05	0.07
1		High	Masters	Fair	High
2		High	Degree	Excellent	Medium
3		Medium	Degree	Excellent	Medium
4		High	Diploma	Excellent	Low
	Post	Driver			
	Sel. Cri.	Experience	Education	Mechanical Skills	
	weight	0.05	0.01	0.01	
5		High	Secondary Level	Medium	
6		Medium	Diploma	Low	
7		Low	Certificate	High	
8		Medium	Certificate	High	
	Post	Assistant			
	Sel. Cri.	Experience	Education	Office Mgmt. Skills	Communication Skills
	weight	0.21	0.06	0.04	0.04
9		High	Certificate	Best	Low
10		Low	Degree	Poor	High
11		Medium	Certificate	Good	Medium
12		Low	Diploma	Poor	Low
13		Medium	Degree	Best	Medium

Table 11: Score synthesis - Candidate's qualifications with selection criteria for each post.

	Technical Manager Post				
	Experience	Education	Technical skills	Communi. skills	Score
	0.36	0.12	0.05	0.07	
1	1	1	0.32	1	0.566
2	1	0.44	1	0.64	0.5076
3	0.64	0.44	1	0.64	0.378
4	1	0.11	1	0.2	0.4372
	Driver				
	Experience	Education	Mechanical Skills		Score
	0.05	0.01	0.01		
5	1	0.11	0.22		0.0533
6	0.64	1	0.1		0.043
7	0.27	0.44	1		0.0279
8	0.64	0.44	1		0.0464
	Assistant				
	Experience	Education	Office Mgmt. skills	communication skills	Score
	0.21	0.06	0.04	0.04	

9	1	0.44	1	0.2	0.2844
10	0.27	0.11	0.18	1	0.1105
11	0.64	0.44	0.3	0.64	0.1984
12	0.27	1	0.18	0.2	0.1319
13	0.64	0.11	1	0.64	0.2066

Table 12: Optimal solution for the selection of the candidate problem

Candidate		Number	Post	Monthly Salary (000,000)*Tsh	Total Salary
1		1 Post	Technical Manager	6	6,000,000
9		1 Post	Assistant	1.2	1,200,000
11		1 Post	Assistant	1.2	1,200,000
13		1 Post	Assistant	1.2	1,200,000
Total		4 posts			9,600,000

4.3 Optimizing Manpower Allocation

We present a linear programming model to allocate best human resources.

The objective function coefficients are the priorities of the individual applicants given in Table 11. The decision variables are binary, subject to salary constraints, lower and upper bound constraints and non negativity constraints.

For better demonstration, we begin by redefining the candidates (Candidate 1, 2, . . . 13) to be represented as and the salary entitled for each post (6, 0.8 and 1.2 Tsh for the technical manager, driver and assistant respectively).

The model identifies the candidates that can provide the company with optimal solution of their organization purposes given their applied posts.

$$\text{Max}\,0.566x_1+0.5072x_2+0.378x_3+0.4372x_4+0.0533x_5+0.0439x_6+0.0279x_7+0.0464x_8+0.2844x_9+0.1105x_{10}+0.1984x_{11}+0.1319x_{12}+0.2066x_{13}$$

Subject to salary constraint under each post

$$6x_1+6x_2+6x_3+6x4+0.8x_5+0.8x_6+0.8x_7+0.8x_8+1.2x_9+1.2x_{10}+1.2x_{-11}+1.2x_{-12}+1.2x_{-13}\le 10$$

The constraint relating to the number of vacancy to be filled in each position:

$x_1+x_2+x_3+x_4=1$ (*TechnicalManager*)

$0\le x_5+x_6+x_7+x_8\le 1$ (*Driver*)

$1\le x_9+x_{10}+x_{11}+x_{12}+x_{13}\le 3$ (*Assistant*)

x_j for j=1.2....,13 *are binary*

The problem is to find the number of posts to be filled, best candidate to be hired under each post so as maximize the organization purpose of the company and the total budget the decision makers must spend.

The above model was solved using EXCEL solver. The employees that are to be hired to maximize the goal of the carbonated soft drink manufactured company are as follows (Table 12):

x_1	*Technical Manager*
x_9	*Assistant*
x_{11}	*Assistant*
x_{13}	*Assistant*

5. CONCLUSION

Linear programming is a useful optimization technique for solving allocation problem when tangible measures are considered. Many real world problems like employee selection cannot be readily solved by linear programming because they often contain intangible variables that cannot be quantified. AHP can measure intangible. Combining AHP and LP makes it possible to deal with all optimization problems whether the problems are tangible or intangible.

The selection of new candidates to fill vacant posts in any company is of paramount importance. Decision makers must ensure the selection of qualified candidates who will provide their companies with maximal returns of the human resource investment. In Section 3, the AHP is employed to decompose the company's candidate selection problem into different levels of tangible and intangible factors. Using the additive normalization process, we demonstrated the development of priority weights for the tangible and intangible factors at every level in the hierarchy. In Section 4, we showed through examples, the application of AHP-derived priority weights in the formulation of a linear programming model whose objective function is the optimization of the company's human resource investment. Using EXCEL's Solver the selection of the candidates that can provide the most contribution to the company's laid out mission and vision is illustrated.

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Appendix-1

Partial Questionnaire

Example: For which do you give more Importance?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

Increasing Importance ← → Increasing Importance

Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Increase of Efficiency
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Explanation :

i) If you choose 1, when comparing Quality Assurance and Increase of Efficiency that means you give equal importance to both the criteria.

ii) If you choose 9 towards right side, when comparing Right Side Criteria with Left one that means you give 9 times more importance to the Right Side Criteria (Capacity Expansion) over the Left side criteria (Quality Assurance).

iii) If you choose 6 towards left side, when comparing Left Side Criteria with Right one, that means you give 6 times more importance to the Left Side Criteria (Quality Assurance) over the Right Side Criteria (Product Development).

Name:...

Designation:...

Question 1: What is the relative Importance of '**Quality Assurance**' with respect to others?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

Increasing Importance ← → Increasing Importance

Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Increase of Efficiency
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Quality Assurance	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Question 2: What is the relative Importance of '**Increase of Efficiency**' with respect to others?

Please compare the decision criteria and circle your Answer using the scale below:

1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

Increasing Importance ← → Increasing Importance

Increase of Efficiency	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Capacity Expansion
Increase of Efficiency	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product Development

Question 3: What is the relative Importance of '**Capacity Expansion**' with respect to other? Please compare the decision criteria and circle your Answer using the scale below: 1=Equal;3=Moderate;5=Strong;7=Very Strong;9=Extreme

	← Increasing Importance	Increasing Importance →	
Capacity Expansion	9 8 7 6 5 4 3 2 1	2 3 4 5 6 7 8 9	Product Development