Enhancing Employee Quality through Objective Evaluation: A Delphi-AHP Approach for Selecting Best Employees at McEasy Company

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Abstract—Employees are one of the company's main assets whose quality must be continuously improved. Evaluation of employee performance in the form of selecting the best employees is one of the efforts that can be made to improve the quality of the company's human resources. McEasy Company has conducted a selection of the best employees every year. Selection is made through voting by related parties without clear and measurable assessment parameters so it tends to be subjective towards the views of each assessor. In this study, factors or criteria for evaluating employees will be sought which are measurable and agreed upon by the relevant parties (panelists). The Delphi-AHP method will be applied to obtain these criteria. Through the Delphi 2-round method, a consensus on employee assessment points was obtained from the panelists, and through the calculation of the AHP method, the weight was obtained as the value of relative importance or the contribution scale of each factor. From the results obtained, the 3 factors with the highest ratings were work finish on time (31.21%), good communication skills (16%), and good time management (11.5%). The results obtained can then be used in evaluating the best employees at the McEasy company. Furthermore, the results of this study can be embedded in an information system as a feature of the decision support system for selecting the best employees. Where factor weights can be adjusted through the system, and the appraiser can assess directly without the need to know the weight of each of these factors.

Keywords—employee performance evaluation; decision support system; selection criteria; Delphi; AHP

I. INTRODUCTION

Employees are one of the most important assets owned by a company in its efforts to maintain survival, development, and ability to compete and earn profits. Competition in the increasingly competitive business world has spurred companies to work harder to improve the quality of their companies. One of the efforts is to improve the quality of human resources. To maintain and increase the quality of employees, companies need to conduct an employee performance appraisal in the form of selecting the best employees. Selection of the best employees is an aspect that is quite important in the performance management of a company. Selection of the best employees will produce valid and useful information for employee administrative decisions such as promotions and training as an appreciation of employee performance and other decisions [1]. The McEasy company is a company in the city of Surabaya that was established in 2017 and is engaged in the information technology industry. McEasy selects the best employees to motivate employees to increase their dedication and performance. Selection of the best employees is carried out periodically but has not been maximized in its implementation. Selection of the best employees is carried out without clear criteria, carried out through voting with subjective judgments by related parties.

The Delphi method is a method used to resolve controversial consensus issues [2]. Delphi was developed as a method for finding the most reliable consensus among a selected group of experts [2]. Delphi is well-suited for exploring areas where there is controversy, contention, or a lack of clarity [3]. Delphi studies explore and reveal assumptions from a topic from various disciplines, Delphi has been widely used in various fields, such as planning, policy determination, needs assessment, and utilization of resources to develop various alternatives [4].

AHP is one of several Multi-Criteria Decision Making (MCDM) methods. AHP models the decision-making process mathematically and is used to solve complex problems [5]. Among the main features of AHP is the development of a hierarchical structure of the issues raised and comparative assessments that can be carried out individually or as a group decision [4]. The Delphi and AHP merging technique, called Delphi-AHP, has been used extensively in policy, technology, and education settings.

This study will implement the 3-round Delphi method with AHP integration in the last round to obtain clear criteria for evaluating the best employees in McEasy companies that are agreed upon by various interested parties. With the integration of AHP, in addition

to obtaining clear assessment criteria, weight will also be obtained as a priority determinant or contribution scale from each of the resulting criteria. The results obtained will serve as a reference for McEasy in the process of selecting the best employees in a more clear and measurable manner

II. Related Work

A. Delphi Method

The Delphi method is a method that has been widely used in the process of reaching a consensus on a problem involving several experts or interested parties who have insight into the problem being investigated [6]. These experts are then referred to as panelists or respondents. The main feature of the Delphi method is control feedback from panelists which is carried out through a series of questionnaires in several rounds or iterations [2]. There is wide variation in the type of feedback that can be provided by respondents, but broadly speaking they can be divided into qualitative and quantitative types [7]. Qualitative responses are argumentative responses in the form of reasons or justifications for why the expert chose that opinion. Meanwhile, the quantitative response is related to data measurement and statistical inference. Each iteration stage is a controlled indirect interaction among experts that is carried out relatively tightly [8], with a tendency for experts' judgments to converge as the experiment progresses [2].

There are no agreed guidelines on how to determine the type of feedback to use [9]. In studies that have been conducted, it is known that both argumentative responses with written arguments or through scoring have the same effect on influencing the opinions of other respondents in the iterations carried out [10]. However, the quantitative method, namely the summary of statistics using the median, mean or percentage of agreement, is more commonly used in Delphi studies [11]. Several Delphi studies used a Likert scale in scoring. some authors later dichotomized the scale because they noticed that the distribution of responses was bimodal [12], while others based their definition of agreement on ranking at the upper end of the scale used (e.g., items scored 4 and 5 on a 5-point Likert scale) [13].

Even though the panelists are people who have expertise or knowledge in the field being investigated, a certain level of diversity is considered beneficial, such as the demographic characteristics of the participants, as well as in aspects related to their professional experience [14]. There is no standard for the number of respondents involved, generally between 10 to 100 [15].

Research begins with gaining good knowledge in the field being researched. Some researchers use literature studies to gain broad insights about the subject as zero iteration before preparing a set of elements and indicators for the first round of questionnaires, while others rely entirely on experts to identify indicators and elements regarding issues related to using open questionnaires [16].

Generally, the Delphi study is carried out in two or three rounds or iterations, where each has a different purpose, and the questionnaire in the next iteration is developed based on the results of the previous iteration [2]. It usually starts with identifying indicators or elements in the first step, validating and ranking the level of importance in the second step, and seeking consensus in the third step [17].

In the implementation of Delphi, several studies combine the multicriteria decision-making technique at the final stage of the consensus. Among those that have been used widely and are sufficiently recommended is Delphi-AHP [4], [11], [18]–[21]. AHP is used to measure the priority of various alternatives under various assessment criteria [18]. At Delphi-AHP, AHP assessment is carried out by pairwise comparisons made at each level to make decisions based on the knowledge and experience of experts who have also been involved in previous Delphi iterations. Delphi-AHP proved to be effective because it does not require a large sample size to produce statistically significant results [22].

B. Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is one of the decision support system methods in the category of multi-criteria decision-making techniques. The AHP method begins by building a hierarchical structure based on a problem. AHP is commonly used in selection, evaluation, prioritization, and system development [5]. There are 3 stages in AHP, including:

1) Define decision objectives and build a hierarchical structure for the problem

After determining the objectives of the problem to be solved, a hierarchical structure (Fig. 1) will be built which has several levels with the highest hierarchy being the objectives of the problem. At the second level are the criteria for these objectives, the third and the next level can be set sub-criteria for each criterion at the previous level. At the last level are alternatives that will be determined in order of priority based on the weight or value of relative importance. This value is obtained based on the calculations performed. The number of levels in the developed structure varies according to research needs [23].

2) Decision-making considerations

At this stage, a comparative assessment is carried out between criteria that are at the same level and group in the previously built hierarchical structure. Rating using a scale of 17 bipolar units with the same distance. The description of this scale unit is referred to as "Intensity of importance" [5].
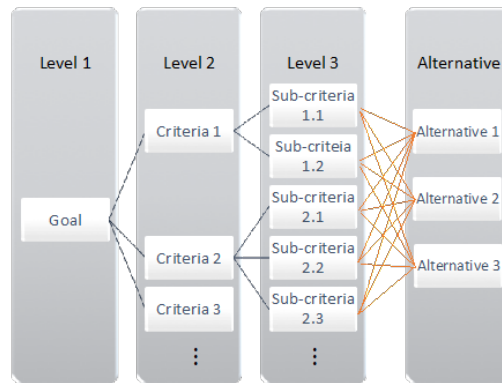
Fig. 1.   AHP Hierarchical Structure

The implementation in the assessment of the respondent form is shown in TABLE II. in the methodology section. The AHP method can be used as an individual or group decision, but the comparative assessment process is carried out by each respondent individually. There are no definite rules regarding the number of respondents in the AHP method. AHP can be carried out on a small or large number of respondents. Findings regarding sample size, it was concluded that generally, it was between 2 - 100, but some studies used many respondents above 100 [24].

Each filling in the assessment form must meet the consistency ratio to be used in the next process. Therefore, in filling out the form by the respondent, a moderator is needed who will provide an explanation and guide the respondent in giving a score on the assessment form [5].

3) Prioritization

In determining priority, a comparison matrix was developed for each form of respondent at each level and group of criteria (TABLE I.). The size of the comparison matrix is $n \times n$, where n is the number of criteria being compared.

TABLE I.   COMPARISON MATRIX STRUCTURE FOR 3 CRITERIA

Criterias	Criteria 1	Criteria 2	Criteria 3
Criteria 1	1	C1–C2 Comparison	C1–C3 Comparison
Criteria 2	C2–C1 Comparison	1	C2–C3 Comparison
Criteria 3	C3–C1 Comparison	C3–C2 Comparison	1

Each comparison matrix must meet a consistency ratio (CR) value, this is to ensure that the contents of the form or comparison values between the criteria provided by respondents are consistent and usable. Each comparison matrix must meet $CR < 0.1$ to be used [5].

Calculation of consistency ratio as shown in the following equation:

$$CR = \frac{CI}{RI}$$

With,

$CI: Consistency\ Index$
$RI: Random\ Consistency\ Index$

Calculation of the Consistency Index as in the following equation:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Where λ_{max} is the maximum eigenvalue and n is the number of criteria.

In making group decisions, there will be several comparison matrices representing each respondent. All of these matrices will be reduced to one comparison matrix as communal or group opinion. In this case, the geometric mean can be used to reduce the matrix.

III.   METHODOLOGY

In getting the best employees, the first step is to determine what factors will be used in evaluating employees. In this work, the Delphi-AHP method will be carried out, namely the 3-stage Delphi method, where in the final stage the AHP method will be used which is intended to avoid biased responses from group experts [4], by obtaining relative importance values from employee evaluation factors. Several respondents or panelists who act as experts will be involved in each stage of the research. They consist of several employees and leaders of the McEasy company from various departments and have an interest in determining the criteria for selecting the best employees. The combination of the Delphi and AHP methods has been widely used in policy, education, and technology [25], [26]

TABLE II.   ASSESSMENT FORM ON LEVEL 2 CRITERIA

	Extreme								Equal								Extreme	
Discipline	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Teamwork
Discipline	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Responsibility
Performance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Teamwork
Performance	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Discipline
Responsibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Teamwork
Responsibility	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Performance

The 3 stages of research conducted in this study can be briefly seen in Fig. 2. With a more detailed explanation as follows:

A. Delphi first round

The first round of Delphi was held with a qualitative approach. Panelists were asked to fill out a questionnaire with an open question. panelists are allowed to express their views freely regarding the criteria for the best employees including what actors can be used to evaluate employees to be selected as the best employees.

The data obtained will then be analyzed by identifying similarities and can then be extracted into main points that are mutually exclusive.
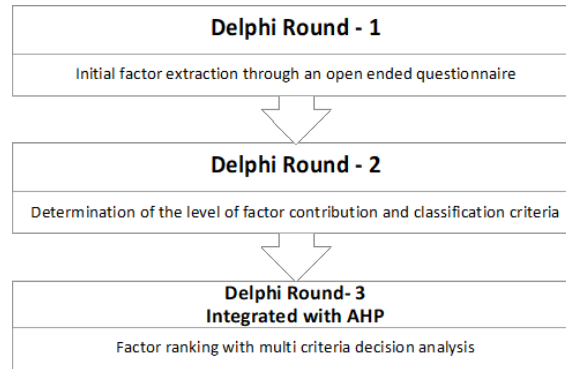

Fig. 2.   Three Round Delphi-AHP

B. Delphi round two

The second round of Delphi will be used as a stage to carry out a consensus between panelists on the points that have been obtained in the previous stage. Unlike the previous round, in this second round, a qualitative approach will be held.

At this stage, the panelists can provide feedback on the points that have been obtained. They will be asked to fill out a questionnaire containing a five-scale point rate for all factors obtained in the first round so that the contribution level of each factor is obtained. Through this method, panelists will gain insight into the points conveyed by other panelists, which may influence their views. At the end of the second round, points that are considered irrelevant or receive low ratings can be eliminated.

C. AHP

As with the AHP method in general, in this study, there were two stages in the AHP method, namely building a hierarchical structure, compiling questionnaires, and conducting surveys. In the AHP hierarchical structure, problems are broken down into sub-

problems at the appropriate hierarchical level so that they can be evaluated systematically in the decision-making process [27]. The hierarchical structure built will conform to the results obtained in the Delphi method in the previous stage.

The questionnaire was developed based on the hierarchical structure that has been compiled. In it, there is a comparative assessment between factors in the same category at all levels. In carrying out a comparative assessment, factors in the same category will be aligned with each other with 17 assessment points that state the scale of importance of the two factors being compared. There are 8 assessments on the right and left, and one neutral assessment in the middle as shown in TABLE II.

To increase consistency in survey implementation, in filling out the form, each respondent or panelist will be guided by a moderator who provides an explanation of the purpose and how to fill out the survey form. Namely how to provide a rating value on the items being compared. In carrying out the survey, the consistency value was calculated from the entries in the AHP form, the results used were those that had a good consistency value, namely CR < 0.1 which would then be further processed to obtain results and final analysis.

IV.   RESULTS

To get a consensus on the evaluation factors for determining the best employee, 3 stages of the Delphi method were carried out with AHP integration in the third round. 20 respondents or panelists who are employees of the McEasy company are involved in each stage. The panelists consist of several company leaders and staff who are representatives of all departments in the company.

A. First round

In the first stage, respondents filled out a questionnaire with an open-ended question type regarding the criteria for the best employee in their view. Panelists write free descriptions of their views on the problems given. Then an analysis of the results obtained was carried out, namely by identifying the similarities between the answers so that the main points that were mutually exclusive were obtained from the respondents' answers.

There are 27 factors obtained from the first stage, these factors are then categorized into 5 different criteria, namely discipline, performance, ability to work in a team, and responsibility. While each factor is referred to as a sub-criteria of related criteria. Grouping is presented in TABLE III.

B. Second round

In the second stage, an assessment is made of the factors that have been obtained in the previous stage using a five-point rating scale survey. The assessment was carried out by all experts, namely 20 respondents who were involved in the first stage, this was done to get the panelist's perspective on the contribution of the factors obtained to determine the best employee in the McEasy company. From the results obtained, the calculation of the frequency distribution, mean and standard deviation is carried out as summarized in TABLE IV.

Based on the calculated results, the average scores for all factors range from 3.95 to 4.65. This indicates that the responses are concentrated mainly within contribution levels 4 and 5. The factor with the highest level of contribution is HNS, displaying an average score of 4.65. Following closely are RTG and GPS, both with average scores of 4.6. Conversely, DRW and GOS received the lowest ratings, each having an average score of 3.95. As we move forward, a selection criterion is applied. Only factors with an average score greater than or equal to 4.3 will undergo further evaluation in subsequent stages. Consequently, nine factors—CAC, DRW, WRT, GOS, GHS, GPM, LRW, CDI, and GTP—were excluded from consideration, leaving the remaining sixteen factors for continued evaluation in subsequent phases.

C. Third round

The purpose of this final stage is to rank and obtain the relative importance of each factor in the evaluation of the best employees at McEasy. This is done by using the analytical hierarchy process (AHP) method as a group decision-making method on multiple criteria issues with comparative judgment [5].

As the first step in the AHP stage, a hierarchy is built, starting from the research objectives which are then reduced to criteria and sub-criteria, and alternatives at successive levels. Then a comparison can be made of the factors at the appropriate level. In the previous stage, 16 factors have been obtained, which have been grouped into 4 different criteria.

The hierarchical structure is built based on the factors and groupings that have been carried out as shown in Fig. 3. Then a comparative assessment is carried out between factors in the same category at all levels.

A comparative assessment was conducted on the same 20 panelists who had been involved in the previous Delphi stage. Among the things that are prioritized in AHP is the consistency of the respondents' answers [28], therefore, all the assessment data used has met the value of the consistency ratio, namely $CR \leq 0.1$.

The assessment of the 20 panelists is a personal assessment, which must then be reduced to a comparison matrix which is the final group or communal opinion. In this case, the geometric mean is used to combine the individual assessment matrices into one communal assessment matrix. The final results as shown in TABLE IV.

TABLE III.   CRITERIA AND SUB-CRITERIA

Criteria	Sub-Criteria	Abbreviation
Discipline	Comply with all regulations in the company	CAC
	Work finished on time	WFT
	Have good time management	GTM
	Departure and return according to working hours	DRW
	Do not procrastinate work	DPW
Performance	Willing to try if face a trouble	WTT
	Work is always right on target, even exceeding the target	WRT
	In-depth knowledge of the product being worked on	IKP
	Good organizational skills	GOS
	Quick to adapt and open to new things	QAO
	Have good Hard Skills and Soft Skills	GHS
	Good project management	GPM
	Have good problem solving	GPS
	Attention to details	ATD
	Little revision work	LRW
	Able to create different new ideas / innovations	CDI
Teamwork	Have good communication skills for all employees	GCS
	Able to work with team	WWT
	Have a growth mindset	HGM
	Cooperative in team	CIT
	Good team player	GTP
Responsibility	Be able to admit and accept when make a mistake	AAM
	Not much dodge, excuse and blame others	NDE
	Responsible for the tasks given	RTG
	Honest	HNS

TABLE IV.   SUMMARY ROUND 2: THE RANKING RESULTS USE A LIKERT SCALE

Criteria	Sub-Criteria	Contribution Level					Mean	Standard Deviation
		1	2	3	4	5		
Discipline	CAC	0	1	2	9	8	4,2	0,833508753
	WFT	0	1	1	5	13	4,5	0,827170192
	GTM	0	1	2	4	13	4,45	0,887041208
	DRW	0	1	5	8	6	3,95	0,887041208
	DPW	0	1	3	4	12	4,35	0,933302004
Performance	WTT	0	0	2	7	11	4,45	0,686332741
	WRT	0	0	3	8	9	4,3	0,732695097
	IKP	0	0	2	7	11	4,45	0,686332741
	GOS	0	0	7	7	6	3,95	0,825577947
	QAO	0	0	4	4	12	4,4	0,820782682
	GHS	0	0	1	7	11	4,3	0,63701607
	GPM	0	0	5	10	5	4	0,72547625
	GPS	0	0	3	2	15	4,6	0,753937035
	ATD	0	0	4	4	12	4,4	0,820782682
	LRW	0	0	5	7	8	4,15	0,812727701
	CDI	0	0	5	9	6	4,05	0,759154655
Teamwork	GCS	0	0	3	7	10	4,35	0,74515982
	WWT	0	0	2	6	12	4,5	0,688247202
	HGM	0	0	2	7	11	4,45	0,686332741
	CIT	0	0	3	6	11	4,4	0,753937035
	GTP	0	0	4	8	8	4,2	0,767771896
Responsibility	AAM	0	0	2	7	11	4,45	0,686332741
	NDE	0	1	1	6	12	4,45	0,825577947
	RTG	0	1	1	3	15	4,6	0,820782682
	HNS	0	0	1	5	14	4,65	0,587142949

From the results of calculations using the AHP method, the weights for each criterion and sub-criteria are obtained. This weight is the value of the relative importance of each of these factors in determining the best employee at McEasy. In addition, the weights obtained are also used to provide ratings for both criteria and sub-criteria. The factors in the sub-criteria have 2 weight values, namely local weight and global weight. Local weight refers to the priority weight related to the previous hierarchical level, namely criteria. On the other hand, the global weight is the priority weight related to the highest hierarchical level, which is calculated by multiplying the local weight of the attribute with the local weight of the criteria to which it belongs [29].

From the results obtained, it is known that the disciplinary criteria received the highest rating, followed by teamwork, performance, and responsibility. In the sub-criteria, the first 3 are the factors of work being completed on time with a relative importance scale of 0.312, followed by having good communication skills with all employees and having good time management. While the 3 lowest ranks are having good problem-solving, paying attention to details, and being honest with a global weight of 0.006.

V.   DISCUSSION AND CONCLUSION

This study aims to gain consensus on employee evaluation factors that are agreed upon by all relevant parties and will be used to determine the best employee at McEasy every year. In this case, the Delphi-AHP method was used, with the respondents consisting of 20 experts who were employees at McEasy, both leaders and staff from all existing departments. Data collection began with the first two rounds of the Delphi method, which showed that the experts identified 16 main factors that contributed to the assessment of the best employees. Then with the AHP method in the third round, the weight of each factor was obtained to determine the contribution scale or priority of each evaluation factor (Fig. 4).

Based on the findings, the top-ranked factors fall within the discipline and teamwork category. This illustrates that the panelists give precedence to qualities such as discipline and collaborative skills as essential attributes for the best employees. The outcomes derived from this investigation will subsequently serve as a decision support mechanism in the annual selection of the best employees at McEasy. All employees involved as the best employee candidates will act as an alternative to the AHP structure. The obligated party will provide an assessment for each employee on the 16 factors that have been obtained from this study, and the weight of each factor will be a multiplier for each factor to obtain the final score for each employee.

For further development, the results of this research can be embedded in an information system as a feature for selecting the best employees. Where factor weights can be adjusted through the system, and the appraiser can assess directly without the need to know the weight of each of these factors.
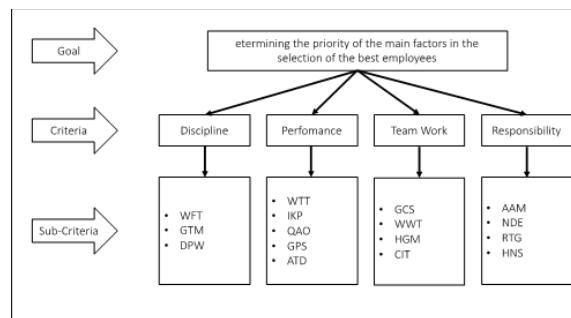

Fig. 3.   Best Employee Evaluation Factor Hierarchy Structure

TABLE V.   AHP CALCULATION RESULTS IN ROUND 3

| Criteria	Weight	Sub-Criteria	Local Weight	Local Rank	Global Weight	Global Rank
Discipline	0,488936952	Work finished on time (WFT)	0,638360699	1	0,312118135	**1**
		Have good time management (GTM)	0,235786274	2	0,115284622	**3**
		Do not procrastinate work (DPW)	0,125853027	3	0,061534195	5
Performance	0,13021248	Willing to try if face a trouble (WTT)	0,422940948	1	0,05507219	6
		In-depth knowledge of the product being worked on (IKP)	0,235283936	2	0,030636905	9
		Quick to adapt and open to new things (QAO)	0,161761586	3	0,021063377	12
		Have good problem solving (GPS)	0,108678036	4	0,014151237	14
		Attention to details (ATD)	0,071335493	5	0,009288772	15
Team Work	0,292607519	Have good communication skills for all employees (GCS)	0,54914828	1	0,160684915	**2**
		Able to work with team (WWT)	0,219100694	2	0,06411051	4
		Have a growth mindset (HGM)	0,144743313	3	0,042352982	8
		Cooperative in team (CIT)	0,087007713	4	0,025459111	10
Responsibility	0,088243049	Be able to admit and accept when make a mistake (AAM)	0,486347583	1	0,042916794	7
		Not much dodge, excuse and blame others (NDE)	0,255994882	2	0,022589769	11
		Responsible for the tasks given (RTG)	0,189220991	3	0,016697437	13
		Honest (HNS)	0,068436544	4	0,006039049	16
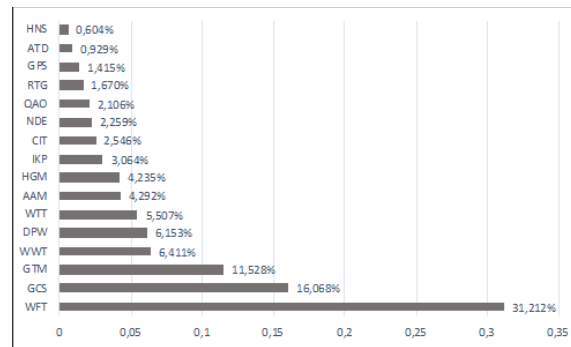
Fig. 4.   Identified Factors With Its Contribution

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