Determining an algorithm as the researcher's contribution: An alternative to performance-based research honorarium

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Abstract. The research grant is carried out with a quality assurance cycle that involves the research group to produce the research outcomes such as publication, books, or other intellectual property. However, there are problems regarding the distribution of honorariums from the rest of the budget so that they are fair according to the contributions of each researcher. Therefore, the purpose of the study is to establish the algorithm to produce the fairness index of honorarium distribution based on the researchers’ contribution. The index was built on the input, which is a manifestation of research quality assurance cycle and implemented in pseudocode and flowchart. The results show that the simulation of three conditions with different contributions from each researcher was carried out with accurate results and reflected the performance-based research honorarium distribution. Thus, the algorithm can be used by researchers for the fairness of honorarium distribution.

1. Introduction
In the past few decades, the government and world research funding institutions have given serious attention to research and publications. They realise that research contributes significantly to the prosperity of a nation. Through research, new knowledge has emerged, and the series of new technologies continue to be developed. Research results have a significant and strategic role in determining the competitive advantage and economic growth of a nation [1–5]. Therefore, scientists and stakeholders agree that the research and its outcomes such as publication, books, or other intellectual property have a close relationship to knowledge and nation prosperity. However, the honorarium distribution in research grants presents the problem for the researchers, especially in the fairness of its distribution.

In the world, there may be thousands of rules about research, whether issued by the government, research ministries, associations, universities, research institutions, or industries that provide research
funds to scientists and lecturers. A research regulation issued by MgHill can be the example [6]. However, the general standard for conducting research includes four main phases, namely planning, implementation, reporting and follow-up. In each phase, there are special rules concerning the minimum qualifications of human resources, facilities, financing, assessment processes, ethics, material, output, and perhaps more.

A researcher in developed countries generally has a promised salary as compensation for his work. In an industrial research institution, researchers may get a monthly salary that does not depend on the project. Meanwhile, in some independent research institutions and universities, compensation for researchers will depend on the project that is done after all outcomes have been achieved. A study conducted by the European Commission shows that the remuneration standards for researchers are different, depending on the country and the status of the researchers’ contributions [7].

Due to the research is group activities to produce the outcomes through a long process, starting from planning, implementing, reporting and following up [5]. The authors believe that the quality of research outcomes correlates with a good research process. The process involves a research group that jointly undertakes several activities to produce a finding. Therefore, to meet the research process standards, the principal researcher shares the roles to be carried out by its co-researchers. It will be a good collaboration where each researcher has the responsibility to meet the research outcomes in a quality assurance cycle.

In some cases, after the research was done, the research group had an unused budget which was fully owned by the researcher as research honorarium. Occasionally, the unused budget becomes a problem for the research group, especially related to the honorarium distribution. Therefore, this study is aimed to establish an instrument to preserve the research outcomes’ quality and to ensure the fairness of honorarium distribution. The instrument will also be transparent and accountable to the researchers’ performance.

2. Method

2.1. Criteria

To establish the fairness index for research contributions for each researcher, the authors conduct several activities to get the best algorithm. First, make an instrument as input. Second, make a concept to process the inputs. Third, produce a formula for measuring the fairness index as an output.

In Indonesia, implementation of Good University Governance needs to establish an Internal Quality Assurance System (IQAS) as a manifestation of Regulation of the Minister of Technology Research and Higher Education of the Republic of Indonesia Number 44 of 2015 concerning National Standards of Higher Education, which include the research implementation [8]. IQAS for research should regulate minimum criteria of output, content, process, assessment, researcher, facilities and infrastructure, management, and funding.

Therefore, every research grant must go through a cycle of interrelated and inseparable activities. In this context, to compile the fairness index for research contributions, the authors develop an instrument which is consisting of several activities as algorithm input as presented in table 1 as follows.

| No | Research Activities                                      | Weight |
|----|----------------------------------------------------------|--------|
| 1  | Preparation of research proposals                        | 0.15   |
| 2  | Implementation of research activities                    | 0.35   |
| 3  | Preparation of progress reports                          | 0.05   |
| 4  | Monitoring and evaluation activities                     | 0.05   |
| 5  | Preparation of the final report                          | 0.05   |
| 6  | Creation of profiles research and posters                | 0.05   |
| 7  | Preparation of research outputs (articles / books / patents etc.) | 0.20 |
| 8  | Research dissemination                                   | 0.05   |
| 9  | Administration activities                                | 0.05   |
Table 1 informs that every activity has a different relative weight based on the significance. The authors argue that three activities are more important than the others: preparing research proposals (0.15), carrying out research activities (0.35), and seeking research outputs (0.20). It is assumed that the research proposal becomes a sufficient offer for prospective grant-givers and convinces him to provide grants. Then, carrying out research becomes the most substantial weight as it is an essential part of the research. Finally, after carrying out the study, the researchers must also produce research outcomes as a form of knowledge distribution.

2.2. Samples
In this study, the authors simulate three groups of research to examine the compatibility of the index with real situations. The simulations are carried out in three conditions, they are (1) the principal researcher has the more contributions on the research, (2) both principal and co-researcher have the same contributions, and (3) co-researcher has the more contributions on the research. According to the experiences, these three conditions represent the overall conditions that generally occur in the research groups.

3. Results and discussion
In this section, the authors describe the algorithm of researcher contribution index. The results divide into two parts: algorithm and simulations of the index.

3.1. Algorithm index
Algorithms in the form of pseudo code are presented in figure 1 as follows:

```
Step 1: Start
Step 2: Declare Variable Title, Scheme, Year, Total Budget, Used Budget, Count of Person,
Step 3: Initialize variable
Step 4: Count of Person = 0;
Step 5: index = [{0.15}[0.35][0.05][0.05][0.05][0.05][0.05][0.05][0.05]};
Step 6: Read count of Person
    Repeat until count of Person
        Repeat until nine of Indicator Personal Contribution
            index Personal contribution of each Person = sum([personal contribution][index])
            Repeat until count of Person
                index = [0.05][0.05][0.05][0.05][0.05][0.05][0.05][0.05][0.05]
        Step 7: Salary = index Personal contribution / 10 x unused budget
        Step 8: Print Salary each Person
        Step 9: Finish
```

Figure 1. Algorithm for generating researchers’ contribution index.

According to the code, step 1-4 is the stages to fulfil the necessary information of research. Step 5-8 is the main stages of declaring the researchers’ contribution to the research, while step 6-7 is looping scheme. Finally, step 8-10 is the last stages as a result of the algorithm process.

3.2. Result of simulation
The concept is simulated in three conditions. All conditions assume that the total research grant is IDR 150 Million; the used budget is IDR 125 Million, and the remaining or unused budget is IDR 25 Million. The remaining budget of the research becomes the research group’s rights that can be shared. In this case, the researchers’ contribution index is used to guarantee that the remaining budget is distributed fairly.

According to the flowchart, the simulation provides the data which is divided into nine columns. The authors describe these columns as follows:

- The first column contains nine indicators of personal contribution, as presented in Table 1.
- The second column contains the weight factor of each indicator.
- The third column until the seventh column contains the contribution score of principal researcher and co-researcher and must be filled between 0-10.
- The eighth column contains the total score of the research group and must be 10. This column is connected with the ninth column.
- The ninth column contains the control score to ensure that researchers' contributions are filled correctly. The authors provide two information, namely 'TRUE' and 'FALSE'. TRUE if the total contribution is 10 and FALSE if less or more than 10.

The first case is the condition when the principal researcher has the most contributions to the research and presented in figure 2.

![Table](image)

**Figure 2.** Case 1: the principal researcher has the most contributions.

Figure 2 shows that the contribution index for principal researcher (BS) is 5,1; first co-researcher (BK) is 2,7; and second co-researcher (BA) is 2,2. It means that the principal researcher has the most contributions to the research and has the absolute rights to gain a bigger salary than others by IDR 12,75 Million. On the other hand, the co-researcher must be willing to get less salary, IDR 6,75 Million and IDR 5,5 Million, respectively.

The second case is the condition when both principal and co-researcher have the same contributions. The simulation is presented in figure 3.
Figure 3. Case 2: both principal and co-researcher have the same contributions.

In this case, the authors simulated that three main activities are done together by research group while their respective roles do the rest activities. Figure 3 shows that the contribution index for principal researcher and four co-researchers are equal by 2.0. The contribution of each researcher looks different if analysed by indicator, but the total contribution index is the equivalent. It describes that the remaining budget by IDR 25 Million must be divided equally by IDR 5 Million for each.

The third case is the condition that the co-researcher has more contributions than the principal. The simulation is presented in figure 4.

Figure 4. Case 3: the co-researcher has the most contributions.

The last simulation in this study shows that the contribution index for a principal researcher (DS) is 2.55; first co-researcher (DD) is 3.7, and second co-researcher (DA) is 3.75. It means that the principal researcher has fewer contributions to the research and entitled to fewer salaries than co-researchers. This condition makes the principal research can only claim the salary by IDR 6.375 Million, and the co-researchers may claim the salary by IDR 9.25 Million and IDR 9.35 Million, respectively.
The three simulations that the authors discussed can be used as alternatives in distributing research salaries. However, the essential thing about involvement in research is not the wages received, but the ongoing academic career [9]. In a robust research team, there is a transfer of knowledge and motivation between personnel, in efforts to achieve outcomes and academic careers. Many surveys prove that the loyalty of members of the organisation, including the research team, depends not only on the number of wages received, but also strongly depends on justice, transparency, and motivation [10,11].

4. Conclusion
The results show that the algorithm of the index for research contribution can be appropriately used to ensure the fairness of honorarium distribution. This study also found that the amount of honorarium depends on its contribution. The more contributions in research, the higher the honorarium earned, and vice versa. Furthermore, the contribution score that develops on the algorithm depends on the factor set by the authority even though the assumptions that the authors offer have reflected the entire research process.

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