Application of AHP for Optimal Resource Allocation of DOST Grants-in-Aid

Armela K. Razo
Special Projects Division
Department of Science and Technology
Taguig City, Philippines

Giselle Eve O. Siladan
Department of Science and Technology Regional Office No. XII
Department of Science and Technology
Koronadal City, South Cotabato, Philippines

Rex Aurelius C. Robielos
School of Industrial Engineering and Engineering Management
Mapua University
Intramuros, Manila, Philippines
racrobielos@mapua.edu.ph

Abstract

Identification of priorities contributes to optimal resource allocation of funds particularly when working on a certain budget. It is thus important to prioritize projects before funding especially during times of crisis brought by either man-made or natural calamities. This paper focuses on the multi factor evaluation of approved projects using Analytical Hierarchy process (AHP) and evaluates six (6) alternatives. This study considered fifteen (15) decision makers and five (5) criteria in the evaluation. Findings show that among the criteria, urgency and exceptionality are among the main factors considered in prioritization.

Keyword
AHP, resource allocation, DOST, grant-in-aids

1. Introduction

Government plays a crucial role in the allocation of resources in a country. Resource allocation involves the distribution and utilization of available resources across the system. Because resource availability is usually scarce and expensive, it becomes important to find optimal or even "good" solutions to such problems. (Sarge, n.d.) It is in this context where a rational or sound decision-making is taken as an integral part of modern management as decisions are made to sustain all activities and functions of an organization or agency.

The Department of Science and Technology (DOST) is the country's lead agency with respect to research and development (R&D). This cannot be over emphasized in the constitutional provision that the state shall give priority to research and development, invention, innovation and their utilization (Section 10 Article XIV). Such mandate was given life thru Executive Order 128 where DOST was given the power and function to promote, assist and where appropriate, undertake scientific and technological research and development in areas that are vital in the country's development (Section 5).

The DOST through its Grants-In-Aid (GIA) Program aims to harness the country's scientific and technological capabilities to spur and attain sustainable economic growth and development. The GIA program provides grants for the implementation of programs/projects identified in the current DOST

priorities and thrusts and supports S&T activities classified in the General Appropriations Act (GAA). Through the funding of relevant science and technology (S&T) undertakings, the DOST GIA program aims to contribute to productivity improvement and quality of life of Filipinos by generating and promoting appropriate technologies. Likewise, it seeks to strengthen the participation of various S&T sectors particularly in research and development (R&D), promotion, technology transfer and utilization, human resources development, information dissemination, advocacy, and linkages.

Research and development budget of DOST accounts to fifty percent (50%) of the country's total R&D budget distributed among the DOST Central Office, the Philippine Council for Agriculture and Aquatic Resources Research and Development (PCAARRD), the Philippine Council for Health Research and Development (PCHRD), the Philippine Council for Industry, Energy, and Emerging Technologies Research and Development (PCIEERD), and the National Research Council of the Philippines (NRCP). From 2007 to 2008, R&D budget drastically increased by more than 200%. In 2019, a six (6) Billion budget was allocated to DOST. The R&D budget will almost increase by 500% in 2020 from the same base line.

Due to the exponential increase in the R&D budget, it becomes extremely important for DOST to fund appropriate programs and projects among the different regions of the country by efficiently allocating funds through a more robust system. The selection of good projects and/or researches to be funded for implementation from numerous proposals is essential in achieving the agency's goals. In dealing with the long-term assets, it is crucial to prioritize a good project/research, which could be able to create a value by providing solution to (immediate or long-term) needs, and by maximizing its benefits through differentiating with competing products or technologies.

In this study, we evaluated the prioritization of approved programs and projects for funding consideration of the agency using the analytical hierarchy process (AHP). Results of the study can serve as basis for the generation and approval of proposals in the succeeding years. The model used in this paper may also be adopted/ used in the events of calamities and disasters as well as in times of crisis brought about by the current global pandemic.

2. Methodology

2.1. Data Accumulation

In this paper, profile of DOST-GIA budget allocation for CY2019 was used. A total of 346 projects have been funded in CY2019 and distributed among the four (4) functions, namely, (1) Generation of new knowledge and technologies (R&D), (2) Diffusion and transfer of knowledge and technologies (Technology Transfer), (3) Development of human resources for the S&T sector and other initiatives for research and facility development in science and technology (Capacity Building), and (4) Provision of quality S&T services including promotion of science and, technology and other related services (Support Services). Accordingly, the 346 projects were distributed as follows: 182 are for R&D (52.60%), 79 for Technology Transfer (22.83%), 10 for Capacity Building (2.89%), and 75 for Support Services (21.68%).

Given the data available, it may be noted the forty six percent (47%) of projects came from the National Capital Region (NCR) while twelve percent (12%) is implemented in the Calabarzon Region. It is highly noted that for 2019, there are no completed or on-going projects in the Zamboanga Peninsula Regions as shown in Table1.

Table 1. Summary of Completed and On-going Projects per Region per Function FY2019

REGION	R&D	Technology Transfer	Capacity Building	Support Services	TOTAL
NCR	95	9	10	50	**164**
Ilocos Region	-	3	-	1	**4**
Cagayan Valley	6	18	-	1	**25**
Central Luzon	9	-	-	1	**10**

CaLaBarzon	23	15	-	7	**45**
MiMaRoPa	-	-	-	1	**1**
Bicol Region	9	5	-	1	**15**
Western Visayas	10	3	-	3	**16**
Central Visayas	2	9	-	1	**12**
Eastern Visayas	-	-	-	3	**3**
Zamboanga Peninsula	-	-	-	-	**-**
Northern Mindanao	9	2	-	-	**11**
Davao Region	9	5	-	3	**17**
SoCCSKSarGen	2	2	-	1	**5**
Davao Region	4	-	-	2	**6**
SoCCSKSarGen	8	12	-	1	**21**
Caraga	1	-	-		**1**
TOTAL	187	83	10	76	**355**

Similarly, similar pattern of budget distribution can also be observed as shown in Table 2. Out of the PhP2.6Million, the NCR got the bulk of the R&D budget and had the complete allocation for all four functions.

Table 2. Budget Allocation per Region per Function for FY2019 Funded Projects

REGION	R&D	Technology Transfer	Capacity Building	Support Services	TOTAL
NCR	941,759,267.03	81,956,812.92	202,289,544.15	727,424,559.43	1,953,430,183.53
Ilocos Region	-	6,211,800.00	-	265,900.00	6,477,700.00
Cagayan Valley	24,889,095.62	20,921,350.00	-	5,000,000.00	50,810,445.62
Central Luzon	28,719,110.76	-	-	25,298,599.42	54,017,710.18
CaLaBarzon	105,906,321.99	31,096,261.50	-	21,104,799.33	158,107,382.82
MiMaRoPa	-	-	-	83,581.20	83,581.20
Bicol Region	17,199,000.22	7,806,922.00	-	370,581.20	25,376,503.42
Western Visayas	122,592,350.63	8,131,236.00	-	31,396,891.91	162,150,478.54
Central Visayas	31,144,828.89	8,134,650.40	-	2,213,191.91	41,492,671.20
Eastern Visayas	-	-	-	7,737,200.00	7,737,200.00
Zamboanga Peninsula	-	-	-	-	-
Northern Mindanao	37,098,140.29	6,956,294.00	-	-	44,054,434.29
Davao Region	59,391,491.09	5,030,689.00	-	10,909,741.21	75,331,921.30
SoCCSKSarGen	3,010,215.26	4,858,921.60	-	1,117,162.28	8,986,299.14
Caraga	11,040,471.18	-	-	747,577.20	11,818,048.38
CAR	36,869,625.25	14,478,603.28	-	790,269.80	52,138,498.33
BARMM	612,405.32	-	-	-	612,405.32
TOTAL	**1,420,262,323.53**	**195,613,540.70**	**202,289,544.15**	**834,460,054.89**	**2,652,625,463.27**

Table 3 and 4 shows the distribution of number of projects and budget allocation according to monitoring agencies. Most of the projects were monitored by the National Research Council of the Philippines (NRCP), Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD), Philippine Council for Health Research and Development (PCHRD), and Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD). Ten (10) R&D projects was monitored by the National Academy of Science and Technology (NAST), 1 program for support service was monitored by Science Education Institute (SEI) and 64 technology transfer initiatives was monitored by the Office of the Undersecretary for Regional Operations (ROS).

Table 3. Distribution of Projects according to Monitoring Agencies

Monitoring Agency	R&D	Technology Transfer	Capacity Building	Support Services	TOTAL
NAST	10	-	-	-	10
NRCP	7	-	3	33	43
PCAARRD	60	-	1	8	69
PCHRD	51	-	2	6	59
PCIEERD	59	17	4	28	108
SEI	-	-	-	1	1
ROS	-	64	0	0	64
Total	**187**	**81**	**10**	**76**	**354**

Table 4. Distribution of Projects according to Monitoring Agencies

Monitoring Agency	R&D	Technology Transfer	Capacity Building	Support Services	TOTAL
NAST	10,301,201.00	-	-	-	10,301,201.00
NRCP	104,742,091.76	-	119,830,887.38	201,333,491.04	331,638,470.18
PCAARRD	138,847,389.71	-	15,000,000.00	62,030,342.40	215,877,732.11
PCHRD	570,793,625.96	-	7,258,826.42	104,916,016.80	682,971,469.18
PCIEERD	712,559,053.08	114,099,195.90	53,097,051.40	413,222,163.44	1,292,977,463.82
SEI	-	-	-	37,374,782.18	37,374,782.18
ROS	-	81,484,344.80	-	-	81,484,344.80
Total	**1,442,978,361.51**	**195,583,540.70**	**195,186,765.20**	**818,876,795.86**	**2,652,625,463.27**

Project evaluation involves a multi-level evaluation process wherein the final stage is at the level of the DOST Executive Committee (DOST-EXECOM). This committee is chaired by the Secretary and co-chaired by the Undersecretary for Research and Development. Other members include the Undersecretary for S&T Services, Undersecretary for Regional Operations, Assistant Secretary for Finance, Assistant Secretary for International Cooperation, Assistant Secretary for Administrative and Legal Services, and Assistant Secretary for Human Resource Development and Special Concern. They are joined by the Executive Directors of PCAARRD, PCHRD, PCIEERD and form part of the permanent member of the DOST-EXECOM. Other members, takes turn in the membership to the DOST-EXECOM to represent their cluster, include representative from the Collegial Body (NAST and NRCP), Research and Development Institutes (ASTI, FNRI, FPRDI, ITDI, MIRDC, PNRI and PTRI), S&T Service Institutes (PAGASA, PHIVOLCS, PSHS, SEI, STII and TAPI), and representatives from the Regional Offices. Hence the DOST-EXECOM comprises of eleven (11) permanent members and four (4) non-permanent members. Non-permanent members are replaced by representatives from their respective clusters every two (2) years.

As mentioned above, the DOST-EXECOM decision is the final stage in the proposal evaluation. The decision is a collective decision and considered final and executory. In the decision-making process, the DOST-EXECOM members use a certain set of criteria, provided under the DOST Administrative Order No. 014, series of 2019, Project Monitoring and Evaluation Protocol of the DOST, summarized below (Table 3). It may be noted that the same set of criteria is used in the approval of the project proposal at the Governing Council's level. Approved projects are treated on equal footing upon reaching the EXECOM level.

Table 5. Governing Council / Board and EXECOM's Evaluation Criteria

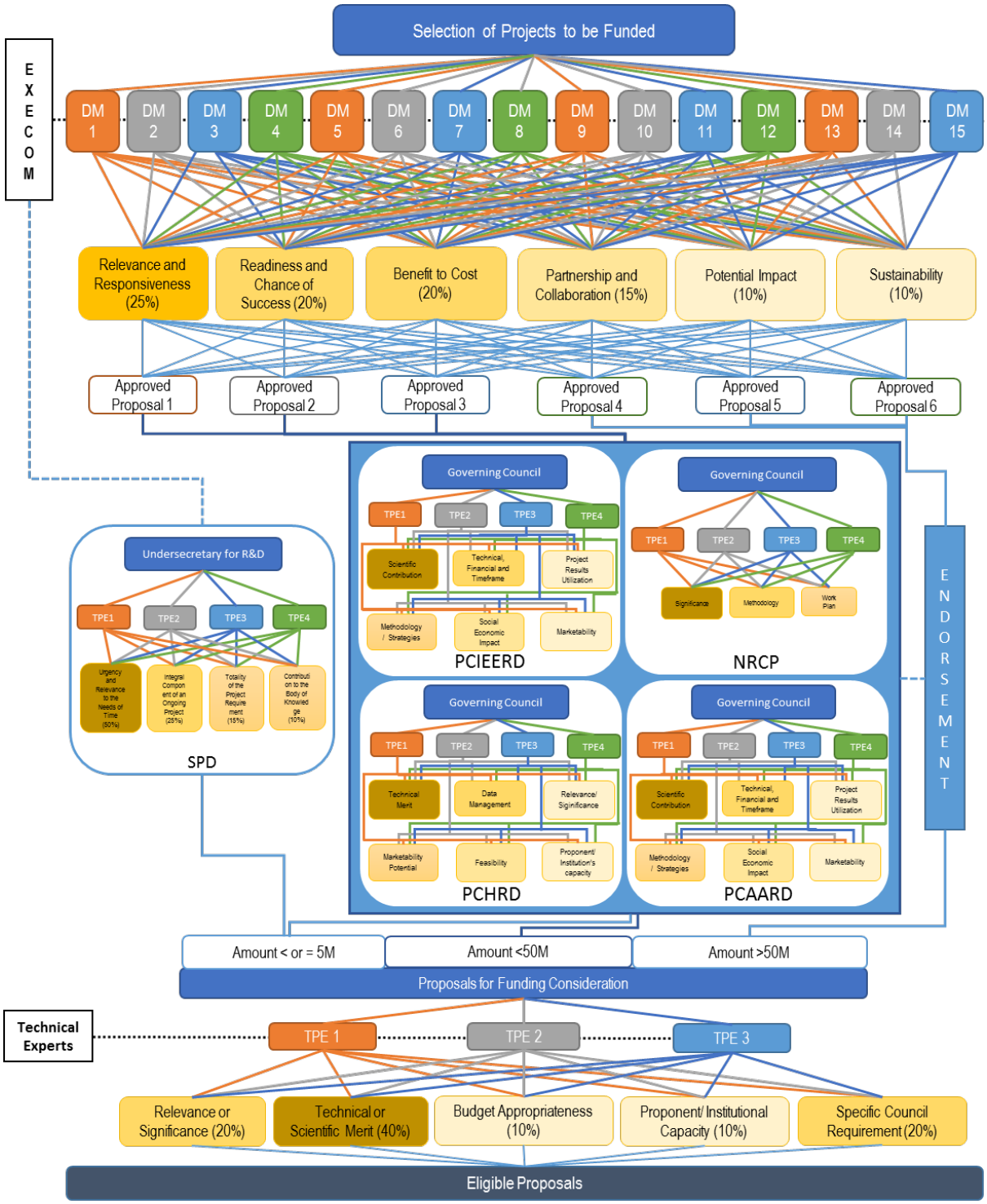
Criterion	Weight	Definition

Relevance	25	Aligned to national S&T priorities, strategic relevance to national development and sensitivity to Philippine political context, culture, tradition and gender and development.
Readiness and Chance of Success	20	Sound scientific basis to generate new knowledge or apply existing knowledge in an innovative manner
Benefit-to-Cost	20	Provides a systematic approach to estimating the strengths and weaknesses of alternatives used to determine options which provide the best approach to achieving benefits while preserving savings (for example, in transactions, activities, and functional requirements).
Partnership and Collaboration	15	Promotes partnership and collaboration supported by a letter of undertaking / commitment specifying roles/ responsibilities and counterpart funding from potential partners, target users or techno-takers; Complements completed or existing initiatives related to the proposal;
Potential Impact	10	Potential impact of the project in terms of socio-economic, academic, policy, environment and health. - Socio-economic potential - Environmental impact, if applicable
Sustainability	10	The likelihood that institutional, financial and other resources are sufficient to sustain the project's outcome in a sustainable way. Also, there are potential partners and techno-takers to be involved in the project. - Research utilization plan under methodology - Sustainability or business plan particularly those with market potential - Letter of undertaking / commitment specifying roles/responsibilities and counterpart funding from potential partners, target users or techno-takers

Since there are fifteen (15) DOST-EXECOM members deliberating on the project proposals, there should be at least eight (8) votes to have a proposal approved. Other factors considered in the approval of the project proposal includes the enumeration below but satisfaction of these are checked upon submission of the proposal.

- The proposal should have the endorsement of the Regional Development Council.
- At least a university capable of doing R&D should be present in the region/ location where the project will be implemented.
- There should researchers with PhD and MS degree in the region.
- There should be cooperation among universities and private sector

Below diagram (Figure1) shows how the selection of the proposals is being done.



Limitations

The study was limited to the approval/ selection of proposals at the EXECOM Level.

2.2. Data Analysis

The analytical hierarchy process (AHP) is a decision aiding technique which aims at quantifying relative priorities for a specified set of alternatives on a ratio scale. It's a powerful and flexible decision-making process to facilitate people set priorities and make the best decision when both qualitative and quantitative aspects of a decision need to be considered (Satty (1994)). The objective is to derive priorities on the elements in the last level that best reflect their relative impact on the focus of the

hierarchy. To apply the principle of comparative judgments, a matrix is set up to carry out pair wise comparisons of relative importance of the elements in the second level with respect to the overall focus of the first level. AHP uses pair wise comparison to deliver ratio-based priorities (Flavio et al. (2003)). AHP is an emerging solution approach to large, dynamic and complex real world Multi Criteria Decision Making (MCDM) problems (Stan Lipovetsky (1996)).

In the first step, the problem on the prioritization of approved proposals to be funded is structured as a hierarchy. AHP initially breaks down a multi criteria decision making problem into a hierarchy of consistent decision elements. A hierarchy has at least three levels: overall goal of the problem at the top, multiple criteria that describe the alternatives in the middle, and decision alternatives at the bottom (Albayrak & Erensal, 2004).

The second step is the comparison of the criteria and results of evaluation by the EXECOM members. Once the hierarchy is constructed, prioritization procedure starts in order to determine the relative importance of the criteria within each level. A pairwise comparison starts from the second level and finishes in the lowest level, priority proposals. In AHP, multiple pairwise comparisons are based on a standardized comparison scale (Table 4).

Table 6. Fundamental scale for pairwise comparison. Adopted from Saaty (1980)

Intensity of Importance	Definition	Explanation
1	Equal importance	Both criteria contribute equally to the objective
3	Weak importance of one over another	Experience and judgement slightly favour one criteria over another
5	Essential or strong importance	A criterion is strongly favoured and its dominance demonstrated in practice
7	Demonstrated importance	
9	Absolute importance	The evidence favouring one criteria over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between the two adjacent judgements	When compromise is needed
Reciprocals	If criterion i has one of the above numbers assigned to it when compared with j, then j has the reciprocal value when compared with i	

Then the consistency index (CI) and the consistency ratio (CR) are determined, respectively. CI is computed as CI= ($\lambda max - n$)/ ($n - 1$), where n is the size of the matrix. Consistency ratio (CR) is the ratio of CI/RI, where RI is the Random Index (Table 5). RI refers to consistency index of a random matrix of order n, where n is the total number of elements being compared. The CR measures the consistency of judgments and it should always not exceed 0.10, as greater value shows inconsistencies which will demand repetition of all the steps.

Table 7. Random Index (RI) table. Li et al. (2008)

n	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	1.51	1.54	1.56	1.57	1.58

Last step is the aggregation of the relative weights of the thematic and individual factors to produce a vector of composite weights for each alternative and ranking them. The decision support that the AHP makes is to verify which proposals should be prioritized for funding, since it presents greater contribution to the achievement of our goals.

Identification of criteria and sub-criteria for prioritizing proposals for funding

Prioritization, in theory, enables public servants to focus their resources on key areas to ensure on-time and in-scope delivery. It requires equal measures of bravery and political capital, tacitly acknowledging that some things are more important than others and, in the process, potentially alienating certain groups of people whose issues are not seen as a priority. (Cheprasov, n.d.)

Given some constraints such as limited budget, limited R&D capacity of some SUCs in the regions and more so the current global situation, it is therefore necessary for DOST to prioritize which approved projects should be funded. Hence, beyond the technical factors that the EXECOM members consider in approving the proposals, a set of prioritization criteria must be considered. And based from the series of EXECOM meetings, urgency, cost, location, exceptionality/uniqueness and multi-sector cooperation are considered as factors for prioritization as shown in Table 6.

Table 8. Prioritization Criteria

Criteria	Definition
Urgency	Researches with outputs that are badly needed should be given priority.
Cost	Researches within the budget allocation/ ceiling should be given priority.
Location	Researches located in regions with less R&D projects should be given priority.
Exceptionality/ Uniqueness	Researches that are unusual or interestingly different and impressive should be given priority.
Multi-sector Cooperation	Researches that involves two (2) or more sectors, i.e. HEI and private sector partnership should be given priority

Building the hierarchy of the decision problem

The hierarchy in AHP starts with the objective or goal of the decision problem. The result of evaluation by the EXECOM members and the criteria are placed in subsequent levels next to the objective. The ultimate level contains the projects to be funded for prioritization. When it comes to pair wise comparison, the result of evaluation by the EXECOM members are compared with themselves, and the criteria under evaluator are compared with each other relative to the judgment of the EXECOM Members. In the cases of the projects, they are compared with respect to each of the criteria. Below diagram (Figure2) describes the hierarchy of the problem on the prioritization of the approved projects to be funded.

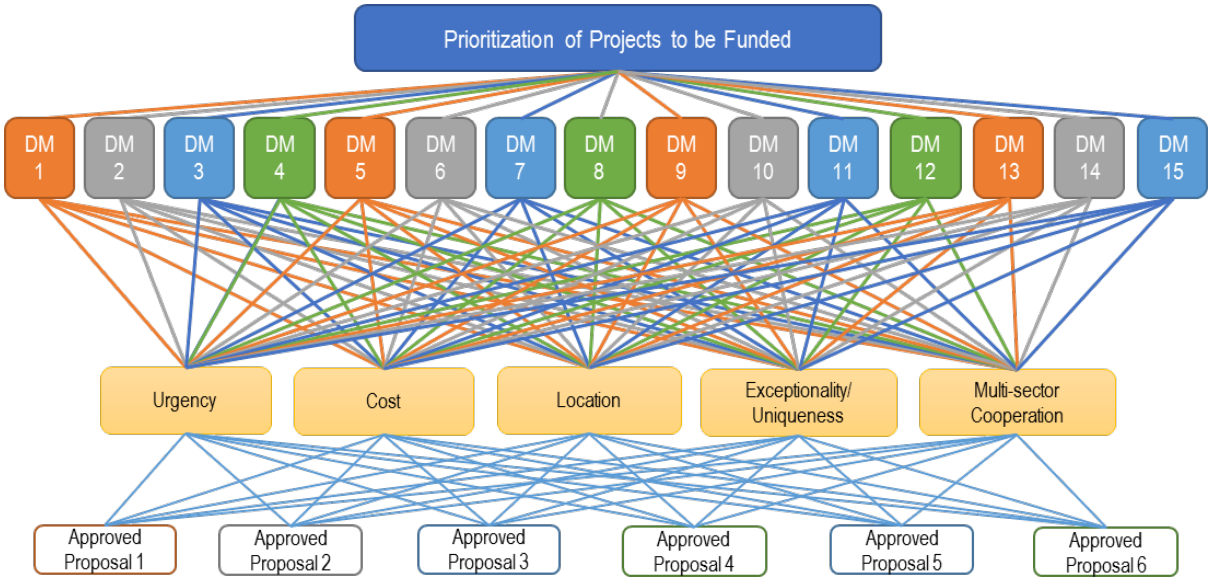


Figure 2. AHP Diagram for Prioritization of Projects to be Funded

Generation of factor and alternatives scores (Pairwise comparisons)

In order to generate importance of the factors considered in the study and their contribution in the prioritization of the projects for funding and implementation, factor weight or factor scores are generated. To generate these factors and alternative scores, a survey was administered to the EXECOM members (Appendix A). Each of the EXECOM member begins by comparing pairs of main criteria (factors) with respect to the main goal by assigning importance. There will be n(n – 1)/2 comparisons. The responses were captured using the scale in Table 4.

Relative weights of the factors compared was calculated, and the column average of the row averages was also calculated. With the value for the column average value known, the CI for each matrix order n was computed. The weights of the different factors are evaluated after the responses are tested for consistency.

Case Study

Six (6) projects were considered in this study. Random preferences were taken, and respective ratings were given to alternatives by using the scale in Table 1.

3. Results and Discussion

The individual pairwise comparison matrices are given in Table 9.

Table 9. Pairwise comparison matrices for the respondent-Decision Makers on criteria with respect to goal (1-Urgency, 2-Cost, 3-Location, 4-Exceptionality, 5-Multi-sectoral Cooperation).

DM1	**1**	**2**	**3**	**4**	**5**	**DM2**	**1**	**2**	**3**	**4**	**5**	**DM3**	**1**	**2**	**3**	**4**	**5**
1	**1**	9	8	4	2	**1**	**1**	7	7	7	7	**1**	**1**	7	5	7	7
2	1/9	**1**	1	1	1	**2**	1/7	**1**	1	1/7	1	**2**	1/7	**1**	1	1/7	1
3	1/8	1	**1**	1/5	1/4	**3**	1/7	1	**1**	1/5	1/5	**3**	1/5	1	**1**	1	5
4	1/4	1	5	**1**	1	**4**	1/7	7	5	**1**	7	**4**	1/7	7	1	**1**	7
5	1/2	1	4	1	**1**	**5**	1/7	1	5	1/7	**1**	**5**	1/7	1	1/5	1/7	**1**
DM4	**1**	**2**	**3**	**4**	**5**	**DM5**	**1**	**2**	**3**	**4**	**5**	**DM6**	**1**	**2**	**3**	**4**	**5**
1	**1**	4	1	1/5	1/7	**1**	**1**	8	6	7	3	**1**	**1**	7	8	1	1/7
2	1/4	**1**	1	1/3	1	**2**	1/8	**1**	1/6	1/3	1/5	**2**	1/7	**1**	1	1	1
3	1	1	**1**	1/3	1	**3**	1/6	6	**1**	1/5	1/3	**3**	1/8	1	**1**	1/8	1/8
4	5	3	3	**1**	3	**4**	1/7	3	5	**1**	3	**4**	1	1	8	**1**	1
5	7	1	1	1/3	**1**	**5**	1/3	5	3	1/3	**1**	**5**	7	1	8	1	**1**
DM7	**1**	**2**	**3**	**4**	**5**	**DM8**	**1**	**2**	**3**	**4**	**5**	**DM9**	**1**	**2**	**3**	**4**	**5**
1	**1**	7	5	5	4	**1**	**1**	1	7	1/3	1/9	**1**	**1**	9	7	7	1
2	1/7	**1**	1/5	1/5	1/5	**2**	1	**1**	3	5	7	**2**	1/9	**1**	1/6	1/9	1
3	1/5	5	**1**	4	1	**3**	1/7	1/3	**1**	5	1/7	**3**	1/7	6	**1**	1/8	1
4	1/5	5	1/4	**1**	1	**4**	3	1/5	1/5	**1**	1/7	**4**	1/7	9	8	**1**	7
5	1/4	5	1	1	**1**	**5**	9	1/7	7	7	**1**	**5**	1	1	1	1/7	**1**
DM10	**1**	**2**	**3**	**4**	**5**	**DM11**	**1**	**2**	**3**	**4**	**5**	**DM12**	**1**	**2**	**3**	**4**	**5**
1	**1**	5	6	5	8	**1**	**1**	9	1	2	2	**1**	**1**	5	7	1	9
2	1/5	**1**	3	1/5	2	**2**	1/9	**1**	9	2	2	**2**	1/5	**1**	3	1/7	1/3
3	1/6	1/3	**1**	1/5	1	**3**	1	1/9	**1**	1/9	3	**3**	1/7	1/3	**1**	1/9	1/7
4	1/5	5	5	**1**	7	**4**	1/2	/2	9	**1**	6	**4**	1	7	9	**1**	9
5	1/8	1/2	1	1/7	**1**	**5**	1/2	/2	1/3	1/6	**1**	**5**	1/9	3	7	1/9	**1**
DM13	**1**	**2**	**3**	**4**	**5**	**DM14**	**1**	**2**	**3**	**4**	**5**	**DM15**	**1**	**2**	**3**	**4**	**5**
1	**1**	9	7	7	1	**1**	**1**	7	7	5	5	**1**	**1**	1/7	5	1/4	1/6
2	1/9	**1**	1	1	1	**2**	1/7	**1**	1	1/3	1/5	**2**	7	**1**	8	1/4	4
3	1/7	1	**1**	1/9	1/3	**3**	1/7	1	**1**	1/7	1/7	**3**	1/5	1/8	**1**	1/9	1/6
4	1/7	1	9	**1**	6	**4**	1/5	3	7	**1**	1/7	**4**	4	4	9	**1**	1/5
5	1	1	3	1/6	**1**	**5**	1/5	5	7	7	**1**	**5**	6	1/4	6	5	**1**

Table 10 gives the resulting priorities using the Row Geometric Mean (RGM) for each of the individual matrices and their corresponding rankings.

Table 10. Individual priority vectors, rankings, Geometric Consistency Indices (GCIs) on criteria.

Criteria	***DM1***	***DM2***	***DM3***	***DM4***	***DM5***
Urgency	0.5238	0.5914	0.5787	0.1279	0.5391
Cost	0.0997	0.0490	0.0593	0.1043	0.0363
Location	0.0545	0.0480	0.1243	0.1200	0.0809
Exceptionality	0.1539	0.2419	0.1960	0.4019	0.2058
Multi-sectoral Cooperation	0.1681	0.0769	0.0418	0.2458	0.1379
Rankings	**1-4-5-3-2**	**1-4-5-2-3**	**1-4-3-2-5**	**3-5-4-1-2**	**1-5-4-2-3**
GCIs	0.30	0.65	0.53	0.83	0.69
CR	0.081	0.186	0.148	0.245	0.195
Criteria	**DM6**	**DM7**	**DM8**	**DM9**	**DM10**
Urgency	0.2438	0.5233	0.1350	0.4961	0.5520
Cost	0.1181	0.0367	0.3988	0.0349	0.9200
Location	0.0392	0.1935	0.0768	0.0716	0.5020
Exceptionality	0.1903	0.1074	0.0739	0.2890	0.2599
Multi-sectoral Cooperation	0.4086	0.1390	0.3154	0.1084	0.0460
Rankings	**2-4-5-3-1**	**1-5-2-4-3**	**3-1-4-5-2**	**1-5-4-2-3**	**2-1-3-4-5**
GCIs	1.26	0.34	2.34	1.42	0.32
CR	0.378	0.095	0.751	0.431	0.089
Criteria	**DM11**	**DM12**	**DM13**	**DM14**	**DM15**
Urgency	0.4006	0.3918	0.5052	0.5273	0.0586
Cost	0.2208	0.0562	0.0835	0.0429	0.4119
Location	0.0941	0.0294	0.0405	0.0365	0.0272
Exceptionality	0.2271	0.4222	0.2367	0.1108	0.1900
Multi-sectoral Cooperation	0.0574	0.1004	0.1340	0.2825	0.3123
Rankings	**1-3-4-2-5**	**2-4-5-1-3**	**1-4-5-2-3**	**1-4-5-3-2**	**4-1-5-3-2**
GCIs	1.88	0.50	1.20	0.61	0.79
CR	0.581	0.140	0.355	0.174	0.227

Table 11 shows the pairwise comparison of the criteria aggregating individual judgments of the EXECOM Members with a consensus rate of 67.7%

Table 11. Pairwise comparison of aggregated results of criteria in lieu of the goal

	Urgency	***Cost***	***Location***	***Exceptionality***	***Multi-sectoral Cooperation***
Urgency	**1**	4.714	5.035	2.308	1.469
Cost	0.212	**1**	1.172	0.403	0.923
Location	0.199	0.853	**1**	0.274	0.444
Exceptionality	0.433	2.482	3.653	**1**	1.982
Multi-sectoral Cooperation	0.681	1.084	2.254	0.505	**1**
					Consistency Ratio = 0.031

Table 12 below shows the over-all weight and ranking of the criteria based on the EXECOM Members' judgments which are given equal weights after normalization of Table 11.

Table 12. Normalized Ranking of Criteria (Group Decision)

Rank	Criteria	Weights
1	Urgency	0.4076
2	Exceptionality/ Uniqueness	0.2461
3	Multi-sectoral Cooperation	0.1656
4	Cost	0.1054
5	Location	0.0753

The respective pairwise comparison results of the alternatives and the criteria (Appendix B) have a consistency ratio (CR) score of less than 0.10). Hence, assessments are admissible. Table 13 below shows the individual priority vectors and consistency ratio on the alternatives. All assessments have consistency ratio of less than 0.10

Table 13. Individual priority vectors and consistency ratio on alternatives.

A. Urgency	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.3373	0.3323	0.2943	0.1360	0.3060	0.0817	0.3920	0.1187	0.2832	0.2990	0.1444	0.3037	0.2382	0.3185	0.0603
P2	0.0916	0.0417	0.0500	0.0969	0.1369	0.0991	0.0954	0.1487	0.0827	0.0783	0.2132	0.0800	0.0899	0.0571	0.2584
P3	0.1217	0.0464	0.0884	0.1351	0.0361	0.0496	0.1057	0.0671	0.0475	0.0406	0.0449	0.0455	0.1112	0.0545	0.0439
P4	0.1173	0.3353	0.1193	0.3900	0.2026	0.1245	0.0668	0.0348	0.3059	0.2266	0.1176	0.3768	0.1746	0.1786	0.2522
P5	0.1443	0.0399	0.0414	0.1672	0.0935	0.1599	0.0834	0.2408	0.0489	0.0467	0.0581	0.0799	0.0725	0.0925	0.2927
P6	0.1877	0.2044	0.4065	0.0748	0.2249	0.4852	0.2567	0.3899	0.2319	0.3088	0.4218	0.1142	0.3137	0.0988	0.0925
CR	*0.096*	*0.053*	*0.093*	*0.093*	*0.038*	*0.081*	*0.065*	*0.096*	*0.063*	*0.065*	*0.068*	*0.089*	*0.083*	*0.088*	*0.073*
B. Cost	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.0603	0.3185	0.2382	0.3037	0.1444	0.2990	0.2832	0.1187	0.3920	0.0817	0.3060	0.1360	0.2943	0.3323	0.3373
P2	0.2584	0.0571	0.0899	0.0800	0.2132	0.0783	0.0827	0.1487	0.0954	0.0991	0.1369	0.0969	0.0500	0.0417	0.0916
P3	0.0439	0.0545	0.0112	0.0455	0.0449	0.0406	0.0475	0.0671	0.0057	0.0496	0.0361	0.0351	0.0884	0.0464	0.0217
P4	0.2522	0.1786	0.1746	0.1768	0.1176	0.2266	0.1059	0.0348	0.0668	0.1245	0.2026	0.1900	0.1193	0.1353	0.1173
P5	0.2927	0.2925	0.0725	0.0799	0.0581	0.0467	0.0489	0.2408	0.0834	0.1599	0.0935	0.1672	0.0414	0.0399	0.0443
P6	0.0925	0.0988	0.3137	0.1142	0.4218	0.3088	0.2319	0.3899	0.2567	0.4852	0.2249	0.0748	0.4065	0.2044	0.1877
CR	*0.073*	*0.088*	*0.083*	*0.089*	*0.068*	*0.065*	*0.063*	*0.096*	*0.065*	*0.081*	*0.038*	*0.093*	*0.093*	*0.053*	*0.096*
C. Location	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.3185	0.0603	0.3373	0.3323	0.2943	0.1360	0.3060	0.0817	0.3920	0.1187	0.2832	0.2990	0.1444	0.3037	0.2382
P2	0.0571	0.2584	0.0916	0.0417	0.0500	0.0969	0.1369	0.0991	0.0954	0.1487	0.0827	0.0783	0.2132	0.0800	0.0899
P3	0.0545	0.0439	0.0217	0.0464	0.0884	0.0351	0.0361	0.0496	0.0057	0.0671	0.0475	0.0406	0.0449	0.0455	0.0112
P4	0.1786	0.2522	0.1173	0.2353	0.1193	0.2900	0.1026	0.0245	0.0668	0.0348	0.1059	0.2266	0.1176	0.1768	0.1746
P5	0.2925	0.2927	0.1443	0.0399	0.0414	0.0672	0.0935	0.1599	0.0834	0.2408	0.0489	0.0467	0.0581	0.0799	0.0725
P6	0.0988	0.0925	0.0877	0.1044	0.1065	0.0748	0.1249	0.0852	0.1567	0.0899	0.1319	0.1088	0.1218	0.1142	0.1137
CR	*0.088*	*0.073*	*0.096*	*0.053*	*0.093*	*0.093*	*0.038*	*0.081*	*0.065*	*0.096*	*0.063*	*0.065*	*0.068*	*0.089*	*0.083*
D. Exceptionality/ Uniqueness	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**

P1	0.3920	0.0817	0.3060	0.1360	0.2943	0.3323	0.3373	0.0603	0.3185	0.2382	0.3037	0.1444	0.2990	0.2832	0.1187
P2	0.0954	0.0991	0.1369	0.0969	0.0500	0.0417	0.0916	0.2584	0.0571	0.0899	0.0800	0.2132	0.0783	0.0827	0.1487
P3	0.1057	0.0496	0.0361	0.1351	0.0884	0.0464	0.1217	0.0439	0.0545	0.1112	0.0455	0.0449	0.0406	0.0475	0.0671
P4	0.0668	0.1245	0.2026	0.3900	0.1193	0.3353	0.1173	0.2522	0.1786	0.1746	0.3768	0.1176	0.2266	0.3059	0.0348
P5	0.0834	0.1599	0.0935	0.1672	0.0414	0.0399	0.1443	0.2927	0.2925	0.0725	0.0799	0.0581	0.0467	0.0489	0.2408
P6	0.2567	0.4852	0.2249	0.0748	0.4065	0.2044	0.1877	0.0925	0.0988	0.3137	0.1142	0.4218	0.3088	0.2319	0.3899
CR	*0.065*	*0.081*	*0.038*	*0.093*	*0.093*	*0.053*	*0.096*	*0.073*	*0.088*	*0.083*	*0.089*	*0.068*	*0.065*	*0.063*	*0.096*

D. Multi-sectoral Cooperation	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.2990	0.1444	0.3037	0.2382	0.3185	0.3373	0.0603	0.3323	0.2943	0.1360	0.3060	0.0817	0.3920	0.1187	0.2832
P2	0.0783	0.0132	0.0800	0.0899	0.0571	0.0916	0.2584	0.0417	0.0500	0.0969	0.0369	0.0991	0.0954	0.0487	0.0827
P3	0.0406	0.0449	0.0455	0.0112	0.0545	0.0217	0.0439	0.0464	0.0884	0.0351	0.0361	0.0496	0.0057	0.0671	0.0475
P4	0.2266	0.1176	0.3768	0.1746	0.1786	0.1173	0.2522	0.3353	0.1193	0.3900	0.2026	0.1245	0.0668	0.0348	0.0059
P5	0.0467	0.0581	0.0799	0.0725	0.0925	0.0443	0.0927	0.0399	0.0414	0.0672	0.0935	0.0599	0.0834	0.0408	0.0489
P6	0.3088	0.4218	0.1142	0.3137	0.0988	0.0877	0.0925	0.0044	0.0065	0.0748	0.0249	0.0852	0.0567	0.0899	0.0319
CR	*0.065*	*0.068*	*0.089*	*0.083*	*0.088*	*0.096*	*0.073*	*0.053*	*0.093*	*0.093*	*0.038*	*0.081*	*0.065*	*0.096*	*0.063*

Results of the product of individual priorities as multiplied to the weights of each criteria was shown in Table 14.

Table 14. Priority alternatives with respect to goal.

A. Urgency 0.4076	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.1137	0.1135	0.1020	0.0055	0.1025	0.0033	0.1060	0.0048	0.1015	0.1022	0.0059	0.1024	0.0097	0.1030	0.0025
P2	0.0037	0.0017	0.0020	0.0039	0.0056	0.0040	0.0039	0.0061	0.0034	0.0032	0.0087	0.0033	0.0037	0.0023	0.0105
P3	0.0050	0.0019	0.0036	0.0055	0.0015	0.0020	0.0043	0.0027	0.0019	0.0017	0.0018	0.0019	0.0045	0.0022	0.0018
P4	0.0048	0.0137	0.0049	0.0059	0.0083	0.0051	0.0027	0.0014	0.0025	0.0092	0.0048	0.0054	0.0071	0.0073	0.0103
P5	0.0059	0.0016	0.0017	0.0068	0.0038	0.0065	0.0034	0.0098	0.0020	0.0019	0.0024	0.0033	0.0030	0.0019	0.0019
P6	0.0077	0.0083	0.0066	0.0030	0.0092	0.0098	0.0105	0.0059	0.0095	0.0026	0.0072	0.0047	0.0028	0.0040	0.0038
B. Cost 0.1054	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.0006	0.0034	0.0025	0.0032	0.0015	0.0032	0.0030	0.0013	0.0041	0.0009	0.0032	0.0014	0.0031	0.0035	0.0036
P2	0.0027	0.0006	0.0009	0.0008	0.0022	0.0008	0.0009	0.0016	0.0010	0.0010	0.0014	0.0010	0.0005	0.0004	0.0010
P3	0.0005	0.0006	0.0012	0.0005	0.0005	0.0004	0.0005	0.0007	0.0011	0.0005	0.0004	0.0014	0.0009	0.0005	0.0013

P4	0.027	0.019	0.018	0.040	0.012	0.024	0.032	0.004	0.007	0.013	0.021	0.041	0.013	0.035	0.012
P5	0.031	0.031	0.008	0.008	0.006	0.005	0.005	0.025	0.009	0.017	0.010	0.018	0.004	0.004	0.015
P6	0.010	0.010	0.033	0.012	0.044	0.033	0.024	0.041	0.027	0.051	0.024	0.008	0.043	0.022	0.020
C. Location 0.0753	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.024	0.005	0.025	0.025	0.022	0.010	0.023	0.006	0.030	0.009	0.021	0.023	0.011	0.023	0.018
P2	0.004	0.019	0.007	0.003	0.004	0.007	0.010	0.007	0.007	0.011	0.006	0.006	0.016	0.006	0.007
P3	0.004	0.003	0.009	0.003	0.007	0.010	0.003	0.004	0.008	0.005	0.004	0.003	0.003	0.003	0.008
P4	0.013	0.019	0.009	0.025	0.009	0.029	0.015	0.009	0.005	0.003	0.023	0.017	0.009	0.028	0.013
P5	0.022	0.022	0.011	0.003	0.003	0.013	0.007	0.012	0.006	0.018	0.004	0.004	0.004	0.006	0.005
P6	0.007	0.007	0.014	0.015	0.031	0.006	0.017	0.037	0.019	0.029	0.017	0.023	0.032	0.009	0.024
D. Exceptionality/ Uniqueness 0.2461	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.096	0.020	0.075	0.033	0.072	0.082	0.083	0.015	0.078	0.059	0.075	0.036	0.074	0.070	0.029
P2	0.023	0.024	0.034	0.024	0.012	0.010	0.023	0.064	0.014	0.022	0.020	0.052	0.019	0.020	0.037
P3	0.026	0.012	0.009	0.033	0.022	0.011	0.030	0.011	0.013	0.027	0.011	0.011	0.010	0.012	0.017
P4	0.016	0.031	0.050	0.096	0.029	0.083	0.029	0.062	0.044	0.043	0.093	0.029	0.056	0.075	0.009
P5	0.021	0.039	0.023	0.041	0.010	0.010	0.036	0.072	0.072	0.018	0.020	0.014	0.011	0.012	0.059
P6	0.096	0.020	0.075	0.033	0.072	0.082	0.083	0.015	0.078	0.059	0.075	0.036	0.074	0.070	0.029
E. Multi-sectoral Cooperation 0.1656	**DM 1**	**DM 2**	**DM 3**	**DM 4**	**DM 5**	**DM 6**	**DM 7**	**DM 8**	**DM 9**	**DM 10**	**DM 11**	**DM 12**	**DM 13**	**DM 14**	**DM 15**
P1	0.050	0.024	0.050	0.039	0.053	0.056	0.010	0.055	0.049	0.023	0.051	0.014	0.065	0.020	0.047
P2	0.013	0.035	0.013	0.015	0.009	0.015	0.043	0.007	0.008	0.016	0.023	0.016	0.016	0.025	0.014
P3	0.007	0.007	0.008	0.018	0.009	0.020	0.007	0.008	0.015	0.022	0.006	0.008	0.018	0.011	0.008
P4	0.038	0.019	0.062	0.029	0.030	0.019	0.042	0.056	0.020	0.065	0.034	0.021	0.011	0.006	0.051
P5	0.008	0.010	0.013	0.012	0.048	0.024	0.048	0.007	0.007	0.028	0.015	0.026	0.014	0.040	0.008
P6	0.051	0.070	0.019	0.052	0.016	0.031	0.015	0.034	0.067	0.012	0.037	0.080	0.043	0.065	0.038

Since, the decision makers are given equal weights, the average of the priorities per criteria were considered. Table 15 shows the averages of the projects per criteria.

Table 15. Average of priority alternatives of DMs with respect to goal

Priority with respect to	**Urgency**	**Cost**	**Location**	**Exceptionality/ Uniqueness**	**Multi-sectoral Cooperation**
Project 1	0.099	0.026	0.018	0.060	0.040

Project 2	0.044	0.011	0.008	0.027	0.018
Project 3	0.028	0.007	0.005	0.017	0.011
Project 4	0.082	0.021	0.015	0.050	0.033
Project 5	0.051	0.013	0.009	0.031	0.021
Project 6	0.104	0.027	0.019	0.063	0.042

Final results of assessment on the best project options for priority funding was shown in Table 16.

Table 16. Best project options for priority funding consideration

Rank	Alternative	Weights
1	Project 6	0.254
2	Project 1	0.243
3	Project 4	0.202
4	Project 5	0.124
5	Project 2	0.108
6	Project 3	0.069

3.1. Discussion

The individual pairwise comparison results of the individual responses of the decision makers are given in Table 10. Table 11 presents the resulting priorities using the Row Geometric Mean (RGM) for each of the individual matrices with their corresponding rankings. It can be noted that only 3 decision makers have an acceptable consistency ratio. With the use of an AHP calculator (Goepel, 2013), individual judgments of the EXECOM Members were aggregated resulting to a consistency ratio of 3.1%, hence, the group assessment made by the decision makers is admissible. Table 10 presents the pairwise comparison result of the criteria in view of the overall goal of the group assessment with consensus rate of 66.5%.

Table 12 below shows the over-all weight and ranking of the criteria based on the EXECOM Members' judgments which have equal weights. From Table 12, it could be seen that urgency and exceptionality, or uniqueness are the two major reasons that influence EXECOM Members' decision in prioritizing approved projects to be funded. These are represented by relative weights of 0.4076 and 0.2461, respectively. This can be attributed to the fact that for urgent projects particularly with outputs that answer to crisis situations such as war and natural disasters, time is critical for project success and delays will mean high probability of project failure. Innovation and high level of creativity in projects is also required for success. Failure to promptly fund projects which provides immediate solutions to problems means losing opportunities, and ultimately negatively affecting the performance of the agency.

Although important in ensuring optimized usage of resources by avoiding duplication of inputs and activities, the weight (0.1656) of multi-sectoral cooperation and the weight (0.1054) of cost in projects means that the factors do not have significant influence in shaping the EXECOM members' decision in project prioritization. Meanwhile, from the result, it is likely that location is not a major factor that the decision makers consider in putting a project on top priority, as this factor has the least weight (0.0753). Clearly based on consensus, providing immediate and viable solutions to the current or existing problems in the society is the single most important factor that influences the EXECOM Members' decision to prioritize a particular project for funding.

The pairwise comparison results of the alternatives and the criteria had CR score of less than 0.10, hence assessments made are admissible. Table 13 presents the priority alternatives with respect to goal per decision maker.

Table 14 shows the synthesis of Tables 12 and 13, while Table 15 presents the average results of priorities since each decision maker is given equal weight. Table 16 shows the best project options for priority funding consideration. From Table 16, Project 6, in lieu of the assessed criteria, is the top alternative for approved funding projects. This is followed by Projects 1, 4, 5, 2 and 3, in that order. The main reasons for the preferences could be attributed to the sense of urgency, immediate impact and time value of the projects.

4. Conclusion

In this study, the main objective was to prioritize the approved projects to be funded under DOST-GIA using the AHP technique for effective countryside development intervention. It also aimed to arrive at a consensus among the EXECOM Members' preferences before processing the data using pairwise comparison matrices. In the current context, urgency is the highest prioritized criterion, while cost and location were found to be the least prioritized criteria. Though individual judgments of the EXECOM Members' differed, their group decision especially during the selection and giving of weights to the criteria for the assessment, is based on a consensus.

As a whole, given that funds are limited and in case of inevitable crisis situations, it is recommended that prioritization of projects to be funded should be carried out. The model in this study can be used by decision makers of organizations with limited financial resources as a prototype before funding a number of projects. It can also be used among the DOST Regional offices in prioritizing projects and activities to be funded.

Application of this model can be further pursued since the DOST Management moves to harmonize the evaluation criteria for R&D proposals at the different levels within the system – same set of criteria will be used at the Division, Technical Experts, and Management Team Levels, and another set same for both the Governing Council and the DOST EXECOM. The model can also be applied at the level of the Governing Councils.

Further conduct of study is being recommended to optimize the number of projects while minimizing the cost of each project among regions thru goal allocation. Looking at the CY2019 DOST-GIA data, NCR had produced the greatest number of proposals, and so had the biggest allocation of DOST-GIA funds. Considering that DOST is proposal driven, there is a need to strengthen generation of proposals among regions to decentralize allocation. Capacity-building in writing and packaging of project proposals should be targeted in SUCs especially in regions with none or less existing projects. DOST could initiate other initiatives such as forging of partnerships between an identified HEI to a respectable university for proposal generation, aside from strengthening its implementation of Science for Change Program.

AHP is an efficient tool in capturing subjective judgments in multi criteria decision making environment, and the AHP calculator by Goepel, Klaus D. (2013) reduced the degree of computation.

References

Aguarón, J.; Escobar, M.T.; Moreno-Jiménez, J.M.; Turón, A. (2019) AHP-Group Decision Making Based on Consistency. *Mathematics 2019*, 7, 242

Artem Cheprasov, Prioritizing Goals: Importance & Steps Retrieved from https://study.com/academy/lesson/prioritizing-goals-importance-steps.html

Baffoe, Gideon (2018). Exploring the utility of Analytic Hierarchy Process (AHP) in ranking livelihood activities for effective and sustainable rural development interventions in developing countries, *Evaluation and Program Planning Volume 72, February 2019,* Pages 197-204

Bahurmoz, Asma M.A. The Analytic Hierarchy Process: A Methodology for Win-Win Management, *JKAU: Econ. & Adm*., Vol. 20 No. 1, pp: 3-16 (2006 A.D./1427 A.H.)

Chatterjee, D.; Mukherjee, B. (2013). Potential Hospital Location Selection using AHP: A Study in Rural India, *International Journal of Computer Applications (0975 – 8887)* Volume 71– No.17, June 2013.

Forman, E.; Peniwati, K.; Aggregating individual judgments and priorities with the Analytic Hierarchy Process. *European Journal of Operational Research 108 (1998*) 165-169.

Goepel, Klaus D. (2013). Implementing the Analytic Hierarchy Process as a Standard Method for Multi-Criteria Decision Making In Corporate Enterprises – A New AHP Excel Template with Multiple Inputs, *Proceedings of the International Symposium on the Analytic Hierarchy Process 2013,* p 1 -10

Hass, Kathleen B. Managing Complex Projects, A New Model. Management Concepts, Inc. (2009)

https://www.intelligentmanagement.ws/learningcentre/how-can-we-optimize-resources-and-processes/resource-optimization/

Sarge B Local Governance and Resource Allocation, University for Development Studies.

XU Zeshui. A Practical Method for Improving Consistency of Judgement Matrix in the AHP. Journal of Systems Science and Complexity (2004) Vol. 17 No. 2.

Biographies

Rex Aurelius C. Robielos is the Dean of the School of Industrial Engineering and Engineering Management at Mapua University. Before joining Mapua, he was Section Manager of Operations Research Group, Analog Devices General Trias. He has a BS in Applied Mathematics from the University of the Philippines Los Baños, and a Diploma and MS in Industrial Engineering from the University of the Philippines Diliman. He is pursuing Ph.D in Industrial Management (candidate) at National Taiwan University of Science and Technology in Taiwan. He is the current Secretary of Human Factors and Ergonomics Society of the Philippines and Director of the Philippine Institute of Industrial Engineers and Operations Research Society of the Philippines.

Armela K. Razo is the head of the Specials Project Division (SPD) of the Department of Science and Technology Central Office (DOST-CO). Prior to joining the SPD, she served as Planning Officer at the Planning Evaluation Service of the DOST-CO. She has a BS Statistics degree from the University of the Philippines Los Baños and a Bachelors of Law degree from the Philippine Law School. Currently, she is pursuing a Masters in Business Analytics from Mapua University.

Giselle Eve O. Siladan is the designated Planning Officer of the Department of Science and Technology Regional Office No. XII. Prior to joining DOST XII, she served as a Secondary School Teacher I at Malamote High School under the Department of Education being a licensed professional teacher. She is a DOST Scholar who finished Cum Laude on her undergraduate degree on Bachelor in Secondary Education major in Mathematics from the Notre Dame of Midsayap College and is currently pursuing Masters in Business Analytics at Mapua University.