University Researchers Valuation

Aileen U. BALBIDO, Adrianne N. DE GUZMAN, Darien Chelsey P. GALURA, Alfonso Miguel A. ALVARAN, Jason Paul L. VILLANUEVA, Timothy M. AMADO, Cherry G. PASCION, John Peter M. RAMOS, Ira C. VALENZUELA, Glenn Calvin C. VIRREY

Technological University of the Philippines-Manila
Manila, Philippines

*ira_valenzuela@tup.edu.ph

Abstract*— One of the key concerns of universities these days is the academic contribution of a faculty member through his research performance. A measurable procedure needs to be re-investigated to provide a more reasonable researcher performance indicator. The faculty valuation will serve as the performance indicator to identify the research competence of a university. The study aims to provide thorough monitoring of its faculty and knowing the patterns and trends in their research activity through developing a faculty valuation criterion. Data collection, data extraction and clustering, and its analysis are crucial in developing such criteria. After scrutiny of all obtainable needed information of the faculty in the institution, the following are the parameters for the valuation: a Highest educational attainment, Google scholar index, intellectual property certification, publications, and research-related awards. The designed criteria provided a more sensible performance indicator.

Keywords*— KPIs, researcher valuation, performance

I. INTRODUCTION

Faculty researchers' criteria sets a guideline for obtaining quantifiable assessment based on their performance. The said guidelines will be the basis for the valuation of their research competence. In the study conducted in India, the key performance indexes (KPIs) for the faculty publication have large values ranging from 50 up to 500 which is not ideal for the proposed valuation [1]. Similarly, Shah et al. created a prediction model with a rating scale ranging from 1, as its highest, up to 5 for its lowest [2]. The model analyzes the trend and pattern in the obtained educational data. Sbeih and Karram develop an e-assessment system based on their 5 evaluations or assessments namely course level, student level, faculty member skills level, research level and workshop level [3]. The research valuation in their study has a simple scoring method of accumulated points based on the criteria.

The faculty valuation will serve as the performance indicator to identify the research competence of the university. In line with a university's common goal, the score can influence the decision making for the research granting office of the institution. The study aims to provide thorough monitoring of its faculty and knowing the patterns and trends in their research activity. The faculty score will have a significant effect on the collaborative impact between colleges in the institution.

II. RELATED STUDIES

Dr. Joshi et al. developed a performance management system that will help the Institutes to elevate their quality standards when it comes to educational practices [2]. The study proposed a key performance indicator (KPI) framework to evaluate the achievements of every faculty from their academic parameters such as academic involvement, student development, institutional development, and professional development. This framework is used to create faculty ranking and will assist universities increase their standards of quality.

In Palestine, a group of researchers developed an e-smart system. Courses, students, faculty member teaching skills, research and academic workshops are the following factors in evaluating the faculty performance [3]. The system utilizes a mathematical model which weighs the data from the said parameters and will generate an appropriate report that shows analytical data on the performance of the faculty member. The system valuation is a simple scoring method of accumulated points based on the said parameters. The system will help to meet the quality assurance standards and to enhance teaching and learning outcomes.

Bai et al. proposed a faculty performance assessment scheme based on ontology in which it is used to conceptualize the qualitative factors of the faculty as well as the set of rules based on the requirements of Institute of Business Administration (IBA) for their faculty members at Pakistan that together make a system [4]. The utilization of the proposed system can save time for evaluating the faculty members which used to enhance their performance and lead to aimed professional growth of the Institution.

E. Deepak et al. devised a system that will assess the achievement of faculty members on the grounds of various parameters for evaluation and predicted using data mining techniques to build models [5]. The parameters considered for evaluating are the following: faculty profile, quality of teaching, maintaining relationships, learning assessment, counseling and mentoring, administrative functions, research and development, organizational qualities, and outcome. The proposed model is a Support Vector Machines (SVM) kernel-based function used to evaluate the performance of the faculties considering all the said parameters in order to obtain a high-quality academic Institution and build the careers of the students.

A framework that assesses the research performance of the faculty members of the Science Technology and Social Science researchers for Research University in Malaysia was created by Jalil, et al. based on their publication output [6]. The publication output includes both those impact factor publication or ISI publication and non-ISI publication or those not covered by impact factor publication such as cited or non-cited publication, proceedings, other articles, and books. The two parameters under publication have been

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compared and the performance of each researcher has been studied to show the significant relationship of research performance-based publication output and categories of researchers.

III. METHODOLOGY

Developing a researcher valuation criterion is one of the main outcomes of this study. Initializing data collection and analysis is critical for such advancement.

A. Data Collection

List of faculty researchers from Technological University of the Philippines-Manila were gathered including their basic information and other information needed for the parameters for the valuation. The system also collected the Google Scholar indexes of the faculty (H-index, i10-index and number of citations), patented research and granted research.

B. Data Extraction & Clustering Collection

Researchers' details were extracted for key categories based on ICT Infrastructures; GAD & Social Impact; Environment & Pollution; and Renewable Energy, Smart Analytics & Technological Environment. Recent publication outputs were also identified through the URDS office.

C. Analysis of Data for Researcher Valuation

The analysis and generation of criteria for researcher performance indicators are based on gathered information and trends. The system was analyzed for its accuracy.

The model-building procedure can be depicted as a bundle of involved schemes as shown in Figure 1. From the discourse to the methodological and logical issues identified with workforce assessment, the limits of the issue were built up and a multi-criteria modelling approach could be adopted. In organizing the data analytics module, criteria were specified to assess faculty researchers. Measures of value were subsequently built, that is, value capacities empowering execution to be changed into an incentive at the level of every measure independently and the regarded criteria were weighted that would mirror the faculty researcher's performance.

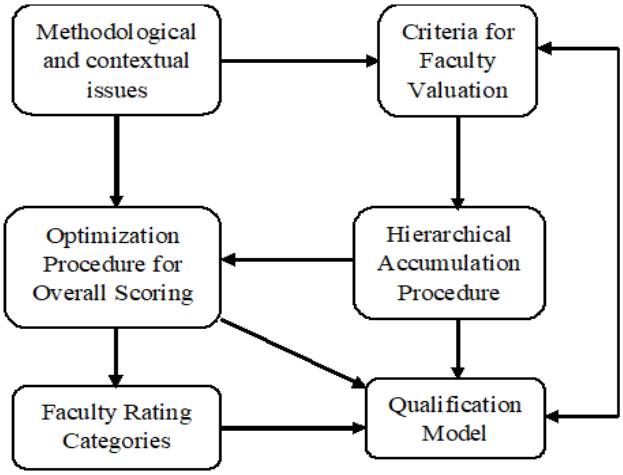

FIGURE 1. BLOCK DIAGRAM FOR THE DEVELOPMENT OF FACULTY RESEARCHER'S VALUATION MODEL

After scrutinizing all obtainable educational information of the faculty in the institution, it was then devised the following faculty valuation criteria.

TABLE I. KPIS IN RESEARCHER VALUATION

Criteria	Score
A. Number of Completed and Relevant R&D Projects in any of the three (3) categories in the last five years	**20**
1. Institutionally-approved research (5 points each)	
2. Nationally-approved research (10 points each)	
3. Internationally approved research (15 points each)	
B. Research Dissemination	**20**
1. Journal Publication	
1.1. ISI, Scopus, and CHED-accredited journal (5 points for each)	
1.2. Non-ISI, Scopus, and CHED-accredited journal (3 points for each)	
1.3. Local Journal Publication (2 points for each)	
2. Paper Presentation	
2.1. International Conference (3 points for each)	
2.2. National Conference (2 points for each)	
2.3. Local Conference (1 point for each)	
3. Poster Presentation	
3.1. International Conference (2 points for each)	
3.2. National Conference (1 point for each)	
3.3. Local Conference (0.5 points for each)	
C. Intellectual Property Certification	**15**
1. Patent for Invention/Utility Model	
1.1. Awarded Patent for Invention or Utility Model (10 points for each)	
1.2. Patent Pending for Invention or Utility Model (5 points for each)	
2. Copyright Resulting from Basic and Applied Research Works	
2.1. Awarded Copyright for Creative Work (1 point for each)	
D. Utility and Commercial Viability of Research Outputs	**15**
1. Adoption/Utilization of Inventive and Innovative Researches (Developmental Researches) by	
1.1. Multinational industries/corporation (10 points each)	
1.2. National industries (7 points each)	
1.3. Local industries (5 points each)	
2. Utilization/Implementation of Basic and Applied Research Outputs by the Clientele/Community	
2.1. International Clientele (10 points each)	
2.2. National Clientele (7 points for each)	

2.3. Local Clientele	(5 points for each)	
E. Research-Related Awards and Recognition		**15**
1. International award and recognition	(5 points each)	
2. National award and recognition	(3 points each)	
3. Local award and recognition	(1 point each)	
F. Google Scholar Metric		**10**
1. H-index	(4 points equivalents for every 10 points)	
2. i10-index	(3 points equivalents for every 15 points)	
3. Yearly Citations	(2 points equivalents for every 20 points)	
4. Citations	(1 points equivalent for every 25 points)	
G. Highest Educational Attainment		**5**
1. Doctor's Degree	(5 points)	
2. Master's Degree	(3 points)	
3. Bachelor's Degree	(1 point)	
	Total	100

Table 1 shows the weights of each parameter or KPIs used in the Researcher Valuation. There are seven (7) parameters namely: the number of completed and relevant R&D projects, utility and commercial viability of research outputs, faculty's highest educational attainment (HEA), Google Scholar Index, intellectual property certification, publications and research-related awards.

The category (A) which is the number of completed and relevant R&D projects in any of the three (3) categories in the last five years has a maximum of twenty (20) points. The accumulated points for each subcategory are shown in Table 2. The scores for the category (A) is added up and the sum of that is added with the other categories if and only if it is not above the maximum point twenty (20), but if so the maximum point will automatically be added.

TABLE II. CATEGORY A

Research Level	Leader	Member
a.1. Internationally-approved research	15 points each	7.5 points each
a.2. Nationally-approved research	10 points each	5 points each
a.3. Institutionally-approved research	5 points each	2.5 points each

The second category is (B) which is Research Dissemination, has three (3) subcategories and a maximum point of twenty (20). The accumulated points for each subcategory are shown in Table 3. The scores for the category (B) is added up and the sum of that is added with the other categories if and only if it's not above the maximum point twenty (20), but if so the maximum point will automatically be added.

TABLE III. CATEGORY B

Research Dissemination	Leader	Member
b.1. Journal Publication		
b.1.1. ISI, Scopus, and CHED-accredited journal	5 points each	2.5 points each
b.1.2. Non-ISI/Scopus/ CHED-accredited journal	3 points each	1.5 points each
b.1.3. Local Journal Publication	2 points each	1 point each
b.2. Paper Presentation		
b.2.1. International Conference	3 points each	1.5 points each
b.2.2. National Conference	2 points each	1 point each
b.2.3. Local Conference	1 point each	0.5 points each
b.3 Poster Presentation		
b.3.1. International Conference	2 points each	1 point each
b.3.2. National Conference	1 point each	0.5 points each
b.3.3. Local Conference	0.5 points each	0.25 points each

The next category is (C), the intellectual property certification. It has a maximum of fifteen (15) points and two (2) categories under. The accumulated points for each subcategory are shown in Table 4. The scores for the category (C) is added up and the sum of that is added with the other categories if and only if it's not above the maximum point fifteen (15), but if so the maximum point will automatically be added.

TABLE IV. CATEGORY C

Intellectual Property	Leader	Member
c.1 Patent for invention/ utility model		
c.1.1 Awarded patent for invention or utility models	10 points each	5 points each
c.1.2 Patent pending for invention or utility model	5 points each	2.5 points each
c.2 Copyright certificate resulting from basic and applied research works		
c.2.1 Copyright certificate for creative works	1 point each	0.5 points each

The category (D) which is utility and commercial viability of research outputs has two (2) subcategories and has a fifteen (15) maximum point. The accumulated points for each subcategory are shown in Table 5. The scores for the category (D) are added up and the sum of that is added with the other categories if and only if it's not above the maximum point fifteen (15), but if so the maximum point will automatically be added.

TABLE V. CATEGORY D

Utility and Commercial Viability	Leader	Member
d.1. Adoption/ utilization of inventive and innovative researches in engineering and technology by:		
d.1.1. Multinational corporations/ industries	10 points each	5 points each
d.1.2 National corporations/ industries	7 points each	3.5 points each
d.1.3 Local corporations/ industries	5 points each	2.5 points each
d.2 Utilization/ implementation of basic and applied research outputs by clientele/ community		
d.2.1. International clientele/ community	10 points each	5 points each
d.2.2. National clientele/ community	7 points each	3.5 points each
d.2.3. Local clientele/ community	5 points each	2.5 points each

The next category is (E), the research-related awards and recognition, has 3 subcategories and a fifteen (15) maximum points. The accumulated points for each subcategory are shown in Table 6. The scores for the category (E) are added up and the sum of that is added with the other categories if and only if it's not above the maximum point fifteen (15), but if so the maximum point will automatically be added.

TABLE VI. CATEGORY E

Awards	Leader	Member
e.1 International Award/Recognition	5 points each	2.5 points each
e.2 National Award/Recognition	3 points each	1.5 points each
e.3 Local Award/Recognition	1 point each	0.5 points each

The category (F), google scholar metric, has ten (10) maximum points and four (4) subcategories. The accumulated points for each subcategory are shown in Table 7. The accumulated points of every component were generated in Equation 1 to get the total points of category. The sum of that is added with the other categories if and only if it is not above the maximum point ten (10), but if so, the maximum point will automatically be added.

TABLE VII. CATEGORY F

GS Metric	Accumulated Points
f.1. H-index	Every 10 points of f.1 is equal to 4 points
f.2. i10-index	Every 15 points of f.2 is equal to 3 points
f.3. Yearly citations	Every 20 points of f.3 is equal to 2 points
f.4. Citations	Every 25 points of f.4 is equal to 1 point

$$Category\ F = \left(\frac{H\text{-}Index}{10} x\ 4\right) + \left(\frac{i10\text{-}Index}{15} x\ 3\right) + \left(\frac{Yearly\ Citation}{20} x\ 2\right) + \left(\frac{Citation}{25} x\ 1\right) \quad (1)$$

Lastly is category (G) which is the highest educational attainment, it has three (3) subcategories and a five (5) maximum points. The accumulated points for each subcategory are shown in Table 8. The scores for the category (G) is added up and the sum of that is added with the other categories if and only if it's not above the maximum point five (5), but if so the maximum point will automatically be added.

TABLE VIII. CATEGORY G

Degree	Designated Point(s)
g.1. Doctor's Degree	5 points
g.2. Master's Degree	3 points
g.3. Bachelor's Degree	1 point

IV. RESULT AND DISCUSSION

A. Validation of Results Accuracy

The system valuation is validated manually and through the system, Table 9 shows the expected and predicted T-index of the year 2017. The highest educational attainment and the google scholar metric is considered through all the years. The parameters considered in choosing faculties to be evaluated are (1) had a Google Scholar profile, (2) TUP faculty, and (3) active in research.

TABLE IX. MANUAL AND SYSTEM VALUATION OF ECE FACULTY YEAR 2017

Researcher ID No.	Expected T-index	Predicted T-index
READS-0000009	2.074	2.074
READS-0000010	0.284	0.284
READS-0000011	1.762	1.762
READS-0000012	0.144	0.144
READS-0000013	0.938	0.938
READS-0000014	0.910	0.910
READS-0000015	0.656	0.656
READS-0000003	1.228	1.228
READS-0000004	0.648	0.648
READS-0000005	0.800	0.800
READS-0000006	0.426	0.426
READS-0000016	0.166	0.166
READS-0000017	0.926	0.926
READS-0000018	3.088	3.088
READS-0000019	1.652	1.652
READS-0000002	3.446	3.446

Only 10.6% of faculty members in TUP-Manila had Google Scholar Profiles, mostly from the College of Engineering (COE) shown in Figure 2. Nevertheless, other faculties can still access their profile in the system.

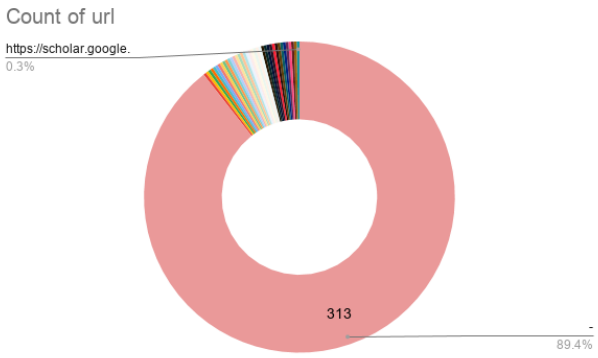

FIGURE 2. PERCENTAGE OF FACULTY WITH GOOGLE SCHOLAR ACCOUNT

FIGURE 3. TOP 10 RESEARCHERS OF 2020

Figure 3 shows the top researchers of the RPAD website from the faculty of ECE in the year 2020. It shows three (3) decimal places to see the differences. The RPAD website only shows top researchers for the current year.

V. CONCLUSION

Evaluating the performance of a researcher is one of the tough tasks and should be evaluated with appropriate criterion. The study helps to identify the researcher's competence and know their research activities. Implementing this valuation will help to develop researcher ranking, satisfy University's expectation and will help for continuing the regularly expanding challenges. This

valuation will encourage the researcher to be more aggressive and improve their standing when it comes to research and will positively assist Universities with raising their quality models. Comparable examinations for all colleges to screen their advancement on the exploration front should be possible for future work. Moreover, examine deeply the key factors, intrinsically and extrinsically, that motivate faculty researchers to perform well.

ACKNOWLEDGMENT

The authors wish to extend their sincere gratitude and appreciation to the University Research and Development Services office and the Technological University of the Philippines-Manila for giving precious contributions towards the completion of this research.

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Ira C. Valenzuela received her PhD in Electronics and Communications Engineering from De La Salle University in 2018. She is currently the Research Director at Technological University of the Philippines. Her research interests include artificial intelligence, evolutionary computing, neural networks, automation, intelligent systems, IC designs and microelectronics. She is the Editor-in-Chief of Philippine Journal for Industrial Education and Technology.

Aileen U. Balbido finished her Bachelor of Science in Electronics Engineering degree at Technological University of the Philippines - Manila on 2020.

Adrianne N. de Guzman finished her Bachelor of Science in Electronics Engineering degree at Technological University of the Philippines - Manila on 2020.

Darien Chelsey P. Galura finished Electronics Engineering Technology, a 3-year technology course, at Technological University of the Philippines, Cavite last 2017 and also passed the Electronics Technician board exam. She also finished her Bachelor of Science in Electronics Engineering at Technological University of the Philippines, Manila last 2020.

Jason Paul L. Villanueva finished his Bachelor of Science in Electronics Engineering degree at Technological University of the Philippines - Manila on 2020.