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Evaluation of Faculty Profile, Investment to R & D, and the Intensity of University-Industry Collaboration (UIC) of State Universities and Colleges (SUCs) in the Caraga Region

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Abstract: High intensity of University-Industry Collaboration (UIC) implies for variety of benefits for universities, industries, and the economy. The University's investment on R & D and the faculty profile are very significant indicators to high intensity of UIC yet related studies remained very few in the literature. This research aims to evaluate the faculty profile (*educational qualification, research publications, number of patent, designations in scientific organizations, and consultancy services*), investment to R & D (*budget allocation in the last three years*), and the intensity of UIC among four State Universities and Colleges (SUCs) in the Caraga Region. The intensity of UIC was assessed by the 170 faculty respondents using a literature-based survey instrument. Data were analyzed using descriptive statistical tools such as frequency and averages. Results show that very high intensity of collaboration is observed in SUC with exemplary faculty profile without having the largest budget on R & D. Medium intensity of collaboration is observed in SUCs with meager R & D budget and not so high faculty qualification. The study concludes that SUC's investment on faculty development and R & D are significant inputs to achieve high intensity of collaboration with industries.

Keywords: University-Industry Collaboration (UIC), Faculty Profile, R & D Investment, UIC Intensity, Evaluation.

INTRODUCTION

In the past, the main role of universities was to preserve the culture and knowledge of society (Brockliss, 2000; & Etzkowitz, 2008). During the early 19th century, universities began to position its focus from teaching to research (Brockliss, 2000). Etzkowitz (2008) further stressed that universities are becoming more and more entrepreneurial and the relationships with industry and university are more direct and interactive. Universities began to expand its initiatives to collaborate with the industries to expose and promote the relevance of research carried out in public institutions, foster the commercialization of public R&D outcomes, and increase the mobility of labor between public and private sectors (World Bank, 2013). Also, the need firms have for new knowledge (Schartinger *et al.*, 2002) and universities have for financing (Santoro & Gopalakrishnan, 2000) generates an interdependence between them that constitutes a driving force behind their collaboration.

Intensity of collaboration with industries is measured in different ways that remained an on-going research area in the literature (Thune, 2007). A commonly used tool of Perkman & Walsh (2007) to measure the intensity of SUC's collaboration with industry is used in this study. The indicators include Research Partnerships, Research Services, Shared Infrastructure, Academic Entrepreneurship, Human Resource Training and Transfer, Commercialization of Intellectual Property, Scientific Publications, and Informal Interaction.

High intensity of University-Industry Collaboration (UIC) gives faculty access to industrial facilities, equipment, and know-how. It also benefits students through real-life learning opportunities, funding, and employment (Perkman & Walsh, 2007). While the positive impacts of university and industry collaboration are becoming evident in the literature, majority of the authors delimit their analysis on the university's R&D structures, facilities, funding, and leadership (Ssebuwufu *et al.*, 2012; & Guimón, 2013). Very few studies deal with the possible contribution of SUC's faculty personnel and financial investment on R & D activities. This research asserts that the faculty profile and the adequate budget on R & D are key players of SUCs in improving collaborations with industries. The assertion subscribed to the new institutional theory as a useful framework to link faculty qualification and engagement in the form of commodification of knowledge through linkages with industry and academic norms. It explains how the faculty competence and qualification promote successful collaboration with external industries particularly in terms of knowledge and technology

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transfer, research publications, and consultancy services.

This study aims to evaluate the intensity of State Universities and Colleges (SUCs) collaboration with industries along with the faculty profile in terms of educational qualification, research publications, number of patent, designations in scientific organizations, consultancy services, and role in research and extension, and the budget allocation to R & D among the rising and thriving SUCs in the Caraga region. The variables are analyzed simultaneously so that possible associations are hypothesized. Study findings will serve as inputs for SUCs to develop strategies to improve and attract successful collaboration with external industries.

METHODS

A descriptive cross-sectional research design was used in the study. Necessary data were collected from primary and secondary sources. Secondary data including the profile of 170 faculty respondents and three-year R & D budget allocations were obtained from the Human Resource Management Office and Office for Research and Extension of four SUCs, respectively. To assess the intensity of collaboration with external industries a literature-based questionnaire of Perkman & Walsh (2007) was used. Frequency distribution was used to analyze data on faculty profile and budget to R & D. Further, weighted mean was used to assess the intensity to which SUC collaborates with industries with 50% on the indicators Research Partnerships, Research Services, Shared Infrastructure, 30% for Academic Entrepreneurship, Human Resource Training and Transfer, and 20% for Commercialization of Intellectual Property, Scientific Publications, and Informal Interaction. The assignment of weights is based on the categorization published by Perkman & Walsh (2007). The study was conducted in four state colleges and universities in Caraga region from May 11, 2020 until July 31, 2020. Specific names of SUCs were hidden for confidentiality purposes.

RESULTS AND DISCUSSIONS

This section presents the analysis of data and discussions considering the study objectives.

Budget Allocated To R & D in the Last Three Years among Four SUCs

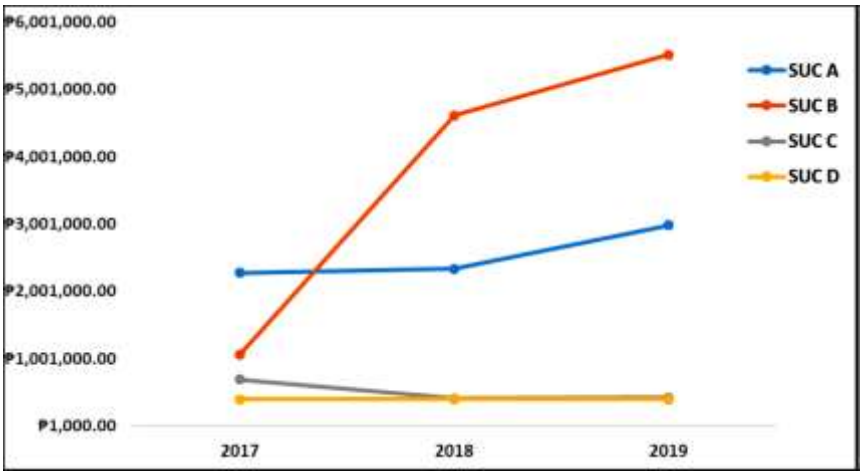

Figure 1: Three-year budget allocation for R & D in four SUCs

Figure 1 shows a three-year trend of R & D budget in four SUCs. Evidently, SUC B experienced a surging increase of budget from 2017 (1,055,000.00) to 2018 (4,615,000.00) and 2019 (5,517,000.00). The increase of R & D budget in SUC A is also observed. The said budget from SUC A is highest in 2019 that amounts to 2,985,000.00 pesos compared to 4,615,000.00 pesos and 1,055,000.00 pesos, in 2017 and 2018, respectively. Further, SUCs C and D received an average R & D budget of 505,000.00 pesos and 390,000.00 pesos, respectively, in the three-year period. Information about the three-year budget trends in R & D are very useful inputs in understanding the research performance of faculty and the intensity of collaboration which will be discussed further in the later part of this section. In the study of Santoro & Gopalakrishnan (2000), besides the presence of competent faculty personnel, budget allocation to R & D plays a crucial role in the production of technologies and spin-offs that entice collaboration among industries. This shows coherence to the findings of Gilsing (2005) which gives a special emphasis to budget as a critical factor to the improvement of an institution's R & D and consequently leads to industry collaboration opportunities.

Faculty Profile of Four SUCs

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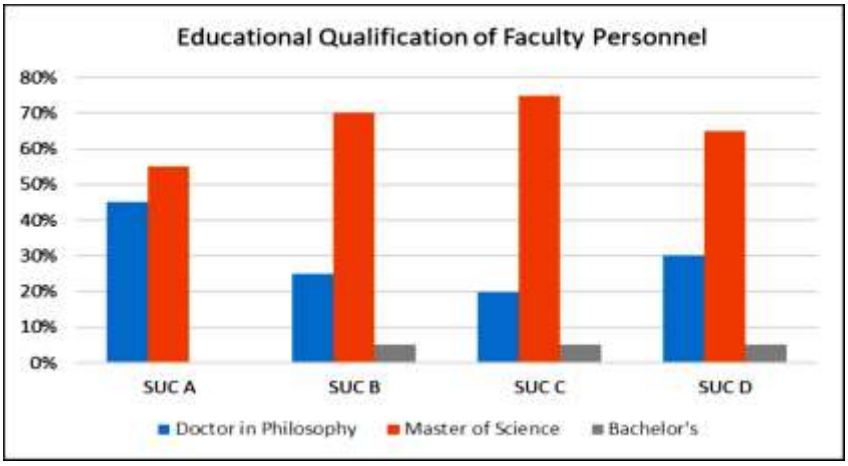

Figure 2: Educational qualification of Faculty respondents in four SUCs

Figure 2 shows the graphical distribution of faculty respondents in terms of educational qualification. SUC A posited the highest percentage of faculty with full pledge doctorate degrees with 45% (23) Ph. D. and 55% (29) master's degree holders. Next to SUC A was SUC D with 30% (9) Ph.D. holders and majority (65%) master's degree holders. SUC B and C had 25% (14) and 20% (6) doctorate degree holders, respectively. The percentages of undergraduates in SUCs B, C, and D are accounted to those faculties who are finishing their master's degree. The educational qualification of faculty respondents is at par with the national standards. In the study of Giuliani *et al.* (2010), it was argued that the success of a university's R & D and Extension depends on the professional qualifications of faculty members. Subscribing to the idea of D'Este & Patel, (2007), the qualifications of faculty respondents among SUCs in the Caraga region contributed to the development of R & D and extension which probably led to successful industry collaboration.

The impressive educational qualifications of many faculties in SUC A could be construed as one of the assets in enhancing collaboration with external industries particularly on research engagements and consultancy. In spite of the almost stagnant budget allocation on R & D, partnerships with industries remained evident in SUC A. Mendoza *et al.* (2012) argued that evidence suggests that faculty are likely to engage in a variety of strategies to protect their academic freedom and ability to publish in the face of UIC such as extensive negogiations and aggresively seeking various sources of funding in order to keep a healthy stream of revenue to pursue their research interests. For some, patenting is the channel by which applied research is dissemniated and is not a significant compromise for faculty because patents are incidental and a byproduct of basic research (Nelson, 2012).

Table 1. Research, Consultancy, and Networks of Faculty Respondents

Indicators	**SUC A**		**SUC B**		**SUC C**		**SUC D**	
	Mean	**Sd**	**Mean**	**Sd**	**Mean**	**Sd**	**Mean**	**Sd**
Research Publications	3.83	8.74	0.70	0.95	0.48	2.17	1.84	1.84
Patented Idea or Technology	0.02	0.01	0.00	0.00	0.00	0.00	0.02	0.01
Innovative Projects Developed	0.35	0.97	0.05	0.23	0.06	0.25	0.74	0.74
Research Presentations	7.58	12.79	1.89	1.88	1.65	2.29	3.90	3.90
Research Programs or Projects Handled	1.10	3.01	0.09	0.48	0.45	0.68	1.19	1.19
Membership in Research and Scientific Organizations	1.58	1.61	0.82	0.61	0.90	1.16	1.52	1.52
With position/designation in research or scientific organizations	1.19	1.12	1.01	1.02	1.12	1.02	1.13	1.05
Consultancy services rendered in private and public organizations or industries	1.19	3.14	0.25	0.44	0.10	0.30	0.71	0.71
Speaking Engagements in Research and Scientific Community	2.96	7.35	0.32	0.92	0.10	0.40	1.52	1.52

Note: Sd denotes for standard deviation

Table 1 presents the profile of faculty respondents in terms of research outputs, consultancy services, and networks. In SUC A for example, records showed that competent faculty researchers had published an average of 3.83 papers with a standard deviation of 8.74. One remarkable finding from the data gathered was the 38 research publications and 64 research presentations that were authored by a single

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Faculty from SUC A. Accordingly, majority of the publications were outputs from several projects funded by government and non-government organizations. Particularly, in the area of engineering, biology, and environmental science, SUC A had developed linkages with local and international organizations that opened opportunities for research, consultancy, and networks. It is further shown that majority of the faculty personnel in SUC A were members of research and scientific organizations with special designations. Consultancy services by faculty members were also notable in SUC A. On another note, patent and innovation outputs was very poor in SUC A as well as the other three SUCs.

SUC D has also published research papers with a maximum of 15 publications that were authored by a single person. This resulted to a mean of 1.84 research publication per faculty with a standard deviation of 1.84. Research presentations reached an average 3.90. Membership to scientific and academic organizations among faculty was also evident.

Research publications among faculty were also reported in SUCs B and C as evidenced by mean publications of 0.70 and 0.48, respectively. Statistically speaking, the relatively lesser (smaller than 1.00) mean publications of SUCs B and C was due to the majority of the faculty who had no record research publications but revealed experiences in research presentations. Consequently, mean scores in consultancy and networks were relatively smaller (smaller than 1.00) for SUCs B and C.

Remarkably, SUC A posited significant number of research outputs despite having almost stagnant R & D budget in the last three years. The bulk of research publications and technology transfer in SUC A is linked to highly credible and qualified team of faculty who mobilized the function of linkage and extension. Hence, along with the university's efforts to strengthen industry collaboration, it is very important that faculty are capacitated and holistically involved in the process. Guimón (2013) exemplifies that the production of research results that suit industry needs is one of the prime reasons why industries collaborate with SUCs. This goes along with the notable faculty memberships to scientific organizations, handling of big projects, and rendering expert's services to industries. The remarkable research outputs and networks of faculty are playing essential roles in the promotion of collaboration among industries. Noticeably, in spite of the SUC D's meager budget on R & D and Extension, their faculty involvement in R & D is remarkable. This confirms the conclusion of Giuliani *et al.* (2010) stating that faculty competence in R & D has an essential role in promoting collaboration and external partnerships. While evidence of R & D outputs is evident among SUCs in the Caraga region, patenting and innovations remained a crucial challenge. If these SUCs envision to promote culture of quality industry collaborations, research outputs must step-up towards useful innovations and technological productions (Guimón, 2013).

Intensity of SUCs' Collaboration with Industries

Table 2. Intensity of university-industry collaboration as perceived by the faculty members of SUCs

Indicators		**SUC A (Mean)**	**SUC B (Mean)**	**SUC C (Mean)**	**SUD (Mean)**
Research Partnerships		4.88	4.65	2.80	4.13
Research Services		4.87	4.75	2.85	3.73
Shared Infrastructure		4.75	4.37	2.35	2.63
	Mean	**4.83**	**4.59**	**2.67**	**3.50**
Academic Entrepreneurship		4.53	2.39	2.11	2.82
Human Resource Training and Transfer		4.26	3.55	2.90	3.65
	Mean	**4.40**	**2.97**	**2.51**	**3.24**
Commercialization of Intellectual Property		3.87	2.62	1.86	2.58
Scientific Publications		4.34	4.12	3.10	3.45
Informal Interaction		4.81	3.71	3.40	3.92
	Mean	**4.34**	**3.48**	**2.79**	**3.32**
	Weighted Mean	**4.60**	**3.88**	**2.65**	**3.39**
Intensity of Collaboration Based on Perkman and Walsh (2007)		**Very High**	**High**	**Medium**	**Medium**

Note: Weighted mean falling within 1.00-1.50 Very Low Intensity, 1.51-2.50 Low Intensity, 2.51-3.50 Medium Intensity, 3.51-4.50 High Intensity, 4.51-5.00 Very High Intensity

Table 2 displays the intensity of university-industry collaboration as assessed by the faculty respondents. The indicators in measure intensity of collaboration are those that were published by Perkman

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& Walsh (2007). For SUC A, the first three indicators yielded an overall mean of 4.83, while 4.40 for the next two indicators, and 4.34 for the last three. These mean scores consequently resulted to a weighted mean of 4.60. Subscribing to the rule of Perkman & Walsh (2007), this further implies that the intensity of collaboration in SUC A is very high. SUC B posits a high intensity of collaboration with industries as supported by the weighted mean of 3.88. With reference to similar table, both SUC C and D reveal medium intensity as evidenced by the respective weighted means of 2.65 and 3.39.

Numerical findings displayed in table 2 empirically imply that R & D activities in SUC A and B have gone beyond research publications by means of engaging partnerships, provision of expert services, and even sharing of infrastructures and technology for production (SUC A and B, 2019 Annual Reports). Strengthening R & D results to various benefits which include industry collaboration opportunities and resource sharing (Guimón, 2013). Research services and shared infrastructure in SUC D pooled the mean score to only 3.50 while research partnership reached 4.13. This explains the fact that partnerships are evident in SUC D but not to the full extent where expert services and sharing of resources are practiced. It further implies that this has to be done for SUC D to improve collaboration by either empowering faculty or investing more on R & D and Extension activities (Tumuti *et al.*, 2013). Moreover, SUC C having a medium intensity of collaboration depicts that the said institution is still on its way to improve R & D and Extension activities. Their faculty profile, though not yet comparable with the other SUCs, is already improving because of their subscription to the Faculty Development Programs and scholarship programs (SUC C, 2019 annual report).

With the consistency of the data presented, SUC A has shown to have remarkable faculty profile, and partnership experiences, though with an insufficient budget. SUC B on the other hand, was revealed to have more partner industries, high budget allocation, and higher R & D outputs (SUC B, 2019 annual report). This potentially explains why SUC B's rating on the intensity of collaboration remained high although evident proportion of faculty are not involved in the Research and Extension section.

Although we cannot invoke causality of variables in this descriptive study, results show that the variation of SUCs scores in table 2 goes along with the differences of their respective faculty profile and budget to R & D. For example, the very high level of intensity in SUC A goes along with the fact that the indicators such as research partnerships, research services, and shared infrastructure are very evident because of their highly qualified faculty workforce and established Research and Extension structure. This is behind the not so high budget allocation for R & D for the last three years. The high intensity of collaboration in SUC B is at the same time observed with its consistently increasing budget and growing faculty workforce who immersed in research and development. Accordingly, the growing number of faculty who pursued graduate degrees and immersed in research have gradually formed its R & D section and consequently promoted research partnerships.

Plausible Interplays of Variables

Very high intensity of collaboration is observed in SUC A which has high educational qualification and significant number of research publications. This is along with the constant increase in R & D budget for the last three years. High intensity of collaboration is observed in SUC B which has the largest and increasing R & D budget. Some percentage of faculty personnel are none master's degree holders. Further, medium intensities of collaboration are observed to both SUCs C and D which have the relatively lesser and stagnant R & D budget for the last three years. Some percentage of faculty personnel from these SUCs are none master's degree holders.

The study concludes that SUC's investment on faculty development and R & D are significant inputs to achieve high intensity of collaboration with industries. This adheres to the New Institutional Theory which stressed that faculty personnel are generators of knowledge and technologies that attract industries to collaborate. Financial investment on R & D also promotes opportunities for faculty to be immersed in research and extension activities that eventually attract collaboration with industries (Guimón, 2013).

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