Spatial Information on the Central Mindanao University's Academic Services in the Northern Mindanao Geographically Isolated and Disadvantaged Areas

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ABSTRACT

Central Mindanao University (CMU) is a premier university in Northern Mindanao with a mission to provide quality education. In response to Sustainable Development Goal #4 on Quality Education and the government's program on Geographically Isolated and Disadvantaged Areas (GIDAs), this study aims to assess the extent of CMU in providing academic services, particularly in GIDAs in Northern Mindanao, Philippines. This study employed an online survey among CMU students and alumni supplemented with secondary data. The study applied the Geographic Information System (GIS) to generate maps and spatially analyze the data. A total of 721 students and 641 alumni responded through the online survey, with 3,594 alumni sourced out from CMU graduation programs. The study's findings revealed that the distribution of students and alumni in CMU is mostly in Bukidnon, particularly in the central and southern parts. Most of the students and alumni in Northern Mindanao are spread in non-GIDAs, although a considerable percentage is in GIDAs. For CMU to respond to GIDAs and SDG Goal #4, the University should craft scholarship programs to attract students and extend its academic services in GIDAs to provide quality education in Northern Mindanao significantly.

Keywords: quality education; Geographically Isolated and Disadvantaged Areas (GIDAs), human capital; human resources; Northern Mindanao

INTRODUCTION

Universities play a critical role in producing human resources with relevant professional, technical and vocational skills to meet the labor market demands. Cortese (2003), Elton (2003), and Lozano (2006) argue the primary role of universities in creating and breaking paradigms for decision-makers, entrepreneurs, and leaders. Universities often offer courses in response to the nature and demands of the labor market in their respective localities, in the region, or at the national levels. Tertiary education in the context of social sciences and law enables students to possess the "capacity to analyze and understand complex socioeconomic and political problems" (Schweisfurth et al., 2018). The Philippines Commission on Higher Education (CHED) emphasized outcomes-based and critical thinking as curricular program outcomes.

According to Leftwhich (2009), "thinking skills developed through high-quality higher education are key in higher tertiary enrolment rates and good governance." Policymakers evaluate the performance of universities as a basis for funding support to satisfy quality standards so that universities that can attract more students even outside of their territories become an indicator of the quality of the University (Columbo et al., 2021). Among universities, attracting students to enroll in offered degrees in tertiary education is a challenge. Choices and preferences in tertiary education are driven more by socioeconomic characteristics than the "services, variety and quantity of educational supply" based on the study of Columbo et al. (2021). The students anchor their decision to study on socioeconomic considerations such as social capital, occupational opportunities, and rewards (Columbo et al., 2021). Similarly, some studies found out that aside from socioeconomic conditions, economic peculiarities in their respective geographical area of origin, and the location of the universities where they choose to study drive students' choices (Bratti et al. in 2019; Dotti et al. in 2013 and Giambona et al. in 2017). Columbo et al. (2021) further demonstrated that "the divergences in the socioeconomic and structural conditions of origin and destination play a critical role in determining students' mobility choices."

The study of Bailey & Dynarski (2011) and Carneiro & Heckman (2002) argued that students in low-income families are less likely to pursue tertiary education. If these students study in tertiary education, they are more likely to attend low-quality schools than those belonging to higher income categories (Hoxby & Avery, 2013). In the Philippines, state universities offer courses and specialized skills to cater to low income families. In addition, the Commission on Higher Education (CHED) implemented the RA 10687 known as the Unified Financial Assistance System for Tertiary Education (UniFAST) Act for students in both private and public schools.

Lozano et al. (2013) studied universities engaging in sustainable development and noted that several universities "tend to respond slowly to society's needs" and are lagged "behind corporations and governments

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in regards to contributing to making societies more sustainable." In the study of Andrews et al. (2020) on the Longhorn Opportunity Scholarship, they argued that raising the educational attainment and earnings of the high-achieving, low-income students addresses "multiple disadvantages faced by these students in the higher education system." Thus, Aleixo et al. (2018) highlighted "conceptual and organizational change in higher education institutions" through "new sources of financing, more flexible organizational forms, more comprehensive mission statements, more tailored educational offers, life-long learning and commitment to internationalization, and more strategic human resource management."

Article XIV, Section 1 of the Philippine Constitution mandates the protection and promotion of the rights of all Filipinos to quality education for all levels. Furthermore, it also calls on an education that is accessible to all. Under various Circulars and Memoranda, CHED formulates guidelines and programs in achieving these mandates. Education is a fundamental human right source of progress and social mobility. Education increases the value of a labor force, thus propelling the economic growth of an individual and the nation (Maiyo et al., 2009). In the report of Former CHED Chairperson Patricia Licuanan (2017), she highlighted that at the macro-level, education is an instrument for poverty alleviation as it builds human capital while at the micro-level, it expands and enhances career and life choices and chances of an individual. In this context, State Universities and Colleges (SUCs) face challenges as to their contribution in achieving this mandate, specifically in providing quality tertiary education. The number of CHED-declared Centers of Excellence and Development, accredited academic programs, board examination performance and ranking, and research and publication outputs are performance indicators in delivering quality education. But as producers of professionals and the labor force, SUCs are essential in improving the lives of low-income families and communities.

In a more focused approach, the government has identified Geographically Isolated and Disadvantaged Areas (GIDAs), which refer to communities with marginalized populations due to physical and socioeconomic separation from the mainstream society. The Department of Health (DOH, n.d.) defines GIDAs as a "marginalized population physically and socio-economically separated from the mainstream society and characterized by - 1. Physical Factors - isolated due to distance, weather conditions, and transportation difficulties (island, upland, lowland, landlocked, hard to reach, and unserved/underserved communities); and 2. Socioeconomic Factors (high poverty incidence, presence of vulnerable sector, communities in or recovering from a crisis or armed conflict). The categories of GIDAs are Focus Area A, i.e., both GIDAs and conflict-affected/vulnerable area with more than 30% poverty incidence; Focus Area B, i.e., conflict-affected/vulnerable area with more than 30% poverty incidence; and Focus Area C, i.e., GIDAs with more than 30% poverty incidence. Quality tertiary education should be able to cater to GIDAs. Interventions of universities in GIDAs contribute to the United Nation's Sustainable Development Goal #4 on Quality Education aims to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."

Providing quality education in GIDAs poses more challenges among SUCs. The question is the number of graduates and where the graduates came from, i.e., which University has impacted molding and building the human capital in the region. On the other hand, this will also be a constant challenge for the University to align its institutional priorities to the region's needs for human capacity development.

Central Mindanao University's (CMU) contribution to the development of Mindanao, if not to the country, is beyond doubt. Founded in 1910, CMU has produced professionals as pools of human resources in various fields and professions. Many of these graduates hold portfolios in key government and private agencies at local, national, and international levels.

The CMU University Annual Reports highlight the number of graduates produced. Similarly, colleges also keep track of the employability of their graduates. Now and then, University Administrators face the question of what have CMU contributed to poverty alleviation in the Province of Bukidnon, in particular, or in Mindanao, in general? Where do the student clients of CMU originate? Does the University reach out to the youths in the GIDAs? This study seeks to provide CMU the spatial information on the distribution of its students and graduates. Specifically, it evaluated whether CMU can spread its impacts and contribute to developing human resources within GIDAs. Using GIS as the primary tool, the outputs helped visually and critically assess the University's achievement in fulfilling its mandate. The output of this study may also aid in CMU interventions in GIDAs to address the Philippine and Northern Mindanao (Region X) Agenda on human capital development and the provision of economic opportunities.

One of the tools to show the extent of SUCs academic service areas is through mapping. GIS-based mapping can spatially show the scope of a university's reach in contributing to human resources development and addressing quality education, especially in GIDAs. Chandra et al. (2021) applied mapping to show the geographical distribution of foreign medical graduates.

The study's goal is to generate the spatial distribution of CMU students and alumni in Northern Mindanao. Specifically, the study aimed to:
1. map out the distribution of CMU students and alumni in Northern Mindanao;
2. classify the geographic distribution of CMU students and alumni in non-GIDAs and GIDAs Focus Areas in Northern Mindanao;
3. evaluate the geographical spread of CMU's academic services for the human resources development in Mindanao.

METHODOLOGY

The response to this study is purely voluntary. Questionnaire is structured to avoid discrimination in terms of age, gender and socio-economic status. Data collected were on year graduated and not specific age of

the respondent. A salary range or grade was used instead of directly asking for income. Respondent has also the option of not responding to this specific question and were classified as "No information" in the data analysis.

1. Protocols on Data Collection and Confidentiality

This study has approval from the Data Privacy Office of CMU in adherence to Republic Act 10173, otherwise known as the "Data Privacy Act." This study also secured clearance from the Institutional Ethics and Review Committee (IERC). With the current COVID-19 pandemic, this study reduced the risk of exposure to COVID-19 both on the researchers and on the respondents by using an online survey and limited printed forms for CMU alumni employees only with no email accounts.

The actual participation of student and alumni respondents was only in answering the online questionnaire via Google Form, which lasted on an average of five (5) minutes per respondent. The researchers disseminated the online survey links to various colleges and offices in CMU and personal contacts via social media. Participation in the online survey was purely voluntary. Respondents had the freedom to answer the questionnaire by not clicking or opening the link or to end it by clicking the exit button or not submitting the form. The questionnaire also contained statements on Informed Consent and Confidentiality of the data. The researchers verified the names of the respondents from the list of the University Registrar and the Human Resources Management Office. The online survey was opened in December 2020 and was closed in September 2021 to allow data analysis time. Data were supplemented from the list of graduates found in the CMU graduation programs from 1991 to 2016 that still show the names and addresses.

The online survey was pre-tested to non-CMU respondents primarily to check for any difficulties and technical issues in answering the online survey form. Since the data aimed to be inclusive for validity, the questionnaire was structured to avoid age, gender, and socioeconomic status discrimination.

The intent of this study is primarily in mapping out the extent of CMU's academic services, particularly in Northern Mindanao GIDAs. The generated maps provide the context for spatial analysis. The data analysis and presentation excluded the names and identities of respondents. Data on student names, courses, and year

graduated validate if respondents are CMU alumni or students. Data were coded in the analysis to protect the identity and confidentiality of the respondents. Researchers created a database for easy access and retrieval.

Data Processing and Analysis

The primary aim of this study is to map out the distribution of students and alumni by transforming data into spatial information using the Geographic Information System (GIS). The software used in the mapping is ArcMap ver. 10, a component of ArcGIS ver. 10 available at the Center for Geomatic Research and Development in Mindanao (GeoMin) in CMU. The mapping process started with acquiring necessary input data such as the location data of CMU students and alumni, GIDA focus areas, and GIS data on political boundaries. The data on GIDAs extracted from the National Economic and Development Authority (NEDA) list in the Northern Mindanao region was then appended to existing GIS data on political boundaries by attribution. The outputs of this process were the graduated symbol maps that provided better visualization as to where CMU students and alumni are across the Northern Mindanao region. These graduated symbol maps also showed the distribution pattern and concentration of CMU students and alumni relative to GIDAs in the region.

Researchers generated the following map overlays:
- Geographic distribution of CMU students
- Geographic distribution of CMU alumni
- Overlay of maps with GIDA Focus Areas.

In the absence of GIDAs data from other regions, the overlay of student and alumni distribution focused only on the Northern Mindanao region. Data analysis calculated the percentages of the distribution of students and alumni per province and in GIDAs in the region.

RESULTS AND DISCUSSION

1. Geographic Distribution of Students and Alumni of CMU

A total of 721 students and 4235 alumni responded thru the online survey. Most of the students who responded to the online survey come from Northern Mindanao, comprising 86% of the total student respondents. The geographical origin of these students comes from Bukidnon Province (78%), as depicted in Figure 1. The rest of the student respondents originated from other regions outside of
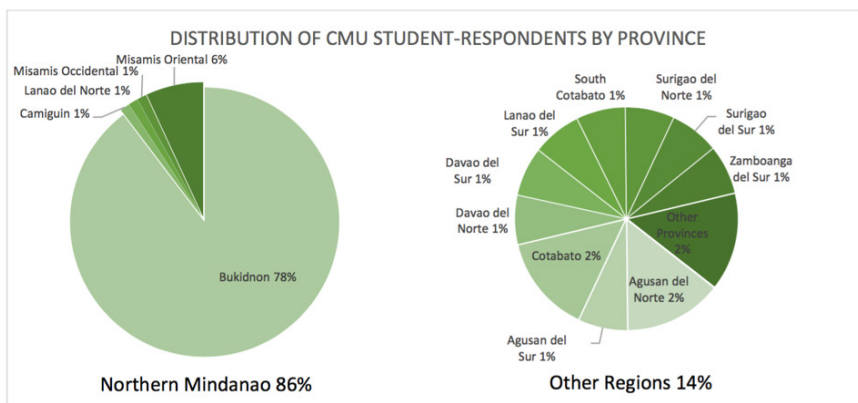
Figure 1. Distribution of CMU student-respondents by province, SY 2021-22. This figure illustrates the percentage distribution of CMU students in their respective provinces.
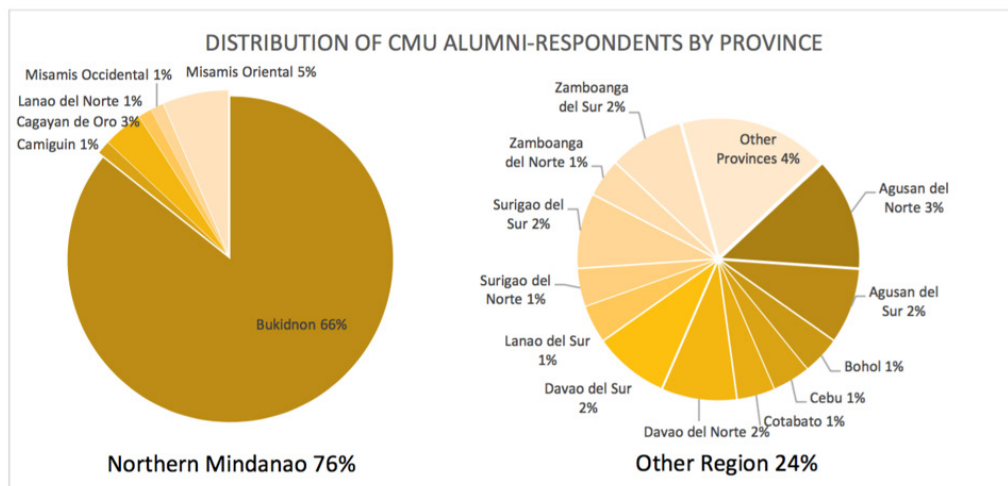
Figure 2. Distribution of CMU alumni by province. This figure illustrates the percentage distribution of CMU alumni in their respective provinces.

Northern Mindanao but are primarily from Mindanao Island.

The findings conformed to the studies of Bratti et al. (2019), Dotti et al. (2013), and Giambona et al. (2017), of which students are driven by "economic peculiarities in their respective geographical area of origin and the location of the universities." The peculiarity of the Bukidnon landscape is agricultural, and it is the agriculture sector that drives the province's economy. To match this economic peculiarity, CMU is a premier education and the Center of Excellence in Agriculture that caters to the labor demands of the agri-based economy of Bukidnon. CMU is the most convenient and accessible University for students who opt to enroll in agriculture and related courses. Another notable finding is the relatively few students in the northern part of Bukidnon because these places are near Cagayan de Oro City. The northern Bukidnon landscape is agricultural, but there are demands for non-agricultural jobs in adjacent Cagayan de Oro City. The choice of Cagayan de Oro is due to its "economic peculiarities," as described in Bratti et al., 2019; Dotti et al., 2013 and Giambona et al., 2017, such as the non-agricultural and urban economy. Thus, universities in Cagayan de Oro offer diverse tertiary courses, curricular programs, and, most importantly, diverse job opportunities for professional, technical, and vocational skills.

Of the total student respondents in Northern Mindanao, most are from Bukidnon (78% or 560 student respondents). The possible reason for the low number of students outside of Bukidnon is the availability and accessibility of equally high-quality education offered by universities in Cagayan de Oro and Iligan City – urban centers in Northern Mindanao. Cagayan de Oro City in in the midst of Misamis Oriental while Iligan City is in the midst of Lanao del Norte. These urban centers host several job opportunities, access to basic services, and higher and more diverse demand for the workforce. Other provinces with less than 1% include Siquijor Island in the Visayas, Pampanga in Luzon Island and Davao de Oro in Mindanao.

Alumni data generated from the online survey revealed that the oldest respondent graduated in 1970, while the recent ones were in 2020. Figure 2 presents a similar distribution pattern with the students, most of whom now reside in Northern Mindanao (75% or 3443 alumni respondents) while the remaining 25% are outside of Northern Mindanao. Among the alumni in Northern Mindanao, 66% (3001) are in Bukidnon. In addition to the Mindanao regions, alumni respondents currently work in the Visayas region, i.e., Bohol and Cebu. Data also revealed that there are alumni who are now in Metro Manila, areas in the National Capital Region and Cebu, and in the countries of Thailand, Australia, New Zealand, Dubai, United Arab Emirates, USA, Canada, and the United Kingdom.

Data in Figures 1 and 2 imply that CMU attracted students mainly in Bukidnon and extended its service areas to nearby provinces in Northern Mindanao and the Mindanao region. This extent of CMU students and alumni distribution validates CMU's claim as a premier university and an "academic paradise in the South." According to Columbo et al. (2021), "universities who can attract more students even outside of its territories become an indicator of the quality of the university." This idea means that CMU has extended its reach to other Mindanao provinces to provide quality education. These students will soon become the human resources to fill in the workforce's needs in Mindanao.

CMU Students and Alumni in GIDAs in Northern Mindanao

One of the two characteristics of GIDAs is socioeconomic factors, particularly areas with high poverty incidence and the presence of vulnerable sectors. High poverty incidence translates to low-income households who are less likely to pursue tertiary education (Bailey & Dynarski, 2011 and Carneiro & Heckman, 2002) thus, the need to address "multiple disadvantages faced by these students in the higher education system" (Andrews et al., 2020).

Figures 3 and 4 show the distribution of students and alumni in Northern Mindanao GIDAs. Overall, most student and alumni respondents are in non-GIDAS.

Data in Table 1 show that only 28% of the student

respondents are in GIDAs, most of which are in Focus C (17%) and Focus A (9%). Figure 3 spatially show the distribution of student respondents in GIDAs in Northern Mindanao. Boundaries of GIDAs are at the barangay levels as per category of NEDA. It is interesting to know how many of these students will finish tertiary education and obtain the degree. The distribution of alumni in GIDAs is similar to students, of which 27% are in GIDAs of Northern Mindanao. Most of the alumni respondents in GIDAs are in Focus C (13%) and A (11%). Of the other five provinces in Northern Mindanao, only Misamis Oriental has students in GIDAs (9%).

On the other hand, most of the students in Northern Mindanao are in non-GIDAs. Figure 5 shows the distribution of CMU students in Bukidnon, the province where CMU is located. Among the student respondents in Bukidnon, 64% have geographical origin in non-GIDAs. The remaining 36% are in GIDAs, of which 12 % are from Focus Area A, 3% from GIDAS Focus Area B, and 22% from Focus Area C.

The majority of the students in GIDAs are from Maramag, understandably because CMU is under the political jurisdiction of this municipality in Bukidnon. However, CMU can provide quality education to nearby cities and municipalities, i.e., the GIDA Focus Area A in Impasugong, Malaybalay, Maramag, Quezon, and Kibawe. However, the significant coverage of GIDAs shows only a few students from CMU.

The fewer students in GIDAs may imply that those who want to pursue higher education may be constrained due to lack of financial resources due to high poverty incidence, lack of transportation facilities, or unstable peace and order situations. Bailey & Dynarski (2011) and Carneiro & Heckman (2002) argued that low-income families are less likely to pursue tertiary education. In this case, those in GIDAs opted to earn income or stay in their respective geographical origin rather than going out to pursue tertiary education and obtain a degree.

Of the total alumni respondents, 60% are in non-GIDAs, while 11%, 3%, and 13% are in GIDAs Focus Area A, B,

Geographic al Location	Non-GIDAS (%)		GIDAS (%)						Other Region	
			A		B		C			
	Stud.	Alum.	Stud.	Alum.	Stud.	Alum.	Stud.	Alum.	Stud.	Alum.
Northern Mindanao	58	60	9	11	2	3	17	13	14	13
Bukidnon	64	66	12	14	3	4	22	16	N.A. (No available data on GIDAs)	
Camiguin	100	100								
Lanao del Norte	100	91	0	0	0	9	0	0		
Misamis Occidental	100	87	0	7	0	0	0	7		
Misamis Oriental	91	95	0	0	2	1	7	3		

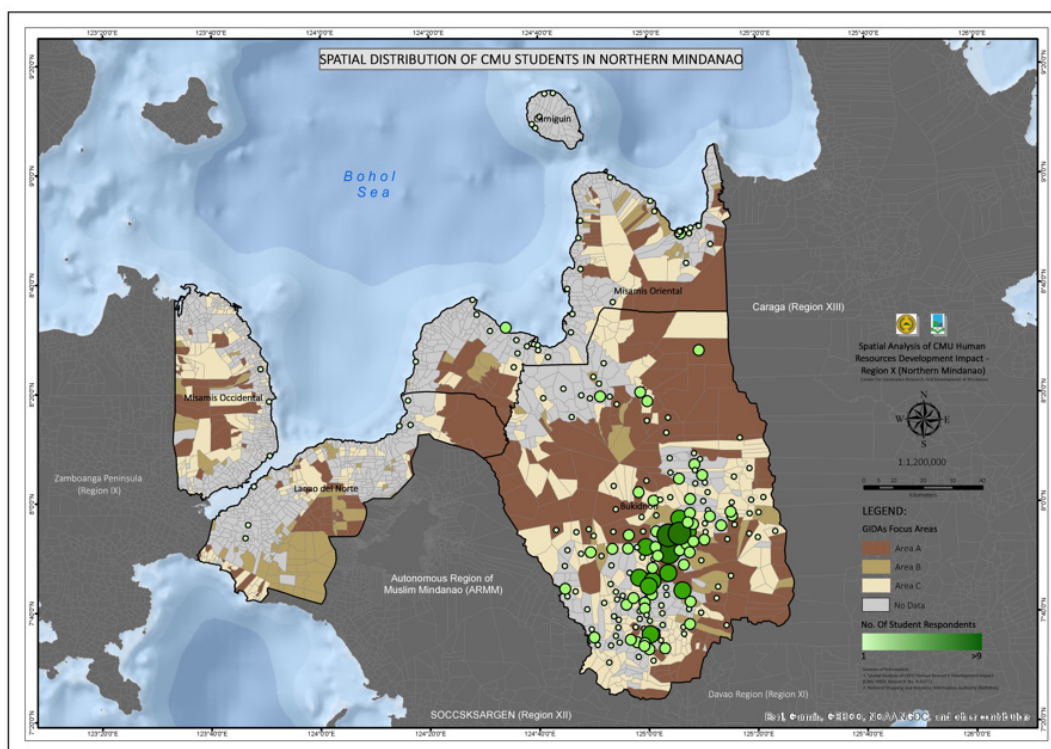Table 1. Data Statistics of the GIS-generated Map

Figure 3. Spatial distribution of CMU students in Northern Mindanao. This figure illustrates the geographic location of CMU students in GIDAs and non-GIDAs in Northern Mindanao.
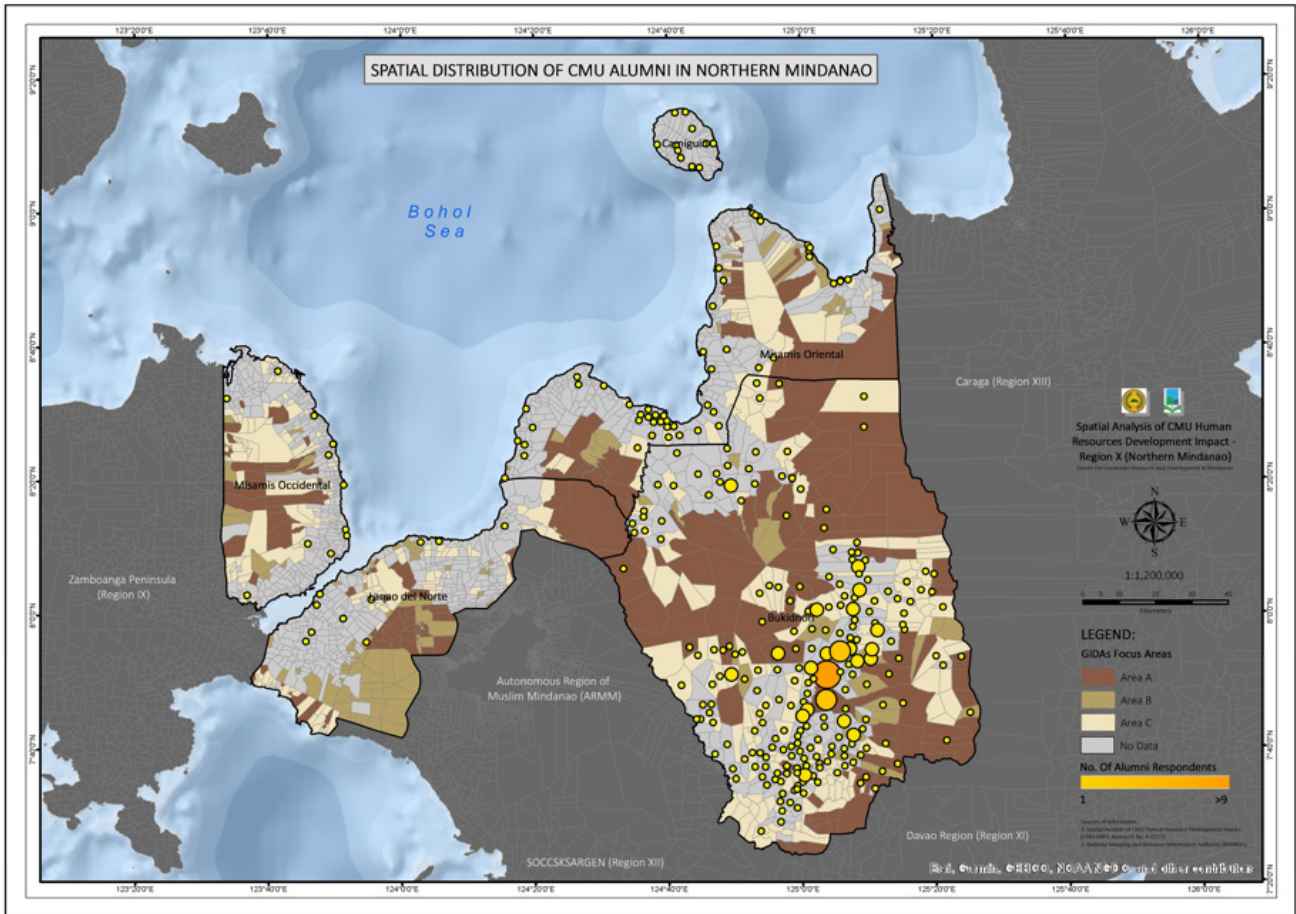
Figure 4. Spatial distribution of CMU alumni in Northern Mindanao. This figure illustrates the geographic location of CMU alumni in GIDAs and non-GIDAs in Northern Mindanao.
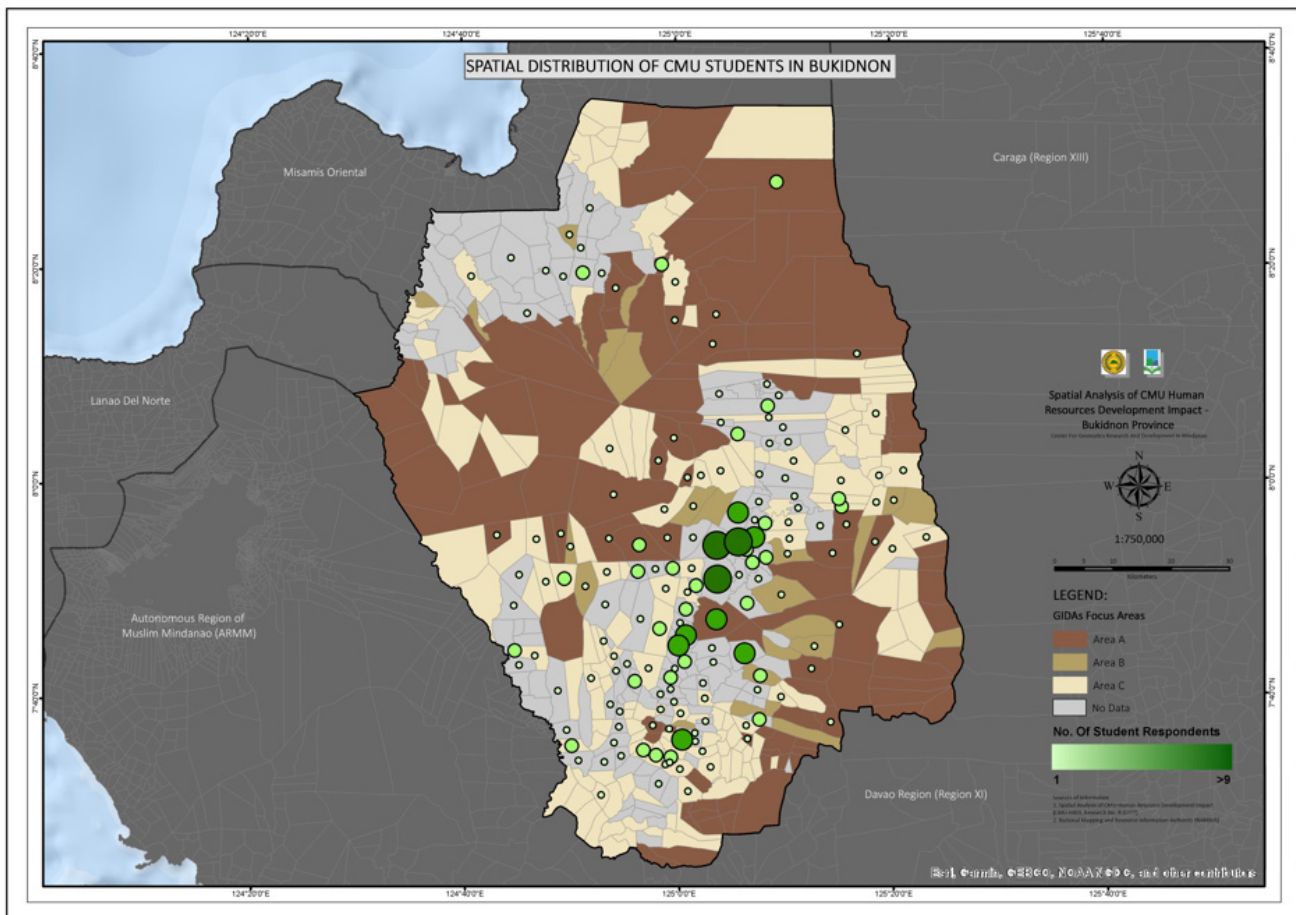

Figure 5. Spatial distribution of CMU students in Bukidnon. This figure illustrates the geographic location of CMU students in GIDAs and non-GIDAs in Bukidnon.
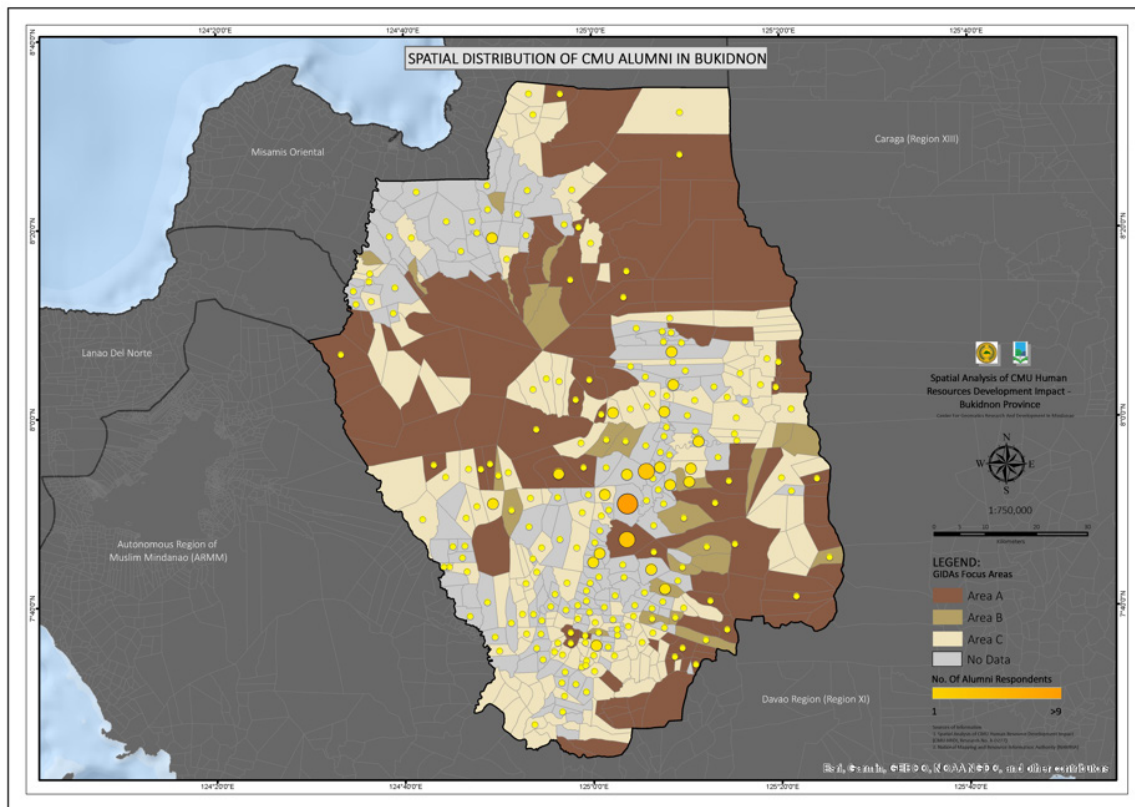
Figure 6. Spatial distribution of CMU alumni in Bukidnon. This figure illustrates the geographic location of CMU alumni in GIDAs and non-GIDAs in Bukidnon.

and C, respectively. Among the provinces in Northern Mindanao, Bukidnon has the highest percentage of alumni in GIDAs (34%) followed by Misamis Occidental (14%). The 95% of the alumni are in non-GIDAs probably because of the diverse employment sources, particularly in non-GIDAs urban and urbanizing places in Misamis Oriental such as Magsaysay, Tagoloan, Villanueva, El Salvador and Laguindingan.

In Bukidnon, CMU alumni are thinly spread but relatively high in the central and southern parts. The high number of CMU students in Bukidnon also coincides with the high number of CMU alumni mainly distributed in the south part of Bukidnon shown in Figure 6. Interestingly, these alumni are also spread in the GIDAs of the province, such as in the cities of Malaybalay and Valencia – urban centers with higher demand for employment with professional, technical, and vocational skills.

Geographical spread of CMU's academic services for the human resources development in Mindanao.

The generated data shows that CMU has a broad reach in Bukidnon, particularly in the central and southern parts. Outside of Bukidnon, the distribution is more focused in urban and urbanizing cities and municipalities.
The majority of the students in CMU come from Bukidnon and Misamis Oriental, but the quality education service of CMU has also spread to other provinces even beyond Northern Mindanao. A similar pattern of CMU student and alumni distribution indicates that CMU concentration is within these two provinces, probably due to the proximity of CMU to these provinces. However, the limited number of students and alumni in other provinces in Mindanao is

due to other state-run colleges and universities that offer quality education at a cheaper cost. These findings indicate that CMU has impacted producing human resources for the regions in Mindanao, particularly in Bukidnon and Misamis Oriental Provinces, as shown in Figures 1 and 2. Bukidnon, an agriculture-based economy, needs human resources in agriculture and related fields such as Veterinary Medicine, Food Technology, Agricultural Engineering, Environmental Science, and others. However, the diverse curricular programs in CMU also cater to professional and technical skills demanded in urban cities and municipalities in the rest of the Mindanao regions. As such, CMU is the source of human resources for the development of the Mindanao region.
CMU's mission to provide quality education extends its academic service areas to the GIDAs. The academic services of CMU are an opportunity for students in GIDAs to exercise the right to be educated, pursue tertiary education, and enjoy the privilege to be educated in CMU that offers a quality education at a lower cost. Pursuing tertiary education in CMU is the gateway for low-income families and high poverty incidence communities to uplift their socioeconomic conditions. The presence of students in GIDAs indicates that CMU responds to the government interventions on basic services and peace and order initiatives in GIDAs and the SDG Goal 4 on Quality Education. This idea reiterates Andrews et al.'s (2020) point on "raising the educational attainment and earnings" among the high-achieving, low-income students by addressing "multiple disadvantages faced by these students in the higher education system."
CMU service areas in tertiary education have spread beyond Northern Mindanao, reaching other Mindanao regions and other parts of the country and abroad. Data generated
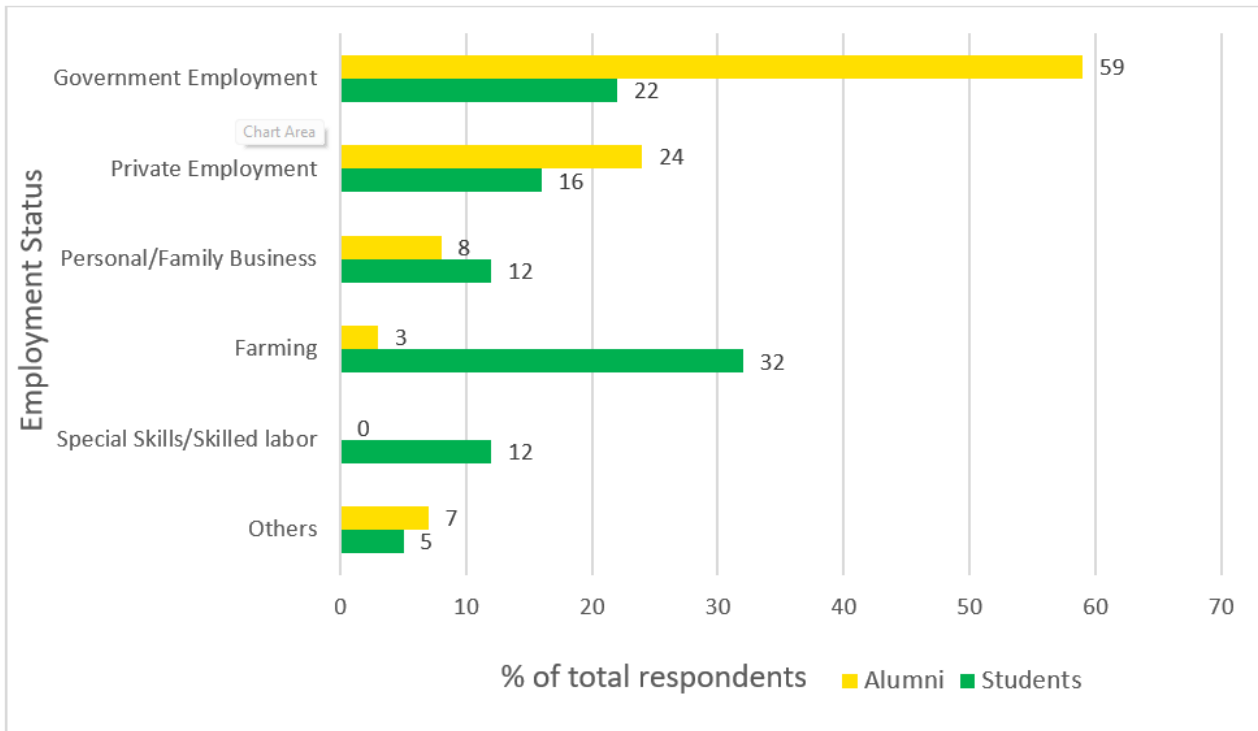
Figure 7. Comparison of the employment status of the households of CMU students and the alumni. This figure illustrates the percentage distribution of the sources of income of households of students and alumni.
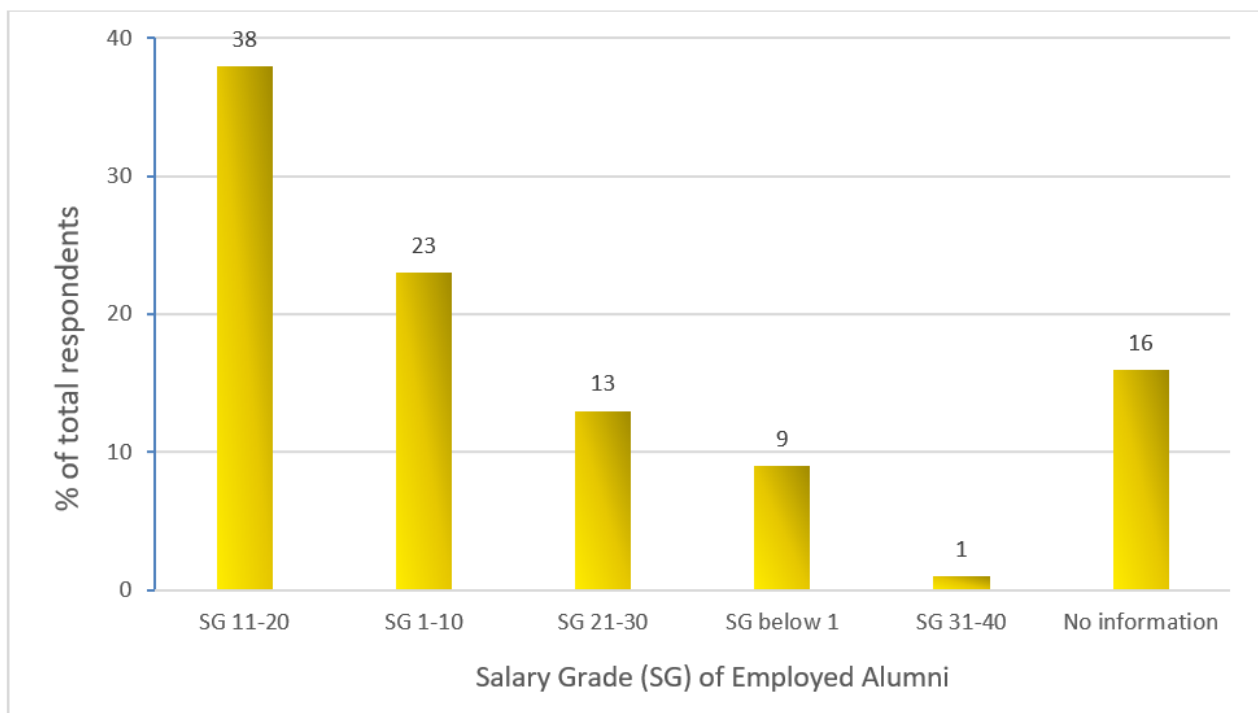

Figure 8.Salary grade of employed alumni. This figure illustrates the percentage distribution of alumni based on salary grade.

from this study also reveal that CMU has produced human resources for Mindanao. Figure 7 shows that farming (32%) is the source of household income for the majority of the students. On the other hand, alumni sources of income are government and private employment, while others venture into business. The alumni have an income ranging from 20,000 to 50,000 pesos per month, equivalent to Salary Grades 11-20 in government standard, as shown in Figure 8.

Figures 7 and 8 imply that CMU has produced graduates who contribute to the government and private sectors workforce. Their salary grade also means that these graduates are already occupying key positions. These data show that the academic services of CMU provide human resources for the workforce in Mindanao and the other regions. Thus, CMU has contributed to the region's human resources development through the employment of its graduates.

CONCLUSIONS AND RECOMMENDATION

From the generated data, the following conclusions are as follow:

1. The majority of the student respondents have geographical origin in Northern Mindanao (86%), of which 78% come from Bukidnon. Student respondents outside of Northern Mindanao comprise 14%.
2. The 76% of the alumni respondents are in Northern Mindanao, of which 66% come from Bukidnon. Alumni respondents outside of Northern Mindanao comprise 24%.
3. In Northern Mindanao, 28% of the student respondents are from GIDAs, while 27% of the alumni are in GIDAs. Bukidnon has the highest percentage of students and alumni in GIDAs, i.e., 36% and 34%, respectively.
4. CMU students and alumni are concentrated in central and southern Bukidnon. The relatively small number of students in other provinces of Northern Mindanao is due to the presence of state-run universities that offer quality education at a cheaper cost.
5. CMU has contributed to human resources development whose graduates have employment in government, private, and business sectors. The diverse curricular programs of CMU cater to the employment requiring professional and technical skills in the other regions of the country and abroad.

This study acknowledged its limitations regarding the number of responses, duration, and data sources. Methodologically speaking, the following recommendations are forwarded:
1. The Office of the Director of Instruction may extend the study using the same questionnaire to require all students to fill in the form. This filling up of the questionnaire may be a requirement for students to secure the final exam permit. Hence, CMU has a regular tracking and monitoring of the geographic location of their students per school year.
2. The Alumni Relations Office may continue to administer the survey for the alumni to increase the response rates and gather more data.
3. The Digital Transformation Office of CMU may create a database of the students and alumni with their corresponding addresses, i.e., city/municipal and province, but maintaining the confidentiality of the names. The database is helpful for easy access of the data for similar studies on the distribution of students and alumni.

The following suggested actions may provide more equitable access to quality instruction of CMU:
1. The CMU Administrative Council may strategize actions to encourage potential students from other provinces and regions, such as face-to-face or online campaigns through social media.
2. The Office of Admissions, Scholarships, and Placement (OASP) and the Office of Student Affairs may craft a scholarship program for students in the GIDAs. The program may encompass recruitment, accommodation, academic advising and coaching/mentoring, and monitoring activities. The program may also contain criteria for selecting and prioritizing potential students from the GIDAs.
3. CMU Administration may forge partnerships with other government agencies, legislators, and private companies to generate funding for the said scholarship.

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