



Developing Regional Economic Complexity through Product Specialization

Krista Danielle S. Yu



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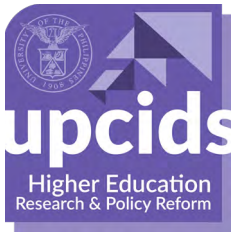
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UP PRESIDENT
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FELLOWSHIP

The **UP President Edgardo J. Angara (UPPEJA) Fellowship** is a grant for pioneering policy research. It aims to promote high-level policy discussions and research on a wide range of topics that address national development goals and imperatives, such as science and technology, economic development, environment and climate change, good governance, and communications.

The Fellowship was established by the University of the Philippines Board of Regents on September 29, 2008 in honor of the late Senator Edgardo J. Angara, who served as UP President from 1981 to 1987 and concurrent UP Diliman Chancellor from 1982 to 1983.

Angara, also a former Senate President, is known for his contributions to Philippine education, serving as the Chairperson of the First Congressional Commission on Education in 1990, which was credited with a number of pioneering reforms in the education sector, including its “trifocalization” and the Free Higher Education Act.

In addition to his notable contributions as a legislator, Angara’s leadership also gave rise to the **UP Center for Integrative and Development Studies (CIDS)**, which he initiated during his presidency.

Officially established on June 13, 1985, and originally called the University Center for Strategic and Development Studies (UCSDS), CIDS serves as a think tank that leverages the multidisciplinary expertise of UP to address the nation's most pressing challenges. The core objectives of CIDS encompass the development, organization, and management of research on national significance, the promotion of research and study among various university units and individual scholars, the securing of funding from both public and private sources, and the publication and wide dissemination of research outputs and recommendations.

For 2024, the Higher Education Research and Policy Reform Program (HERPRP) served as the UP PEJA Fellowship Awards secretariat in partnership with the Second Congressional Commission on Education (EDCOM II).

From the Executive Director of UP CIDS

It has been a long time in the making, but I am pleased to see the UP PEJA Fellowship finally coming to fruition. After all the forums, meetings, presentations, and threads of communication between and among the PEJA Fellows, UP CIDS' Higher Education Research and Policy Reform Program (HERPRP), and the Second Congressional Committee on Education (EDCOM 2), we now have a series of papers that tackle the various facets of Philippine higher education. The series includes the study you're reading.

For much of its history, the UP PEJA Fellowship has been housed in and implemented through the Center for Integrative and Development Studies (CIDS), the University of the Philippines' policy research unit. Over the years, the Fellowship has funded and published the studies of policy scholars, many of them luminaries in their respective fields.

In 2023, after a few years' hiatus, not least because of the COVID-19 pandemic, the UP PEJA Fellowship resumed and began looking for a new set of Fellows. This time, however, UP CIDS, through its Higher Education Research program, embarked on a historic partnership with the Second Congressional Committee on Education (EDCOM 2).

Linking directly with the government in administering the UP PEJA Fellowship was a first for UP CIDS. And that this was a partnership with a national-level policy-making body made it even more special.

As I have always maintained, this type of linkage is exactly what UP CIDS, as a policy research unit, must do: embedding research within a framework of stakeholder engagement.

Guided by the policy objectives of EDCOM 2, the PEJA papers not only tackle the complex issues in education, but also show stakeholders – the state, civil society, and the teachers themselves – how we can tackle them. For all our efforts in improving education in the Philippines, what else can and should we do?

Many thanks to the PEJA fellows for their valuable contribution, and to the UP CIDS Higher Education Research Program for shepherding this important undertaking. With collaboration, great things do happen.

Rosalie A. Hall, PhD

Executive Director

UP Center for Integrative and Development Studies

From the Convenor of UP CIDS-HERPRP

We at the Higher Education Research and Policy Reform Program serve as a convening body that builds partnerships and networks that pursue a shared research agenda and build an evidence basis for policy. Our activities include fellowships for scholars who publish with us and consultancies for junior researchers who wish to begin a career in higher education studies. We maintain databases, conduct events, and publish various manuscripts on higher education.

For 2024, our full attention was devoted to the UP PEJA Fellowship Program, serving as a secretariat for the researchers who studied higher education as it intersected with government and finance, industry and agriculture, regulation and tuition and technical and vocational education, training and lifelong learning, the UP PEJA Program awards grants for pioneering work on a wide range of topics that address national development concerns. This was the very first time that the program focused on a singular topic. This demonstrates the commitment of the University of the Philippines to higher education.

With the support of the UP Foundation, we have assembled what we have been calling the *Avengers* of Philippine education. They are preeminent scholars whose findings and recommendations directly address key policy concerns. Their papers at once draw from empirical data as well as their professional expertise for which they have been identified as a UP PEJA fellow.

Fernando dlc. Paragas, PhD

Convenor

Higher Education Research and Policy Program

UP Center for Integrative and Development Studies

Letter from the Executive Director of EDCOM II

The **Second Congressional Commission on Education (EDCOM II)** is collaborating with scholars across various institutions to provide valuable insights for the development of evidence-based policies that address the unique challenges and opportunities in the Philippine education landscape.

Our commitment to excellence, integrity, and ethical conduct in advancing research and disseminating knowledge, which we share with our research partners, is defined by the following principles:

The Commission is dedicated to upholding the highest standards of academic rigor in the evaluation, review, and dissemination of research publications. Our pledge is to ensure the integrity and quality of the knowledge we contribute to the scholarly community.

The Commission is committed to fostering transparency and data integrity in all aspects of research. This includes transparent communication, disclosure of methodologies and data sources, and providing clear guidelines to authors, reviewers, and the broader academic community.

The Commission promotes ethical research conduct, emphasizing the responsible and respectful treatment of research participants.

The Commission places a strong emphasis on accessibility. We are committed to facilitating the translation of research findings into accessible formats in order to engage the broader public, taking into account ethical and legal considerations. Our goal is to promote public understanding and awareness of scientific advancements.

In adherence to these principles, the members of the Second Congressional Commission on Education (EDCOM II) pledge to be stewards of good scholarly research for a better, more inclusive educational system for the Filipino people.

Karol Mark R. Yee, PhD

EDCOM II Executive Director

Declaration of Funding

This research was conducted in collaboration with the Second Congressional Commission (EDCOM II).

The funding source played no role in the design of the study, data interpretation, or decision to publish the findings as the author(s) maintained complete autonomy in the research process, ensuring objectivity and impartiality in the presentation of results.

Declaration of Interest

None

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List of Acronyms or Abbreviations

BARMM	Bangsamoro Autonomous Region of Muslim Mindanao
CARP	Comprehensive Agrarian Reform Program
CPBI	Census of Philippine Business and Industry
FDI	Foreign Direct Investment
LPD	Livestock, Poultry, and Dairy
M-ECI	Multidimensional Economic Complexity Index
OTOP	One Town, One Product
PCPP	Philippine College of Poultry Practitioners
PRRI	Philippine Rubber Research Institute
SEIPI	Semiconductor and Electronic Industries of the Philippines, Inc.
TESDA	Technical Education and Skills Development Authority

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Developing regional economic complexity through product specialization

*Krista Danielle S. Yu*¹

Executive Summary

Economic complexity is the knowledge of a country's society as reflected through the goods that it produces..It is measured based on the diversity and ubiquity of a country's exports. Ubiquity refers to the number of countries that can manufacture a particular product (Hausmann et al., 2014). In order to maintain or improve a country's economic complexity, the quality of education should simultaneously improve. Private sector initiatives to innovate and invest in the workforce should also be developed. The education system should be attuned to the needs of the industry; thus, academe-industry linkages must be strengthened to ensure that when students graduate and join the workforce, they have the skills needed by the industry.

Using the multidimensional economic complexity index (M-ECI) developed by Yu et al. (2024), this study focuses on the sectors relating to egg production in Region V, chicken and potential egg production in Region VIII, the semiconductor industry in the Caraga Region, and the rubber industry in the BARMM. The M-ECI accounts for a sector's contribution to the economy, multiplier effect,

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product complexity, employment (in terms of compensation and number of jobs created), gender equality, food security, and environmental impact. The multidimensional aspects of the M-ECI allows the index to account for various components that are necessary to sustain economic livelihoods. A typical economic complexity study will not account for food security contributions and is unlikely to include agricultural sectors that are deemed of low economic complexity. However, it is important that the Philippines is able sustain itself in food production given its large population. Therefore, an analysis of agricultural sectors is a key contribution of the study.

This study identifies the needs of the industry in terms of training and skills (Priority Area#19), and the involvement and investment of industry in training (Priority Area#20). It forwards the following recommendations:

- Involve industry partners in curriculum review to ensure that academic programs serve the needs of the industry.
- Develop a feedback mechanism to enable the academe to regularly assess the needs of the industry.
- Integrate entrepreneurial values and the Tatak Pinoy concept early on in the education system.
- Instill the value of lifelong learning and develop the ability to adapt to change.
- Develop industry career guides that are regularly updated to increase the awareness of potential opportunities available to graduates of various programs.
- By identifying gaps in the value chain and developing the ability of industries to address these gaps.
- Strengthen the value chain and create more employment opportunities for Filipinos.
- Put in place government interventions to encourage academe-industry linkage.

Academe-industry linkage is imperative to achieve efficient economic outcomes. When market forces are unable to promote academe-industry linkage organically, government interventions should be in place to initialize and encourage cooperation. Possible interventions include supporting research and development that require significant investments, such as animal pharmaceutical research facilities, wafer fabrication plants and nickel processing plants, and commercialization of products such as rubberized asphalt and veterinary pharmaceuticals. This will help the employability of graduates and a more productive Filipino workforce, which will ultimately raise the welfare of the country.

Introduction

Economic complexity is the knowledge of a country's society as reflected through the goods that it produces. It is measured based on the diversity and ubiquity of a country's exports. Ubiquity refers to the number of countries that can manufacture a particular product (Hausmann et al. 2014). Legislation has already been passed to support the improvement of the Philippines' economic complexity. The Tatak Pinoy Act was signed into law on February 26, 2024, mandating the adoption of a whole-of-government approach to boost the country's economic products. The One Town, One Product Philippines Act was signed into law on August 24, 2023, establishing the One Town, One Product (OTOP) Philippines program, which focuses on the development of indigenous raw materials across the country to drive local economic activity and boost national economic growth. These laws provide a foundation for the government to give support to activities that will achieve their specific goals.

However, in order to maintain or improve a country's economic complexity, the quality of education should simultaneously improve. Private sector initiatives to innovate and invest in the workforce should also be developed. The education system should be attuned to the needs of the industry; thus, academe-industry linkages must be strengthened to ensure that when students graduate and join the workforce, they have the skills needed by the industry.

During the 1st Philippine Economic Complexity Briefing, Yu et al. (2024) presented the multidimensional economic complexity index (M-ECI) which identifies sectors that the Philippines should develop to improve its economic complexity. However, the results were only at the national level. There is a need to determine which regions should specialize in

the sectors previously identified to ensure efficient allocation of the government's limited resources. Thus, this study has identified regions that will develop the industries analyzed in the previous study. More specifically, this study identifies the needs of the industry in terms of training and skills (Priority Area#19) and the involvement and investment of industry in training (Priority Area#20).²

Economic Complexity and Human Capital

Developing the human capital of a country is necessary to achieve economic growth. Among ASEAN economies, it was found that spending on education has a significant positive contribution to economic development (Che Sulaiman, Saputra, and Muhammad 2021). Economies must invest in human capital to attract foreign direct investment (FDI) that can ultimately drive growth. However, it is not always the case that FDIs have positive effects on their destination economy. Countries with higher economic complexity experience gains from FDI inflows, while countries with very low levels of economic complexity can experience adverse effects (Ranjbar and Rassekh 2022). In China, it was found that economic complexity can attract FDI in the short run; in the long run, economic complexity and FDI was observed to have a bidirectional relationship such that higher economic complexity attracts FDI, and FDI can in turn increase economic complexity (H. Khan, U. Khan, and M.A. Khan 2020).

Economic complexity strengthens an economy's resilience against financial crises (El Khattab et al. 2022). This is in line with findings that Asian countries with economic complexity are more effective in reducing output volatility compared to African countries, as Asia produces more complex and diverse products (Breitenbach, Chisadza, and Clance 2022).

There is evidence that building on productive capabilities can lead to higher relative prices for exports in the short run, but this will have a less significant effect in the long run as productive capabilities are built into the economy (Daude, Nagengast, and Pera 2015). Better production capabilities will lead to more productive opportunities that will then yield higher returns to the country in the long run. Human capital and economic complexity, individually and jointly, contribute positively to economic growth (Zhu and Li 2017).

² Any views, statements, or analyses expressed in this paper are those of the authors and should not be attributed to those of EDCOM II.

Ultimately, economic complexity affects labor market outcomes such that economies with higher levels of complexity have lower levels of unemployment (Adams et al. 2023). Although shifting towards more sophisticated production capabilities will render some industries obsolete, this will lead to higher returns and opportunities. Thus, upskilling and retooling are imperative measures that firms should implement, while lifelong learning should be instilled early on to ensure the adaptability of the workforce to technological changes.

Data

The 2018 Census of Philippine Business and Industry (CPBI) was used to analyze the key sector performance in four identified regions. This study focuses on the poorest regions, namely Region V for Luzon, Region VIII for Visayas, and Caraga Region and the Bangsamoro Autonomous Region of Muslim Mindanao (BARMM). Key informant interviews were conducted with representatives of academe, industry, and government agencies.

Priority Sectors at the National Level

Using the multidimensional economic complexity index (M-ECI) by Yu et al. (2024), this study focuses on the sectors relating to egg production in Region V, chicken and potential egg production in Region VIII, the semiconductor industry in the Caraga Region, and the rubber industry in the BARMM. The M-ECI accounts for a sector's contribution to the economy, multiplier effect, product complexity, employment (in terms of compensation and number of jobs created), gender equality, food security, and environmental impact. The multidimensional aspects of the M-ECI allows the index to account for various components that are necessary to sustain economic livelihoods. A typical economic complexity study will die for food security contributions, and is unlikely to include agricultural sectors that are deemed of low economic complexity. However, it is important that the Philippines is able sustain itself in food production given its large population. Therefore, an analysis of agricultural sectors is a key contribution of the study.

Sector Profiles

Region V – Chicken, Egg Production, and Other Related Sectors

Region V, also known as the Bicol Region, is composed of 6 provinces, namely Albay, Camarines Norte, Camarines Sur, Catanduanes, Masbate, and Sorsogon. The Bicol Region is located in the southeastern part of Luzon. The poverty incidence among the population for the first semester of 2023 was 32.9 percent (PSA RSSO V 2024). The region's top agricultural produce are coconut,

palay, corn, and abaca. However, there is much potential in its chicken and egg production, and other related industries such as slaughtering, meat packing, and animal feeds. With corn as a major input for animal feeds, there is much potential in developing and expanding this industry. Table 1 shows sector statistics gathered from the 2018 CPBI. Among the four sectors identified, the animal feeds sector has the largest revenue and employs the largest number of employees. The average number of respondents were four firms, indicating the relative size of these industries in the region.

TABLE 1. REGION V SECTOR STATISTICS

SECTOR	CHICKEN	EGG PRODUCTION	SLAUGHTERING AND MEAT PACKING	ANIMAL FEEDS
Number of Firms	4	5	4	4
Total Revenue in Php	67,289,135.00	157,460,118.00	131,279,841.00	673,067,539.00
Total Expense in Php	41,496,980.00	140,495,202.00	117,805,185.00	641,742,073.00
Compensation for direct labor in Php	9,067,107.00	12,298,702.00	24,158,237.00	50,026,572.00
Number of Male Employees	68	201	251	427
Number of Female Employees	8	82	201	53
Total Number of Employees	76	283	452	480

Source: Philippine Statistics Authority (2021).

Although these sectors were identified due to their potential to raise the multidimensional economic complexity profile of the region, it is also important to investigate the capability of the region to expand and develop these sectors.

Region VIII – Chicken and Egg Production

Region VIII, also known as Eastern Visayas, is composed of six provinces namely, Biliran, Eastern Samar, Leyte, Northern Samar, and Southern Leyte. The poverty incidence in Eastern Visayas as of 2021 is 28.9 percent (NEDA Region VIII 2022). Based on the 2023 First Semester Official Poverty Statistics, poverty incidence in Eastern Visayas has declined to 26.1 percent (PSA 2023). Eastern Visayas has suffered through the strongest typhoons, acting as ground zero to Typhoon Yolanda in 2013.

In the agricultural sector, the region's top produce are coconut and rice. With that said, there is much potential in their chicken sector. Table 2 presents the total revenue and total expense for the six firm respondents of the 2018 CPBI in Region VIII. Comparing this with Table 1, the total revenue of the 6 firms in Region VIII is almost ten times the total revenue in Region V. This indicates a strong presence for the industry. However, it is very interesting to note that Region VIII has no commercial egg production. This was confirmed by anecdotes during the COVID-19 pandemic; when lockdowns and checkpoints were in place, trucks entering Region VIII were carrying eggs into the region as the residents claim they import their eggs.

TABLE 2. REGION VIII SECTOR STATISTICS

SECTOR	CHICKEN
Number of Firms	6
Total Revenue in PhP	673,001,028.00
Total Expense in PhP	295,664,283.00
Compensation for direct labor in PhP	28,085,230.00
Number of Male Employees	241
Number of Female Employees	54
Total Number of Employees	295

Source: Philippine Statistics Authority (2021).

Developing the egg production industry of the region can contribute to solving the high prevalence of stunted growth, which can then lead to low educational performance and other harmful consequences (Meniano 2022).

Caraga Region – Semiconductor Industry

The Caraga region is composed of five provinces: Agusan del Norte, Agusan del Sur, Dinagat Islands, Surigao del Norte, and Surigao del Sur. While the region is known for its beaches, Caraga is also known as the mining capital of the Philippines. Table 3 presents the sector profile for nickel ore in the Caraga region based on the 2018 CPBI. Although its mineral production reached 60 billion pesos for the first three quarters of 2023 (MGB 2024), the region remains to be one of the poorest in the country. The most recent statistics show that 20.8 percent of Caraga Region remain poor as of the first semester of 2023, which was an improvement from 31 percent in 2021.

TABLE 3. CARAGA REGION SECTOR STATISTICS

SECTOR	NICKEL ORE
Number of Firms	15
Total Revenue in PhP	27,406,993,714.00
Total Expense in PhP	20,566,297,632.00
Compensation for direct labor in PhP	2,379,696,712.00
Number of Male Employees	4,404
Number of Female Employees	653
Total Number of Employees	5,057

Most of the nickel produced in the Philippines is exported in raw form. There is a need to process the nickel ores into nickel concentrates to increase their value. The high cost of investment and electricity is the major barrier to building such facilities. However, Global Ferronickel Inc. is already undertaking negotiations to build a USD 1 billion nickel processing plant in the region (Bloomberg News 2023). Looking further into the value chain, nickel is a vital input in producing batteries and semiconductors. In line with the shift towards greener technologies, the region can secure its place as a hub for more complex and higher-value production.

BARMM – Rubber Industry

The Bangsamoro Autonomous Region of Muslim Mindanao is composed of five provinces (Basilan, Lanao del Sur, Maguindanao, Sulu, and Tawi-Tawi), and one city (Cotabato City). The region has come a long way from its conflict-ridden history. However, it remains as the region with the highest poverty incidence with 34.9 percent of families living below its poverty threshold (PSA RSSO V 2024). Using data from the Observatory of Economic Complexity (2024), rubber is identified as the product with the second highest opportunity gain index in the Philippines. This means that even if rubber has low economic complexity, it can open opportunities for the country to produce more complex products. Rubber is a raw material for more complex products such as tires, balls, and footwear among others. Instead of importing more complex products, the country can move up the value chain and create more jobs for its citizens. Table 4 presents the sector statistics for the rubber industry in BARMM. It should be noted that the total expense of the four firms included in

the 2018 CPBI exceeds the total revenue generated. Thus, the rubber industry in BARMM is operating at a loss. This is a serious problem that needs to be addressed.

TABLE 4. BARMM SECTOR STATISTICS

SECTOR	RUBBER
Number of Firms	4
Total Revenue in PhP	67,692,916.00
Total Expense in PhP	82,757,312.00
Compensation for direct labor in PhP	25,346,963.00
Number of Male Employees	336
Number of Female Employees	28
Total Number of Employees	364

Source: Philippine Statistics Authority (2021).

98 percent of the country's rubber production comes from Mindanao (DTI 2023). While all other Southeast Asian producers of rubber are experiencing growth in the production of natural rubber, the Philippines experienced a decline of 20.9 percent in 2022.

Academe-Industry Linkages: Opportunities and Challenges

To develop the sectors identified in the previous section, there is a need for training to ensure production efficiency. Academic programs in colleges and universities should be designed to equip the workforce with the necessary skills to address the needs of industry. Thus, it is imperative for the academe and industry to work with each other to achieve optimal outcomes for the economy. Government plays an important role in encouraging academe-industry linkages by providing initial support and incentives that may lead to long-term partnerships.

Region V and Region VIII (Chicken, Egg Production, and Other Related Sectors)

There is a limited number of veterinary programs offered by higher education institutions in Region V and Region VIII. The entire Bicol region only has two veterinary programs, which are offered by the Central Bicol State University College of Veterinary Medicine, and the Bicol University College of Veterinary Medicine. The Bicol University College of Veterinary Medicine was only established on December 20, 2023, through the adoption of R.A. 11973. Furthermore, there are only 20 veterinarians based in Albay (Serrano 2021).

Region VIII also has a dearth of veterinary programs that can support the industry. Region VIII only has two veterinary medicine programs offered by Visayas State University, and the University of Eastern Philippines.

In addition to these programs, the Technical Education and Skills Development Authority (TESDA) also offers the Animal Production (Poultry-Chicken) NC II program to prepare the workforce. The Animal Production (Poultry-Chicken) NC II program was last updated in 2013. With the advancements in technology, there is a need to revisit the course to ensure applicability to the private sector.

The private sector also organizes different trainings and activities that promote the industry. The Philippine College of Poultry Practitioners (PCPP) offers training programs that teach state-of-the-art techniques to improve production. The Philippine Veterinary Drug and Nutrition Association actively conducts workshops in collaboration with the Food and Agriculture Organization of the United Nations (FAO), and the Bureau of Animal Industry (BAI). However, such trainings are conducted in Manila, which may not be as accessible to businesses in the regions. Offshore programs can also be developed to address the growing needs of the industry.

Currently, there are no locally manufactured animal pharmaceutical products such as vaccines for animals. With the large-scale requirements needed for such production, academic programs can be integrated with research programs to produce the needs of the industry. Revenue from production can be used for scholarships and further research and innovation. These can be lodged with the Virology and Vaccine Institute of the Philippines, once Senate Bill No. 941 is signed into law. It can also be supplemented by the pending Livestock, Poultry, and Dairy (LPD) Industry Development and Competitiveness Act.

Caraga Region – Semiconductor Industry

There is an opportunity for the Caraga region to flourish by expanding their horizons. Beyond the production of raw materials, there is a need to develop the industries along the value chain to maximize the returns to their community. The Caraga State University (CSU) offers academic programs in mining engineering and electronic engineering. Strong industry partnerships are made through their active participation at the Semiconductor and Electronics Industries in the Philippines Inc. (SEIPI). The relationship between the faculty and the industry is important as industry should be able to integrate their future needs into the curriculum of academic programs.

Based on the industry interviews, firms train for an additional six months their recently graduated new hires before they are considered ready to perform tasks. With a closer relationship between academe and industry, this additional training period may be reduced or avoided altogether, thereby saving resources for the industry while simultaneously boosting the profile of the academic program. With the constant technological advancements within the semiconductor industry, there is a need for faculty members to upgrade their knowledge as well. This can be done through faculty internships and co-mentoring arrangements during student internships, ensuring that the curriculum remains up to date. Furthermore, there are not enough graduates to support the requirements of the industry. Thus, there is a need to motivate students to take up programs that will cater to the industry.

TESDA, in partnership with SEIPI, developed the Semiconductor Front-of-Line (FOL) Operations NCII, and Semiconductor Back-end Operations NCII programs in 2013. However, these programs are only available in Luzon and Visayas. Opportunities to develop more training programs can be made once facilities are acquired through the assistance of the US CHIPS Act.

BARMM – Rubber Industry

The BARMM produces 16 percent of the total natural rubber production of the Philippines. However, flagship academic programs and facilities are mostly located in universities outside the region. Nevertheless, the relative proximity of the BARMM to the Philippine Rubber Research Institute (PRRI) increases the level of assistance that the farmers receive, allowing them to be trained on proper techniques and care for rubber trees.

The Comprehensive Agrarian Reform Law of 1988, more commonly referred to as CARP, has proven to bring more harm than good to farmers. Section 2 of the law states that:

a more equitable distribution and ownership of land, with due regard to the rights of landowners to just compensation and the ecological needs of the nation, shall be undertaken to provide farmers and farmworkers with the opportunity to enhance their dignity and improve the quality of their lives through greater productivity of agricultural lands.

However, limitations to land ownership size brought about the loss of economies of scale. Furthermore, CARP assumes that farmers have the business acumen and entrepreneurial interest needed to manage a farm, which is not the case (Fabella 2017). Key informant interviewees attribute the failure of the rubber industry to expand in the Philippines to CARP and lack of entrepreneurial interest from farmers.

TESDA also has a rubber production NCII program that was recently updated. Some training requires farm immersion. These are strongly recommended to be integrated into academic programs and even other TESDA programs to ensure readiness of graduates. However, the industries relating to the downstream products of the rubber industry are mostly located in Luzon.

Collaborating with academic institutions to develop products for commercialization can also be pursued. For example, rubberized asphalt that can be used for roads. This can be used for government projects and create revenue for our farmers at the same time. Based on the interviews conducted, the peace and order situation remains a major concern for investors. As such, the government—through development banks—can provide loans to local firms to develop the downstream industry. This can be a pilot project once the legislation on the Philippine Rubber Industry Development Act of 2022 is signed into law.

Conclusion

This study identifies the needs of the industry in terms of training and skills (Priority Area#19) and the involvement and investment of industry in training (Priority Area#20) for the selected sectors and regions. It highlights the importance of establishing academic programs attuned to the needs of the industry. In some regions, there is a need to develop more programs, or at least expand by offering offshore programs.

Mindset is another important factor for success. While the study focuses on higher education and the needs of the industry, it should be noted that mindset can be slowly cultivated over time by integrating values into basic education. There is a need to develop career guides that can inform the Filipino youth and their families on potential opportunities and how to achieve them through the right education programs. Through these career guides, positive role models can inspire the Filipino youth and encourage them to aspire and achieve more in the future.

It is also important to identify gaps in the value chain, and develop the ability of the identified industries to address the gaps so they may strengthen the value chain and create more employment opportunities for Filipinos. For example, in the poultry and livestock value chain, there are no locally manufactured animal pharmaceutical products that are necessary to sustain the food security of the country. In the rubber industry, the development of downstream products such as rubberized asphalt can increase the profits of rubber producers and simultaneously support the infrastructure programs of the country. There is a need for a tri-bundle of interventions in the form of training, financing

and market access to succeed in closing the gaps in the value chain from smallholders to the firms (Balaoing-Pelkmans, 2024).

Academe-industry linkage is imperative to achieve efficient economic outcomes. When market forces are unable to promote academe-industry linkage organically, government interventions should be in place to initialize and encourage cooperation. Possible interventions include supporting research and development that require significant investments, such as animal pharmaceutical research facilities, wafer fabrication plant and nickel processing plants, and commercialization of products such as rubberized asphalt and veterinary pharmaceuticals. This will ensure the employability of graduates and a more productive Filipino workforce, which will ultimately raise the welfare of the country.

Biographical note

Krista Danielle Yu, Ph.D. is a Full Professor of Economics at the De La Salle University. She was recognized by Thomson Reuters as the Philippines' Promising Star in Economics, and by the National Academy of Science and Technology as an Outstanding Young Scientist. She advocates that economic education should start at an early age with her book, "Economics for Babies". She convened the 1st Philippine Economic Complexity Briefing on the Tatak Pinoy Act in May 2024.

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