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## Chemistry and Philippine Economic Progress

William J. Schmitt

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# Chemistry and Philippine Economic Progress\*

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WILLIAM J. SCHMITT

**T**HE Philippine economy is predominantly agricultural. Despite the advances that will continually be made by the manufacturing industries, agriculture will remain the foundation of our economy for an indefinite period. World-wide experience has shown that such an economy cannot be stable and prosperous and may even fail altogether if it is not fed and encouraged by creative chemical research and the various chemical industries.

It is the purpose of this article to show that chemistry not only can help our economy but that it is in a unique position in this regard; it can provide an economic stimulation available from no other source.<sup>1</sup>

## TWO WAYS

There are two ways in which chemistry can assist agriculture. First, it can help in the actual production of the crop. We are all familiar with the fact that fertilizers are almost a necessity for successful farming today. Pesticides are also well established for certain crops. The use of herbicides is now

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\* The second of a series of articles on chemical research in the Philippines.—*Editor*

<sup>1</sup> Although the emphasis in this article is on chemistry and the chemical industries, this should not be understood as a denial of the importance of other industries and professions in furthering our economic progress. It is merely an attempt to emphasize a neglected factor.

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Mf Arzpo [con rúbrica]  
(Sello)

Por mandado de S.E.I.  
el Arzobispo mi Señor  
Tomas G. Feijoo, Srio.  
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Dadas en el Palacio Episcopal de Vigan, firmadas de Nos, selladas con el de este Provisorato y Vicaria General y refrendadas por el infrascrito Secretario de Camara y Gobierno de esta Diocesis a trece de Diciembre de mil ochocientos ochenta y nueve.

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Por mandado de S.I.

Eduardo Probanza

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very common in some countries. All of these had their origin in the test tube and some are now produced in ton quantities in the Philippines. The need for expansion here is obvious.<sup>2</sup>

Most of us are less familiar with the second way that chemistry can help agriculture, viz. by providing a steady market for the crop and its by-products. It is here that the Philippine economy stands in greatest need and it is here that chemistry produces its most spectacular results. A clear example of this is seen in the Quaker Oats Company. For years they supplied the American public with breakfast cereals both hot and cold. It may seem strange, but a large part of their profits today comes from their allied chemical industries. Their research chemists showed them how to take the thousands of tons of oat hulls and similar agricultural wastes and obtain from them by a simple chemical process a liquid called furfural. This chemical has since been used in tank car quantities for petroleum refining, in the synthesis of fungicides and plastics, as the starting material for nylon, and in a whole host of other applications. Now it may truly be said that the Quaker Oats breakfast foods are the by-products of the chemical industry. A similar example is had in the copper refining business. Some years ago operation costs were rising and they feared that the product would have to be priced so high that the bottom would fall out of the market. Chemical research revealed that the anode mud, a slimy by-product of the electrolysis refining process, was a literal gold mine. Instead of throwing out the mud it was processed chemically and the income from the recovered gold, silver and platinum was sufficient to make the difference between operating at a loss and making a profit.<sup>3</sup>

#### DIVERSIFICATION

These two examples illustrate what economists mean by "diversification," a term they are very fond of using. It is nothing more than a turning away from the old put-all-your-

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<sup>2</sup> Another need in this connection is lower prices. Fertilizer produced at the Maria Cristina plant is the most expensive fertilizer in the world.

<sup>3</sup> *Fortune* 14 (Dec. 1936) 86.

eggs-in-one-basket type of economy. The need for diversification and its advantages for the Philippines was clearly stated by Cornelio Balmaceda, economic expert and former secretary of commerce and industry:

An economy that is so sensitive to the vagaries of foreign markets and mainly dependent on a few export crops and raw materials can not be stable and safe, and hence the need for more diversified production and industrialization.<sup>4</sup>

Our late President Magsaysay incorporated these ideas into his program for Philippine progress. In his last state of the nation address he said:

Our primary economic goal has been to strengthen and broaden the base of our economic activities. For unless a greater number of our people are engaged in productive enterprises sufficiently diversified to supply our basic necessities, increase the opportunities for employment, and raise the income of our workers, our economic structure will be weak and lopsided. . . We must foster an economy in which industrial expansion and agricultural progress are complementary. Industry can draw its raw materials from agriculture; in turn, as our farmers increase their income, the products of industry will have an expanding domestic market. In this way, there will be formed a partnership of enduring strength and a sound pattern for unlimited growth.<sup>5</sup>

The same ideas are found in the Bell Report of the United States Economic Survey Mission to the Philippines in 1950.

Since the devastation of war and enemy occupation, the Philippines has not only made a heartening recovery but it also has made progress in diversification. In the past few years many new industries have been established. These now produce materials hitherto imported and thus both save foreign exchange dollars and provide jobs for many. Figure 1 shows the important share the chemical industries of the Philippines have had in this diversification. The Caltex Refinery in Batangas can supply more than a third of our yearly requirement of 582 million gallons of gasoline, kerosene, diesel and fuel oils. Another refinery, built by Standard Vacuum Oil Company, is expected, when completed, to result in an annual

<sup>4</sup> *Progress* '56. "The Changing Pattern of Philippine Foreign Trade" p. 170 (published by *Manila Times*).

<sup>5</sup> *Manila Daily Bulletin* (Tues. 29 Jan. 1957) 4.

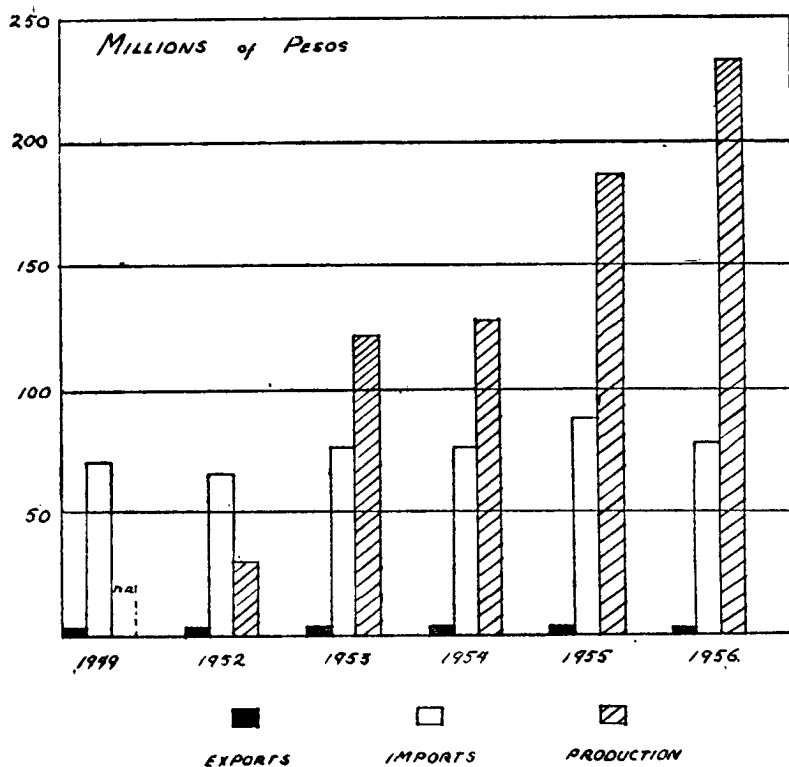
*PHILIPPINE CHEMICALS*

Fig. 1

dollar saving of \$4,110,000 and to give employment to 600 Filipinos.<sup>6</sup> Fertilizer production, which was nonexistent until 1953, reached over thirty thousand metric tons in 1955. Table I lists other chemicals produced in significant amounts in this country. A large part of our chemical industries are foreign subsidiaries. The most commonly recognized are the pharmaceutical plants, tire companies and soap manufacturers. The production of cement, glass, paper, textiles, paint, plywood and many other items also rely on chemical reactions.

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PRODUCTION OF SELECTED CHEMICALS

<i>Item</i>	1955
Sulfuric Acid .....	24,312 metric tons
Sodium Hydroxide .....	1,969 "
Baking Powder .....	1,350 "
Ammonium Sulfate .....	30,801 "
Anhydrous Ammonia .....	9,028 "
Calcium Carbide .....	1,756 "
Bleaching Powder .....	786 "
Glycerine .....	3,343 "
Soap .....	63,469 "
Methyl Alcohol .....	25,884,718 liters

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T A B L E I

Although a good start has been made, there is need for much more. In fact, never will the day arrive when we can say "enough." Economists admit the need of a continually expanding economy with continual diversification. In very many cases this can be accomplished only with the aid of chemistry.

TWO ASPECTS

It will be helpful here to note briefly two aspects of chemistry. First of all there is *chemical research*. This consists in an examination of some product such as the coconut, or of some problems such as the abaca mosaic blight, or of some process such as the manufacture of paper from bagasse—looking at these things from a chemical point of view. What

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<sup>6</sup> *Manila Daily Bulletin* (1 August 1957).

## PRODUCTION IN THOUSANDS OF METRIC TONS

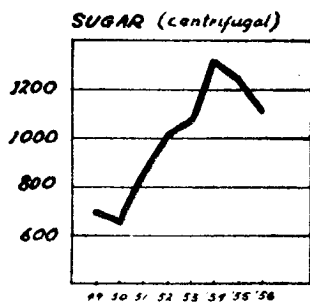
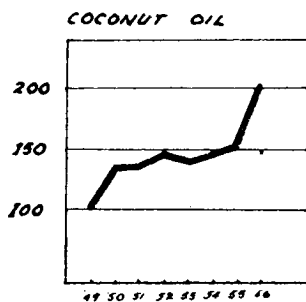
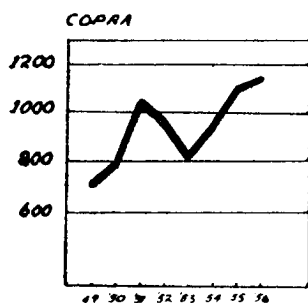


Fig. 2



compounds are present? How can they be purified? What can they be used for? What chemicals will control this disease? How can this process be improved? Answers to such questions as these are sought in chemical research.<sup>7</sup> Secondly, there is *industrial chemistry* or the application of chemical processes on a large scale. This application, of course, is entirely dependent on prior research in the laboratory. You cannot produce ten tons of plastic a day from sugar until you first have found in the laboratory a process that will start with sugar and end up with a plastic material. It should be pointed out here that the growth in the chemical industries after the war has been almost entirely based on chemical research accomplished in other countries.<sup>8</sup> Realizing, therefore, the connection between chemistry and our agricultural economy, and keeping in mind the distinction between chemical research and industrial chemistry, we will proceed to discuss our Philippine economy more in detail.

#### THE COCONUT INDUSTRY

The coconut is one of the most important items in our economy (Figure 2). It provides us with over 38% of our export dollars. But there is a great need for reorientation in the coconut industry. One-fifth of the exported copra and oil is used to make toilet soap and it is predicted that synthetic detergents will soon move into this field, thus wiping out part of the market. A vigorous program of research is needed to provide new applications for coconut products. For instance, it is already known from work done in other countries that coconut oil is a possible raw material for the chemical production of materials useful in the manufacture of plastics, detergents, lubricants, and others. Yet a study of the very valuable bibliography prepared at the Institute of Science and Tech-

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<sup>7</sup> Of course research in other branches of science is also needed, and some of this is being carried on now in the Philippines. But the strictly chemical approach, which has proved so successful in modern times, is seldom employed here.

<sup>8</sup> Applications for chemical patents during the past few years are almost nonexistent.

nology<sup>9</sup> shows how little *chemical* research on the coconut is being done in the Philippines. Stress is placed here on the need for *chemical* research because it is the chemist who traditionally plays the fundamental role in product diversification. With the coconut as the economic bulwark of the Philippines we should be outstanding in contributions to its chemistry. The results of research cannot be predicted but it is certain that there will be no results as long as the coconut is considered only as the lazy man's tree instead of a potential gold mine.

Another problem facing the coconut industry is the kadang-kadang blight. Despite the fact that chemistry is one of the most powerful weapons against disease today, the attack against this blight has been limited to biologists, plant pathologists, and others. Chemists are not represented.<sup>10</sup> Yet we cannot expect this research to be carried out in other countries, for it is not their problem. Only in the Philippines can there be that enthusiasm born of necessity that will motivate such an investigation.

#### THE SUGAR INDUSTRY

Thanks to man's sweet tooth, sugar provides us with our second largest export item. Figure 2 shows, however, the leveling off of sugar production. The producers are very fearful for the future. The United States has placed a quota limit on imports at preferred prices, and in addition, there will be a gradual imposition of tariff duty until 1974 when the Philippine product will have to compete on equal footing with sugar from other countries. It is useless to complain of higher costs of production or of the economic measures taken by the United States. We certainly cannot feel that they are obliged forever

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<sup>9</sup> *Classified List of References on Coconut (Cocos Nucifera) Available in the Scientific Library* compiled by Quintin A. Eala, Pilar C. Garcia and Benigna T. Aquino (Manila 1956-57).

<sup>10</sup> There is no attempt here to belittle the efforts already made. Nor should it be concluded that an attack from a biologist's point of view is not useful. It is merely sad to see that the most powerful gun is lying idle. If chemists have studied this disease, their work has not come to my notice despite a thorough literature search.

to pay us more for our sugar than they pay other producing countries, or that they buy more sugar from us than they can use.

What is needed is a vigorous program of sugar research aimed at lower production costs and increased market demand. Some progress in this has already been made. A certain amount of our Philippine bagasse is being used by the Compañía de Celulosa to make a high quality paper at the rate of ten million pounds a year. An increased market for bagasse would of course lower the production costs of sugar. Puerto Rico has partly solved the problem by opening a plant for the production of furfural from bagasse at the rate of thirty million pounds a year. The process is similar to that used by the Quaker Oats Company.

Chemists are also finding new uses for sugar itself. Since it is a very cheap organic chemical, it is a "natural" for test tube exploitation. There is talk of using sugar as the starting material in the production of detergents. Years of study sponsored by the Sugar Research Foundation of New York<sup>11</sup> have finally borne fruit. Their chemists have produced a plastic in which sugar can provide up to 50% of the starting material. These sucrose phenol-formaldehyde resins have useful properties and can be produced cheaply.<sup>12</sup> Another group plans early commercial production of new chemical intermediates for many diverse industries. One of the starting materials for this process can be sugar.<sup>13</sup> It is hoped that this heartening news will spur the sugar industry to invest more in chemical research. An increasing amount of it can and should be done in this country. Just as we have found that we cannot import our manufactured goods, so we cannot import all our chemical ideas and processes.

#### THE ABACA INDUSTRY

Another large export item is abaca. This industry of late has had anything but smooth sailing. The musaic disease is

<sup>11</sup> It is indeed fortunate that our sugar industry is a contributor to this Foundation.

<sup>12</sup> *Chemical and Engineering News* (25 March 1957) 27.

<sup>13</sup> *Chemical and Engineering News* (16 Sept. 1957) 84.

wiping out whole areas of production. Lack of enforced standards and grades, and increasing cost of production are causing great unrest. Still the demand is high. If a group of chemists were to face these problems they would probably make a three-pronged investigation seeking to combat the disease with chemotherapy, to stabilize production by introducing improved chemical processes, and to lower the cost of production by the utilization of waste products. If anyone thinks that abaca and chemistry have nothing in common, they might consider the experience of the corn industry. We do not usually connect corn with chemistry yet the application of chemical processes to corn utilization has resulted in an industry whose products are worth over P888 million a year and which employs almost 12,000 men and women in the United States. The products are mainly starch, dextrose, corn syrup, dextrin, animal feeds, cooking oil, soap stock, synthetic fiber and growth medium used in the production of penicillin.

#### TIMBER

Our vast timber reserves, besides providing materials for direct export, for conversion to lumber and for plywood manufacture, could form the basis for a chemical industry. By processes already known, paper, plastics, rayon and torula yeast for animal and poultry feed could be produced. These are interdependent in such a way that fluctuations in the market for one product can be offset by increased production of the others. Atlas Powder Company, whose sole interest at one time was TNT, now uses such farm products as sugar, corn, vegetable oils, and wood as starting materials for its chemical industries. They rightly reason that a surplus of such raw materials should not be looked on as a curse but as a blessing. It is only man's timidity and lack of ingenuity and planning that forestalls his gratitude at the bountiful harvest.<sup>14</sup>

#### RAW MATERIALS

It is no exaggeration to say that the Philippines is a treasure chest of raw materials. But it has remained shut for so many years and the key of chemistry has gone unused. It

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<sup>14</sup> *Chemical and Engineering News* (22 Feb. 1954) 708.

is safe to say that we really do not know what our raw material potential is, for our Philippine products are seldom looked at from a chemist's point of view. A few years ago no one had even heard of tranquillizing drugs. Some uneducated people in India knew that a certain plant would yield an extract that was said to cure snake bite. Somehow or other a group of chemists became interested in that plant, called *Rauwolfia serpentina*. One of the alkaloids they obtained, Reserpine, became the focal point of world-wide attention and marked man's entrance into the field of chemotherapy of mental diseases. How many Philippine plants have been looked at chemically? God has blessed our country with a great variety of natural products, but He expects us to use our abilities in exploiting them.<sup>15</sup> Even the products we think we know all about would bear chemical examination. Even something as "useless" as pineapple stumps have their value. Dole Hawaiian Pineapple Company is producing a new proteolytic enzyme, Bromelain, from this waste product of its plantations.<sup>16</sup>

Thus, our agricultural enterprises have much to gain from the coming of chemical industries and investment in chemical research. Chemistry can help increase farm production, can increase demand for crops or create entirely new demands. This diversification is no idle dream. It is not something that "might" work—it has already proved itself in so many cases, even in small countries<sup>17</sup> much poorer in raw materials than the Philippines.

The big question of course is: Who will see to the expansion of the chemical industries and to the wider use of chemical research in the Philippines? Most agree that private enterprise and initiative should be the major motive force in the

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<sup>15</sup> A. T. Suaco and Co. have a drug plantation in Mindanao and are investigating local herbs. This is a fine beginning, but real progress demands that chemistry aid their pharmaceutical efforts.

<sup>16</sup> *Chemical and Engineering News* (23 Sept. 1957) 83.

<sup>17</sup> The International Department of *Chemical and Engineering News* frequently gives comprehensive reports on the chemical industries of the various countries both large and small. Among the good number of small countries reported in the past few years are Iceland (24 Jan. 1955. p. 326) and Israel (10 Oct. 1955 p. 4316).

development of industries, chemical or otherwise. At the same time the government can help by providing a favorable climate for this type of investment. Many hopes were raised at the beginning of 1957 when the National Economic Council adopted a Five Year Economic and Social Development Program which calls for cooperation between government and private enterprise in an undertaking which will do much for economic diversification and stability. In this plan the importance of the chemical industries can be seen from the fact that their share amounts to ₱139 million. It would be very sad if this were lost in the no-man's land of a political battlefield.

#### LOW EBB OF RESEARCH

The low ebb of scientific research in the Philippines is clear from three independent reports in the past few years.<sup>18</sup> And among the sciences in the Philippines, chemistry is the most neglected. Yet, as we have seen, chemistry is best able to solve our most pressing problem—economic stability. The responsibility for chemical research lies with our universities and colleges<sup>19</sup> and with the various industrial enterprises.<sup>20</sup>

#### SUMMARY

By way of summary it will be helpful to quote Mr. Gunnar Myrdal, executive secretary of the United Nations Economic Commission for Europe. Our late President Magsaysay quoted these very words to the members of the Business Writers Association of the Philippines on 7 February 1957:

<sup>18</sup> (a) "Scientific Research and Philippine Progress" by Miguel Ma. Varela, *PHILIPPINE STUDIES* II (Dec. 1954) 360. (b) "Research in the Philippines" by Rudolf Rahmann and Heinrich Schoening, *World Mission* 7 (Spring 1956) 80. (c) Report of Dr. Frank Co Tui to President Carlos P. Garcia (21 April 1957).

<sup>19</sup> Some of the obstacles to research in our colleges are discussed with special reference to chemistry in "The Undergraduate Training of the Professional Chemist in the Philippines" by Miguel Ma. Varela and William J. Schmitt, *PHILIPPINE STUDIES* V (June 1957) 172-3.

<sup>20</sup> The very weak position of research in our industrial enterprises may be seen in *Industrial Research and Development in the Philippines* by R. Norris Shreve, Raymond H. Ewell and Thomas W. Alder prepared for the National Economic Council of the International Cooperation Administration, 1956.

Industrial expansion without agricultural reorganization will leave the bulk of the people in a state of poverty... In other words, we can plan against mass poverty only if we set out to create the conditions of a rapidly expanding and efficient economy *both in agriculture and industry.*

The added emphasis is mine. The importance of chemistry lies precisely in this, that not only will industry profit or the overall economy of the country improve, but the lot of the ordinary farmer, the backbone of our nation, will improve. Chemistry can make his work in the fields easier and more fruitful.

More advanced nations are seeking to conquer the space around us with their Sputniks and rockets. Our aim in the Philippines can not be to conquer outside territories. We must conquer the basic things, the rice, the coconut, sugar and our vast timber lands. We must make these serve us rather than be a slave to them. Chemistry provides a unique key to open the treasurehouses of our own agricultural resources which God, in his Providence, has given us.

To allow space for the publication of the documents on pages 201-209, the usual NOTES AND COMMENT section is omitted from this issue.