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Pacioli, Popes, and the Bottom Billion: A Timeless Perspective on Economic Development

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Cover Page Footnote

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INTRODUCTION

In 1494 Luca Pacioli, a Franciscan Friar, published *Summa de Arithmetica Geometria Proportioni et Proportionalita (The Summa)*. Simply put, *The Summa* was an early business textbook comprised of five sections; four of mathematics and one of bookkeeping (or accounting). The widely translated accounting section was a practical description of the Venetian (or double entry) accounting system. *The Summa* and double entry accounting systems have been credited with a significant role in the rise of market (or capitalistic) economies and the economic development of western business practice and growth.¹

Many contemporary societies are still struggling with economic development, and a significant proportion of their populations often live in extreme poverty. According to the United Nations development in the world's poorest economies will not reach UN targets until at least a decade after the original projections, if at all. Furthermore, after nearly a decade of decline the number of people suffering from hunger rose between 2016 and 2017.²

While there is a consensus that nations with developed economies should assist developing economies,³ the appropriate methods of doing so are debated. Following World War II, a post-colonial aid system developed and was again modified following the Cold War. The disappointing results of this roughly 60-year period of foreign aid sparked debate (mostly) over methods rather than objectives. In the early 2000s the debate was characterized via the contrasting books of Sachs⁴ and Easterly.⁵ Sachs called for a "Big Push" (from Planners, a

¹ See Werner Sombart, 1902. *Der Moderne Kapitalismus*. Munich and Leipzig: Dunker and Humblot; Basil S. Yamey, 1964. "Accounting and the rise of Capitalism: Further notes on a Theme by Sombart." *Journal of Accounting Research*. 2 (Autumn): 117-136; Kenneth S. Most, 1972. "Sombart's Propositions Revisited." *The Accounting Review*. 47 (4): 722-734.; and most recently Tim Harford, 2017. "Is this the most influential work in the history of capitalism?" *BBC News*. October 23, 2017.

² United Nations, 2019. "Sustainable Development Goals Report." *Department of Economic and Social Affairs, Statistics Division*. Retrieved from <https://unstats.un.org/sdgs/report/2019/>

³ Ibid.

⁴ Jeffrey Sachs, 2005. *The End of Poverty*. New York: Penguin Group.

⁵ William Easterly, 2006. *The White Man's Burden*. London: Penguin Books Ltd.

macro approach) while Easterly called a Searchers rather than Planners (or a more micro) approach. Others call for market based or “Trade not Aid” solutions.⁶

The paper suggests a meaningful contribution to an economic development solution may be found in the 500-year-old work of Luca Pacioli. Key problems faced by the developing merchant class in 16th century Italy such as inefficient use of economic capital and unrealized human capital are surprisingly similar to those of contemporary developing economies. Pacioli’s solution focused largely on developing human capital through business education.

This paper extends research on *The Summa* by considering the role of the mathematical content in conjunction with the accounting content. Further, this paper applies the lesson of *The Summa* to emerging economies rather than developed economies. Finally, Pacioli’s work integrates well with various economic development theories especially those proposed by Catholic Social Teaching via Papal Encyclicals published 400-500 years after *The Summa*.

The remainder of this paper is organized as follows. The first section outlines *The Summa* and presents related business literature. The second section provides a brief background and discussion of Foreign Aid and the Aid Debate. The third section offers a concise view of Luca Pacioli and his times with a focus on understanding Pacioli’s role in business and economic development. The fourth section presents specific content from *The Summa* and lessons in *The Summa* that are readily related to the Aid Debate and a solution strategy. The fifth section links concepts of Pacioli’s *Summa* to Papal Encyclicals of the last 125 years. The final section discusses and summarizes a solution based in *The Summa*.

PACIOLI AND *THE SUMMA*

Luca Pacioli, often called “The Father of accounting,” had been teaching for approximately three decades when he published *The Summa* in 1494. *The Summa* was a comprehensive business text or reference book. It was republished in 1504 in Tuscany and titled *LaScula Perfetta dei Merchanti*, “The Perfect School of Merchants.”⁷ Both versions contain five sections described by Taylor⁸ as “(1) arithmetic and algebra; (2) their use in trade reckoning; (3) bookkeeping; (4) money and exchange; (5) pure and especially applied geometry.”

The Summa’s third or bookkeeping section has received the most attention over the centuries and has been translated multiple times. This section advocated

⁶ For example, see Arielle John and Virgil Henry Storr, 2009. “Can the west help the rest? A review essay of Sach’s *The End of Poverty* and Easterly’s *The White Man’s Burden*.” *The Journal of Private Enterprise*. 25 (1): 125-140.

⁷ R. Emmett Taylor, 1942. *No Royal Road: Luca Pacioli and His Times*. Chapel Hill, NC: The University of North Carolina Press.

⁸ *Ibid* at 195.

and popularized the use of Venetian, or double entry accounting; a framework for business operations accounting that has endured essentially unchanged for 500 years. Double entry accounting systems have historically⁹ and recently¹⁰ been credited as a significant factor in the rise of market based economic development and western business practice.

The Summa's third chapter has been translated by Geijsbeck,¹¹ Brown and Johnson,¹² and most recently by Cripps.¹³ These translations have inspired a line of literature in accounting and business providing insights into modern business operational and social practices. Fischer¹⁴ discusses Pacioli's perspective on profits suggesting that Pacioli considered profits to be the purpose of business and essential to the business' ethical considerations. Fischer¹⁵ noted Pacioli's belief in business profit being legal and reasonable and requiring ethical business practices. Sy¹⁶ and McCarthy et al¹⁷ examined the social and humanistic sides of Pacioli and *The Summa*. Sangster et al¹⁸ and Sangster and Scataglinibelghitar¹⁹ discussed Pacioli's as an educator and also recognized the (social) lessons of *The Summa* beyond the technique of double entry accounting, control and profit calculation. Most recently, Coate and Mitschow²⁰ argued that in *The Summa* Pacioli recognized and taught an

⁹ See Werner Sombart, 1902. *Der Moderne Kapitalismus*. Munich and Leipzig: Dunker and Humbolt; Basil S. Yamey, 1964. "Accounting and the rise of Capitalism: Further notes on a Theme by Sombart." *Journal of Accounting Research*. 2 (Autumn): 117-136; Kenneth S. Most, 1972. "Sombart's Propositions Revisited." *The Accounting Review*. 47 (4): 722-734

¹⁰ Tim Harford, 2017. "Is this the most influential work in the history of capitalism?" *BBC News*. October 23, 2017.

¹¹ John Geijsbeck, 1914. *Ancient Double Entry Bookkeeping* (1974 reprint). Houston: Scholars Book Company.

¹² R. Gene Brown and Kenneth S. Johnson. 1963. *Pacioli on Accounting*, McGraw Hill Book Company Inc., New York.

¹³ Jeremy Cripps, 1995. *Particularis de Computis et Scripturis: A Contemporary Interpretation* (Seattle, WA: The Pacioli Society).

¹⁴ Michael Fischer. 2000. "Luca Pacioli on Business Profits." *Journal of Business Ethics* 25: 299-312.

¹⁵ Ibid.

¹⁶ Aida Sy, 2005. "Resurrecting the Social Pacioli: Ethics, Gender and Other Silences." *International Journal Accounting, Auditing and Performance Evaluation*. 2 (4): 441-449.

¹⁷ Patricia McCarthy., Alan Sangster, and Greg Stoner, 2007. "Pacioli and Humanism Pitching the Text in Summa Arithmetica." *19th Accounting Business & Financial History Conference*. September, 2007.

¹⁸ Alan Sangster, Gregory N. Stoner, and Patricia A. McCarthy. 2007. "Lessons for the Classroom from Luca Pacioli." *Issues in Accounting Education*. 22 (3): 447-457.

¹⁹ Alan Sangster and Giovanna Scataglinibelghitar, 2010. "Luca Pacioli: the Father of Accounting Education." *Accounting Education an International Journal*. 19 (4): 423-438.

²⁰ Charles Coate. and Mark Mitschow, 2018. "Luca Pacioli and the Role of Accounting and Business: Early Lessons in Social Responsibility." *Research on Professional Responsibility and Ethics in Accounting* 21: 1-16.

important role for business and business persons in providing positive outcomes for society based on profitable businesses, proper operations and ethical practices.

The above literature is largely applied to the contemporary developed economies and businesses. A significant contribution of this paper is to apply lessons, especially the mathematical lessons, of *The Summa* to emerging economies and Foreign Aid a context more consistent with Pacioli's original purpose.

FOREGIN AID: HISTORY AND DEBATE

History

This section discusses foreign aid in a long-term context where aid is provided with the intention of improving national economic development and the well-being of the population in general and the impoverished in particular. Long term aid must be contrasted with short term aid. Long term aid involves supporting national economic development strategies while short term aid provides services or funding to an area overwhelmed by a non-reoccurring disaster. Repetitive short-term aid is not long-term aid; however, repetitive short-term responses can become a long-term policy that often has detrimental consequences for the recipient.

In a sense, foreign aid began with the Western colonial empires. Chapter eight of *The White Man's Burden*²¹ presents these colonial relationships as unbalanced. European empires extracted resources and wealth from their colonies while offering limited benefits such as medicines, education and transportation systems that often made the colony more dependent on European power. This colonial history also likely left some of the West with a sense of responsibility to their former colonies; hence Kipling's phrase, borrowed by Easterly, "The White Man's Burden."

The Second World War ended the European colonial empires and began the modern version of foreign aid. This modern aid initially began as an effort to rebuild following the Second World War, but the emphasis changed ~~with~~ during the Cold War. These modern aid programs were generally characterized as wealth transfers involving governments or large Non-Government Organizations (NGOs).

*Poverty Inc.*²² offers the Marshal Plan as an early blueprint for foreign aid. The Marshal Plan helped primarily western European countries rebuild following the Second World War. Foreign aid was later supplied to many developing countries in response to Cold War pressures and objectives. That is, aid took the form of wealth transfers to "friendly governments" and was directed to those nation's economic and military needs. Such aid necessarily involved direct

²¹ William Easterly, 2006. *The White Man's Burden*. London: Penguin Books Ltd.

²² *Poverty Inc.* [Documentary Film] (2015). Grand Rapids, MI: The Acton Institute.

transfers to foreign governments. Interestingly, Milton Friedman²³ in his 1958 *Yale Law Review* essay cautioned that such a Cold War based aid system, which were intended to combat communism, could retard economic development while strengthening the government sector.

*Poverty Inc*²⁴ presents foreign aid as an industry that has evolved over six decades and was substantially influenced by aid protocols of the Cold War. The industry structure includes transfers along established channels. These channels flow from the governments of developed nations (e.g., the US, UK, Japan) to poorer recipient governments; often the aid is routed through international agencies (e.g., IMF, the World Bank, NGO's). Further, such aid is often *tied aid* where donor countries link aid to specific programs or policy compliance administered by recipient governments. Other weaknesses include the reduction of aid funding for organizational overhead and the reduction of aid funding due to ineffective and corrupt use.

The Aid Debate

The foreign aid debate focuses on two fundamental questions. Are current aid programs working, and if not, why not? What is the solution to ending the poverty of the *bottom billion(s)*? By 2000, six decades of modern aid programs had not eliminated extreme poverty, particularly in areas such as Africa and Haiti.

Sachs²⁵ called for a “Big Push” expansion of the current aid system. In contrast, Easterly²⁶ argued that **the** current aid system is inefficient. Foreign aid should continue, but the delivery needs to change to a *Searchers* (rather than *Planners*) approach to aid. Traditional aid systems like those supported by Sachs are *Planners* based. *Planners* operate at the highest governmental levels and as outsiders and often impose solutions based on mistaken or biased beliefs. In contrast *Searchers* operate at the lowest (or local) level, search for market-based solutions that include the beneficiaries. Research supports both positions. For example, Feeny and McGillivray²⁷ and Wagner²⁸ suggest the Sachs’ solution will work in time, while Moyo in his book *Dead Aid*²⁹ supports Easterly’s position.

²³ Milton Friedman, 1995. *Foreign Economic Aid: Means and objectives, essays in public policy No. 60*. Stanford, CA: Hoover Institution on War, Revolution and Peace.

²⁴ *Poverty Inc*. [Documentary Film] (2015). Grand Rapids, MI: The Acton Institute.

²⁵ Jeffrey Sachs, 2005. *The End of Poverty*. New York: Penguin Group.

²⁶ William Easterly, 2006. *The White Man’s Burden*. London: Penguin Books Ltd.

²⁷ Simon Feeny. and Mark McGillivray, 2011. “Scaling-up Foreign Aid: Will the ‘Big Push’ Work?” *The World Economy*, 34: 54-73.

²⁸ Laurent Wagner, 2014. “Identifying thresholds in aid effectiveness.” *Review of World Economics*. 150: 619-638.

²⁹ Dambisa Moyo, 2009. *Dead Aid*. New York: Farrer Strauss and Grioux.

Alternatively, a growing body of literature suggests that foreign aid may actually be futile or even destructive. John and Storr³⁰ ask “Can the West help the Rest?” In their paper so titled, they suggest that the positions advocated by both Easterly³¹ and Sachs³² are off point. John and Storr³³ instead offer the fundamental concepts of Adam Smith³⁴ as a solution to the poverty of the *bottom billions*. Sorens³⁵ argues that the current aid system cannot be reformed, a view often reflected in the popular press (Quadir in *The Wall Street Journal*³⁶ and Swanson in *The Washington Post*³⁷). Such an approach is considered the “Trade not Aid” solution to poverty. However, a “Trade not Aid” approach is based in the assumption that an appropriate economic climate can be created if the client can secure trade opportunities, human capital, and financing.

The issue in many developing economies, specifically those of Africa, is not necessarily a lack of capital (financing). In fact, it is often the opposite. According to Hoffman, “Despite the misconception that capital shortages are holding back development, banks across east, west, and sub-Saharan Africa are actually flush with money.”³⁸ In a report titled “Accelerating Entrepreneurship in Africa,” the Omidyar Network states that the issue facing small and medium-sized enterprises (SMEs) in Africa is a lack of fundable business plans. “Financiers argue that many of the new ventures are simply not fundable. Financiers note a lack of fundable business plans, pointing to issues ranging from the quality and feasibility of the business idea to the commitment of the entrepreneur and his or her team.”³⁹ This suggests that insufficient education is a bigger problem than lack capital deficiencies. Similarly, Mead concludes

³⁰ Arielle John and Virgil Henry Storr, 2009. “Can the west help the rest? A review essay of Sach’s *The End of Poverty* and Easterly’s *The White Man’s Burden*.” *The Journal of Private Enterprise*. 25 (1): 125-140.

³¹ William Easterly, 2006. *The White Man’s Burden*. London: Penguin Books Ltd.

³² Jeffrey Sachs, 2005. *The End of Poverty*. New York: Penguin Group.

³³ Arielle John and Virgil Henry Storr, 2009. “Can the west help the rest? A review essay of Sach’s *The End of Poverty* and Easterly’s *The White Man’s Burden*.” *The Journal of Private Enterprise*. 25 (1): 125-140.

³⁴ Adam Smith, 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Retrieved from www.libertyfund.org

³⁵ Jason Sorens, 2007. “Development and political economy of foreign aid.” *The Independent Institute*. Oakland, CA. Retrieved from www.independent.org/students/essay/essay.asp?id=2043

³⁶ Iqbal Z. Quadir, 2009. “Foreign Aid and Bad Government: Helping entrepreneurs is the right approach.” *The Wall Street Journal*, January 30, 2009: A11.

³⁷ Ana Swanson, 2015. “Why trying to help poor countries might actually hurt them.” *The Washington Post*. October 13, 2015. Retrieved from www.washingtonpost.com.

³⁸ Kurt Hoffman, 2005. “Lack of Investment Is the Tragedy in Africa.” *Financial Times*. June 9, 2005.

³⁹ Omidyar Network. 2013. *Accelerating Entrepreneurship in Africa*. April 4, 2013 at 5. Retrieved from <https://www.omidyar.com/insights/accelerating-entrepreneurship-africa-report>

“In Zambia, average hourly profits of those who had completed lower secondary school were more than twice those of enterprises run by people with only upper primary schooling ... These findings suggest that, while small amounts of education appear to have made little difference to enterprise profitability, going beyond a certain threshold – lower secondary in Zambia; upper primary in Kenya – was associated with substantial increases in enterprise profitability.”⁴⁰

The Omidyar Network also warns that obtaining financing is not what determines whether a business will be successful, but “rather, the entrepreneur’s ability to adapt to market changes and cope with uncertainty.”⁴¹ It proposes that one of the solutions to help SMEs find financing in Africa is to incentivize them to “practice sound financial management and maintain adequate records, including audited statements.”⁴²

Wealth transfers are generally made at an economic level well above local business persons. As noted by the Omidyar Network, 84% of SMEs in Africa are either unserved or underserved. That amounts to a gap in credit financing between (US)\$140 - \$170 billion. Looking further at the breakdown of financing for SMEs in Africa, the report states that 45% of financing comes from personal or family loans, while only 19% and 18% comes from private equity and bank debt respectively.⁴³

The above discussion illustrates the obvious, that the aid debate exists because the solution is simply not known. The discussion does suggest that a significant impediment to economic development in emerging economies is limited business skills and knowledge, human capital.

LUCA PACIOLI AND HIS TIMES

Pacioli (1447-1517) was a Franciscan Friar, mathematician and teacher. He was born in the small commercial town of Sansepolcro in northeastern Italy to a family of common heritage. As a young man Pacioli learned firsthand the practice and value of business while working in the house of Antonio Romopianisi, a wealthy Venetian merchant. Pacioli studied mathematics at a school established by the

⁴⁰ Mead, Donald C. Mead, 1999. “MSEs tackle both poverty and growth (but in differing proportions.” At 66-67. In King, K. and McGrath, S. (eds) *Enterprise in Africa: Between Poverty and Growth*. London: Intermediate Technology Publications: 61–70.

⁴¹ Omidyar Network. 2013. *Accelerating Entrepreneurship in Africa*. April 4, 2013 at 5. Retrieved from <https://www.omidyar.com/insights/accelerating-entrepreneurship-africa-report>

⁴² Ibid. at 7

⁴³ Ibid.

republic of Venice and was ordained a Franciscan Friar between 1470 and 1477.⁴⁴ From 1464 to 1514 Pacioli taught throughout Italy at both Universities and Abbaco schools, but primarily the Abbaco schools.⁴⁵

As a Franciscan friar, Pacioli would have been influenced by the then 250-year-old Franciscan order, rule and traditions. When the Franciscan order began in the early 1200s agriculture was the major economic activity. However, cities and commerce were emerging as the feudal system was declining, a process accelerated by the population shortage caused by the plague of the mid-14th century. Hence the people of Europe, including northern Italy were beginning to realize economic independence from the noble class.⁴⁶ Flood notes that at the time of the early Franciscans the people of northern Italy understood business and work as a means to acquire goods and achieve status. Flood further suggests early Franciscans viewed work as a means to provide economic growth and self-sufficiency that could be shared with less able members of society.⁴⁷ Pacioli would have been influenced by Franciscan tradition, which caused him to view business and work as ways to improve the lot of society at large.⁴⁸

Pacioli was an applied mathematician. “He (referring to Pacioli) claims that mathematics is helpful in almost every human endeavor. He apparently is the first to claim mathematics as a part of everyday life,”⁴⁹ including business. The need to solve business problems (e.g., inventory management, predictions, and cost cutting) drove the practical evolution of mathematics.⁵⁰ As business became a flow of activity rather than a series of ventures, “new (math) tools were needed for calculating (profit) and problems solving. A new class of professional mathematician ... or abacists, appeared”⁵¹ These abacists instructed generations of middle-class Italian children in solving genuine business problems. “Pacioli, was

⁴⁴ Satishkumar Jayawardene, 1971. “Luca Pacioli” in *Dictionary of Scientific Biography*: 274-277. New York: Charles Scribner’s Sons.

⁴⁵ Alan Sangster and Giovanna Scataglinibelghitar, 2010. “Luca Pacioli: the Father of Accounting Education.” *Accounting Education an International Journal*. 19 (4): 423-438.

⁴⁶ Paolo Malanima, 2008. “The Italian Renaissance Economy (1250-1600).” International conference. May 2008. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/versions?doi=10.1.1.489.362>

⁴⁷ David Flood, 2001. “Franciscans at Work.” *Franciscan Studies* 59: 21-62.

⁴⁸ Charles.Coate and Mark Mitschow, 2018. “Luca Pacioli and the Role of Accounting and Business: Early Lessons in Social Responsibility.” *Research on Professional Responsibility and Ethics in Accounting* 21: 1-16.

⁴⁹ R. Emmett Taylor, 1942. *No Royal Road: Luca Pacioli and His Times*. Chapel Hill, NC: The University of North Carolina Press. At 195.

⁵⁰ Daniele C. Sturppa and Anja Kruslin, 2016. “An Introduction to the Datini Archives: Early Capitalism in Renaissance.” *Tuscany Journal of Business and Management*. 22 (2): 125-131.

⁵¹ Victor J. Katz, 2004. “Mathematics of the Renaissance.” Chapter 9 in *The History of Mathematics (Brief Version)*. Boston: Pearson Addison-Wesley. At 214.

one of the last abacists.”⁵² Eves recognizes the role of business problems, global contact, and cultural exchange in the development of contemporary algebra.⁵³

The Abbaco (from abacists) schools where Pacioli focused his career stood in stark contrast with traditional universities. Universities were largely restricted to the nobility. The education there was more theoretical, theological and intellectual, and the language of the universities was Latin. The Abbaco schools of northern Italy were established to serve the growing merchant and craftsman classes and emphasized practical skills such as mathematics. These schools needed to import much of the technology; examples of technology include Hindu-Arabic numerals (1-9), number place values (e.g., 10, 100), Persian algebra (including zero), and the use of the Abacus. The Abbaco schools taught in the vernacular (Italian). Fittingly, *The Summa* was written in the vernacular (Italian) rather than in Latin and emphasized the role of mathematics in business operations.

To put further context on Pacioli’s life and times, including the 1494 publication of *The Summa*, consider the following dates and events. In 1440 Guttenberg developed a printing press and in 1450 the Guttenberg Press was ready for commercial use; in 1492 Columbus sailed in search of trade routes to the East but arrived in the Americas; and in 1517 Martin Luther published his 95 Theses. Fifteenth century Europe clearly understood the benefits of trade and a global economy. However, wealth and power were still concentrated with nobles, wealthy merchants and the Church. Further, the individuals in power often did not use wealth to create economic growth (i.e., via investment) but rather to buildings, art, and other luxury projects.⁵⁴

Due to Pacioli’s common heritage and his formative years in Venice, he likely would have understood and appreciated the positive economic and social impact of the evolving merchant economy of Italy and Europe. He would have recognized the wealth concentrations and the importance of wealth to businesses. He would have understood that the success of trade (or commerce) relied not only upon financial capital, but also human capital, which in turn required education. Furthermore, this education needed to address the increasing complex nature of trade. His focus on the Abacco schools was consistent with the Franciscan heritage and traditions. Pacioli, as a Franciscan friar, in contrast with monks of other orders, engaged and worked with common people within their economic and social environments rather than the more secluded monastic life.

⁵² Ibid. at 219.

⁵³ Howard Eves, 1990. *An Introduction to the History of Mathematics (6th Ed)* Boston: Cengage Learning.

⁵⁴ Paolo Malanima, 2008. “The Italian Renaissance Economy (1250-1600).” International conference. May 2008. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/versions?doi=10.1.1.489.362>

THE SUMMA: LESSONS FOR ECONOMIC DEVELOPMENT

Elements of Success

The first chapter of *The Summa's* bookkeeping section is relevant. Here Pacioli lists three elements needed for the successful business person:

“The most important of these is cash or any equivalent.” “The second...is to be a good bookkeeper and ready mathematician.” “The third...is to arrange all the transactions in such a systematic way that we may understand each one of them at a glance.”⁵⁵

“The most important if cash, or some equivalent economic power.” The second thing ... is to be a good accountant and ready mathematician.” “The third...is that all the business man's affairs be arranged in a systematic way so that he may get their particulars at a glance.”⁵⁶

“Three things are needed by anyone who wishes to carry on business carefully: 1) Cash and/or credit, 2) A good accountant, 3) Proper internal control.”⁵⁷

We note that the Cripps translation is streamlined and written more in context with modern business. The other, older translations may be more valuable in the context of emerging economies. We also include in our discussion what we refer to as *Pacioli's wisdom*. *The Summa* includes many sayings in the *Summa* which serve as advice or wisdom to the business person.

All three translations list cash as the first and prerequisite element for a successful business. Cripps also provide a literal quote “money, property, possessions and wealth;”⁵⁸ that is, any means to gain substance. That is, the business person must have capital. Further, the other elements suggest that the capital be sufficient to support a business where substantial decisions and records are critical to success.

The second element is to be a good accountant and ready mathematician. Cripps removes the mathematician reference but Pacioli clearly viewed mathematics as critical. Chapter 1 of *The Summa's* third or bookkeeping section states “...if one has not understood the first part (referring to Sections (1) arithmetic

⁵⁵ John Geijsbeck, 1914. *Ancient Double Entry Bookkeeping* (1974 reprint). Houston: Scholars Book Company. At 33.

⁵⁶ R. Gene Brown and Kenneth S. Johnson. 1963. *Pacioli on Accounting*, McGraw Hill Book Company Inc., New York. At 25-26.

⁵⁷ Jeremy Cripps, 1995. *Particularis de Computis et Scripturis: A Contemporary Interpretation* (Seattle, WA: The Pacioli Society. At 1.

⁵⁸ *Ibid.* at 1.

and algebra and (2) their use in trade reckoning) well, it will be useless for him to read the following (referring to the bookkeeping section).⁵⁹ Brown and Johnson and Cripps have similar translations. Pacioli understood that given capital, the merchant needed to understand the business and make good business decisions; mathematical skills were needed to ensure good decisions.

Pacioli clearly considered mathematics an essential tool of the merchant. There are no complete translations of the *Summa* as the four mathematical sections were not translated. Likely this is not due to their lack of importance, but rather due to the fact that by the fifteenth century mathematics was a well-established discipline in Italy (and Europe).⁶⁰

Hilbert described *The Summa* as “The most complete and detailed fifteenth century mathematical treatise ... a work in which the author borrowed shamelessly from earlier writers.”⁶¹ However, *The Summa* was not the first such work as it was predated by the *Treviso Arithmetic (Treviso)*, which was published in Venice in 1478.⁶² Swetz describes the Treviso as “the earliest known printed mathematics book in the West” he further claims the Treviso to be “one of the first printed European text books dealing with science.”⁶³ Since Pacioli had “stolen shamelessly” in *The Summa* it is very likely that much of *The Summa*’s mathematics was taken from the *Treviso* and adapted, by the applied mathematician Pacioli, to business applications.

The *Treviso* includes multiple well-known fifteenth century mathematics problems such as *hound and the hare*, *the rule of three*, *the courier problem*, and *basins flow*. An example of each, modified from the *Treviso* is provided below.

The hound and the hare. A field is 150 feet, at one end stands a hound and the other stands a hare. Each leap of the hound is 9 feet; each leap of the hare is 7 feet. In how many leap and feet will the hound catch the hare? (The problem assumes that leaps are at the same rate.)

⁵⁹ John Geijsbeck, 1914. *Ancient Double Entry Bookkeeping* (1974 reprint). Houston: Scholars Book Company. At 33.

⁶⁰ See Victor J. Katz, 2004. “Mathematics of the Renaissance.” Chapter 9 in *The History of Mathematics (Brief Version)*. Boston: Pearson Addison-Wesley; and David. Hilbert, 2011. *The Renaissance of Mathematics: Cardan and Tartaglia, The History of Mathematics: An Introduction 7ed*, (Editor Burton, D. M.). New York: McGraw Hill Book Company Inc.

⁶¹ *Ibid.* at 316.

⁶² Frank Swetz, 1987. *Capitalism and Arithmetic: The New Math of the 15th Century Including the Full Text of the Treviso Arithmetic of 1478*. Translated by David Eugene Smith. LaSalle, Ill.: Open Court.

⁶³ *Ibid.* at 24.

The rule of three. If you can sell 20 pounds of product for \$47, how many dollars of sales will 35 pounds of product generate?

The courier problem (also called the Rule of two). The Holy Father sends a courier to Venice; the courier will reach Venice in 7 days. The Bishop of Venice send a courier to Rome; the courier will reach Rome in 9 days. Both are instructed to leave on the same day. In how many days will they meet and how many miles will each travel?

Basin flow. A fountain has two basins, one above and one below each with two outlets. In the top basin, the first outlet of the bottom basin in two hours; the second outlet fills the bottom basin in three hours. In the bottom basin the first in three hours and the other in four hours. How long will it take to fill the bottom basin if all outlets are open?

All of these problems are covered in basic managerial accounting courses. *The hound and the hare* problem is the computational equivalent of a break-even problem where the 150 feet represents the fixed costs, the hound's leap revenue per unit and the hare's leap variable costs per unit. Breakeven analysis is a foundational financial business problem. *The rule of three* is a computational ratio problem with basic applications in gross margins and pricing problems, which has applications in allocations, budgeting and planning. *The courier problem* involves variable rates that can be applied to costs or production. Another version of this problem has multiple workers earning different wage rates. This type of problem can also be used to allocate profit in a partnership. *The basin flow* problem is clearly an inventory management problem. Outlets representing the flow of production contrasted with the flow of sales; the multiple outlets with different rates (and open shut values) allow for multiple suppliers and customers.

Other classic problems include *Lion in the hole* and *Tare and tret*. *The Lion in the hole* problem presents a lion climbing up in the day and slipping down at night and asks the days until the lion is out. Importantly, the day occurs before the night adding a realistic dimension to this inventory management problem. *The Tare and tret* problem is one of (a standard) inventory shrinkage, often in shipping; this problem asked an amount of expected product to arrive; applications also include efficiency and yield ratio problems.

The third element is an accounting system, systematic arrangement (and summary) of transactions. *The Summa's* bookkeeping section taught double entry accounting, proper records to support the accounting and computation of profits. It also taught the need for an accounting system to support the understanding and decisions of a business. Pacioli lists the need for journals, ledgers, and memos. These were the systematic means for the business person to better understand the business and compute profit. Records such as journal and ledgers are also an

important source of information to make decisions based on mathematical models. Memos help the business person track information on customers and agreements. Records provide a would-be entrepreneur a multi-period focus of sustainability and continued improvement; data to support mathematics-based decisions.

For example, consider Pacioli's second chapter of *The Summa's* bookkeeping section. As an early step, the business person is required to take inventory and make a record of all assets and liabilities to determine equity or wealth. An inventory serves two purposes: first, it allows for profit measurement (the change in wealth during a period), and second, it provides a list of assets (capital, economic substance) with which to generate the profit.

Pacioli's wisdom

The above three elements for business success describe resources and technical skill. But Pacioli combined technical mathematical and accounting knowledge with business wisdom.⁶⁴ This wisdom is a list of intangibles, including operational and ethical practices that reflected Pacioli's pedagogical and social styles. While acknowledging ethics, we focus on the operational considerations. Pacioli's wisdom stresses are hard work, diligence\attention to the business, and organization as illustrated by the below quotes from the Geijsbeck⁶⁵ translation of the *The Summa*.

Hard work "Dante says: My son it behooves that you quit your laziness. God promised the crown to the watchful ones."

"Work should not seem strange for Mars never granted a victory to those that spent their time resting."

"A sage said to the lazy man to take the any as an example."

"Apostle Paul says that no one will be worthy of the crown except he who shall fight valiantly for it."

Diligence "Also it is said that the head of the merchant has a hundred eyes, and still they are not sufficient for all he has to do and say."

"I wanted to put these reminders for your own good, so that the daily care about your business would not seem heavy to you, especially the writing down everything and putting down everything that happens to you."

Organization "Every action is determined by the end in view"

⁶⁴ For a list of Pacioli's "peculiar" sayings see John Geijsbeck, 1914. *Ancient Double Entry Bookkeeping* (1974 reprint). Houston: Scholars Book Company.

⁶⁵ *Ibid.* at 27.

“For if he does not put each thing in its own place, he will find himself in great trouble and confusion as to all his affairs, according to the familiar saying, *Ubi non est no order, ibi est confuisio* (Where there is no order there is confusion).

“If you are in business and do not know all about it, your money will go like flies, that is, you will lose it.”

It seems that 500 years ago, as with today’s business, certain characteristics or intangibles are needed for successful business.

The Summa and Emerging Economies

The Summa was arguably written for and taught to persons who would be the Italy’s 1500 equivalents of today’s SMEs business persons of an emerging economy. Business success relied upon capital, math skills, accounting skills and accounting systems as well as a proper work ethic. These issues are still requirements of success in business today, including the SME of emerging economies.

Capital, cash or credit, viewed by Pacioli as a prerequisite for business success is, per Hoffman, much less of an issue in emerging economies in terms of availability.⁶⁶ In contrast with emerging economies of today, Italy of the 1500s (and earlier) had geographic advantages to support trade but a lack of capital. But, those in control of wealth in circa-1500 Italy (nobles, wealthy merchants, and the Church) were less willing to invest than the today’s counterparts (e.g., IMF, World Bank, NGO’s).

Rather, the issue in emerging economies is fundable business plans often due to quality and feasibility.⁶⁷ That is, capital is necessary but not sufficient condition for business success probabilities demanded by finance sources. For Pacioli the second element of success was for the business person to be a good mathematician and a good accountant. And, the mathematical knowledge preceded the accounting knowledge. The bookkeeping (accounting) or section (3) of *The Summa* was preceded by sections (1) arithmetic and algebra and (2) their use in trade reckoning. Section (4) and (5) were also mathematics based.

To illustrate fundable business plans and SMEs we consider micro loans, a well-known and popular development strategy. Consider the micro loan, a small loan of \$50 or \$100 is the capital needed to combine with the prospective business person’s labor and create a profit. The profit is simply the amount above the \$50 or \$100 loan. The micro loan administrator hopes to make a larger loan to this

⁶⁶ Kurt Hoffman, 2005. “Lack of Investment Is the Tragedy in Africa.” *Financial Times*. June 9, 2005.

⁶⁷ Omidyar Network. 2013. *Accelerating Entrepreneurship in Africa*. April 4, 2013. Retrieved from <https://www.omidyar.com/insights/accelerating-entrepreneurship-africa-report>

person, but nevertheless these loans remain a series of ad hoc ventures. In contrast, a SME is a larger, sustainable business entity. To operate such a business, the entrepreneur needs the math and accounting skills taught by Pacioli and documented in *The Summa*. Recall, as the emerging businesses of Italy (1500s and before) became a flow of activity rather than a series of ventures, Katz reported that new mathematical tools were needed for solving problems.⁶⁸ These problems included inventory management, predictions, and cost cutting.⁶⁹ More directly put, math skills are needed to articulate a fundable and successful business plan.

After appropriate math skills were acquired, sections (1) and (2) of *The Summa*, Pacioli taught the third element of success: Venetian or double entry accounting system along with the needed journals, ledgers and memos. Recall, in Pacioli's words, "The third...is that all the business man's affairs be arranged in a systematic way so that he may get their particulars at a glance."⁷⁰ Accounting system allow for preparation of financial statement, the computation of profit, from a set of complex transaction. The Omidyar Network proposed sound financial practices and audited (or auditable) financial statements as one solution to SME financing.⁷¹ Accounting systems also allow the businesses a model of the business and information to support the mathematical decision tools.

Interestingly, Mead offers education levels as a key element in fundable business plans and business success.⁷² Pacioli would agree particularly in communicating business plans and performance. Accounting systems are a quantitative model of a business' operations. *The Summa* was Pacioli's textbook. Finally, Pacioli offered the timeless wisdom of hard work, diligence, and organization. The Omidyar Network offered the commitment of the entrepreneur as a factor in a feasible business plan.⁷³ As with his ethical advice, Pacioli often referenced Bible passages.

⁶⁸ Victor J. Katz, 2004. "Mathematics of the Renaissance." Chapter 9 in *The History of Mathematics (Brief Version)*. Boston: Pearson Addison-Wesley.

⁶⁹ Sturppa, Daniele C. and Anja Kruslin. 2016. "An Introduction to the Datini Archives: Early Capitalism in Renaissance." *Tuscany Journal of Business and Management*. 22 (2): 125-131.

⁷⁰ R. Gene Brown and Kenneth S. Johnson, 1963. *Pacioli on Accounting*, McGraw Hill Book Company Inc., New York. At 25-26.

⁷¹ Omidyar Network. 2013. *Accelerating Entrepreneurship in Africa*. April 4, 2013. Retrieved from <https://www.omidyar.com/insights/accelerating-entrepreneurship-africa-report>

⁷² Donald C. Mead, 1999. "MSEs tackle both poverty and growth (but in differing proportions)." In King, K. and McGrath, S. (eds) *Enterprise in Africa: Between Poverty and Growth*. London: Intermediate Technology Publications: 61-70.

⁷³ Omidyar Network. 2013. *Accelerating Entrepreneurship in Africa*. April 4, 2013. Retrieved from <https://www.omidyar.com/insights/accelerating-entrepreneurship-africa-report>

PAPAL ENCYCLICALS, FOREIGN AID, AND *THE SUMMA*

In this section the concepts of Pacioli's *Summa* and foreign aid are linked to Papal Encyclicals of three selected Pope: Leo XIII, Paul VI, and John Paul II. While recognizing contributions of multiple other sources (including but not limited to Pius XI,⁷⁴ Benedict XVI,⁷⁵ and Francis⁷⁶ to modern day CST, the works of these three Popes seem most relevant to Foreign Aid, economic development, and Pacioli's contributions.

In 1891, Pope Leo XIII wrote the encyclical *Rerum Novarum*, which arguably provided the basis for economic foundations and positions of Catholic Social Teaching (CST) that developed over following 125 years. This encyclical addressed the contemporary social and economic stresses caused by industrialization and the consequent imbalance of wealth and economic power between the owners of capital and the providers of labor. *Rerum Novarum* called for the cooperation between labor and capital as well as equitable wages and treatment for workers. In economic terms, he tasked the owners of capital to recognize the existing imbalance of power and the responsibility placed upon them. Leo XIII also reaffirmed the Roman Catholic Church's support of private property but stressed a need for means, such as labor, where workers could acquire an appropriate level of property and realize economic development.

In 1891 the emerging economies of today were largely under colonial rule or influence. As discussed earlier, colonial relationships were very unbalanced. While Western powers may have believed they were offering a level of civilization and religion; economically, limited education and infrastructure were the only contributions. Modern, post-cold war, aid programs were a nearly century away

In 1967 Paul VI writes his encyclical *Populorum Progressio* which focused on the global responsibility of developed nations. *Populorum Progressio* was significant because it recognized a global responsibility in social and especially economic development calling on developed nations to support economic and social growth in developing nations. Notably, *Populorum Progressio* specifically extended the principles of Leo XIII to developing economies by recognizing economically developed nations' responsibilities to the people of developing

⁷⁴ Pope Pius XI, 1931. *Quadragesimo Anno*. May 15, 1931. Retrieved from http://www.vatican.va/content/pius-xi/en/encyclicals/documents/hf_p-xi_enc_19310515_quadragesimo-anno.html

⁷⁵ Pope Benedict XVI, 2009. *Caritas in Veritate*. June 29, 2009. Retrieved from http://www.vatican.va/content/benedict-xvi/en/encyclicals/documents/hf_ben-xvi_enc_20090629_caritas-in-veritate.html

⁷⁶ Pope Francis, 2013. *Evangelii Gaudium*. November 24, 2013. Retrieved from http://www.vatican.va/content/francesco/en/apost_exhortations/documents/papa-francesco_esortazione-ap_20131124_evangelii-gaudium.html

economies; ie. a responsibility of capital to labor when economic power is imbalanced.

In 1967 the emerging economies of today were two decades into Marshall Plan like aid programs. However, as discussed earlier, Foreign Aid was often driven by Cold War politics and directed to “friendly governments.” Cold War politics both greatly increased foreign aid and heavily influenced where and how that aid was applied. Perhaps in response *Populorum Progressio* recognized, as predicted by Friedman,⁷⁷ that such a foreign aid regime was not addressing real human needs.

John Paul II held the Papacy from 1978-2005. His three encyclicals most relevant to Foreign Aid, economic development and Pacioli are *Laborem Exorcesus*,⁷⁸ *Sollicitudo Rei Socialis*,⁷⁹ and *Centesimus Annus*.⁸⁰ These writings illustrated a clear understanding of economic structures and functions in economic and social development of CST.

Laborem Exorcesus recognized the concept of work both as a critical factor for individual and societal well-being and as a function that evolves with technology. Specifically, it recognized that increasing technology requires that traditional economic classifications of capital and labor be expanded to include human capital as a hybrid input which provides a new dimension of dignity and value to individuals. *Sollicitudo Rei Socialis* re-affirmed the need, presented in *Populorum Progressio*, for co-operative efforts to support global economic development. *Centesimus Annus* linked and summarized 100 years of industrial economic-based CST. As Williams noted, *Centesimus Annus* offered the church an understanding of how markets (capitalistic) economies work and provided a positive role in contributing to the common good.⁸¹ Taken together, these Encyclicals’ perspectives suggest that appropriately applied market-based solutions, with a proper understanding of labor, can have a significant positive impact on developing economies and the lives of the bottom billions.

⁷⁷ Milton Friedman, 1995. *Foreign Economic Aid: Means and objectives, essays in public policy No. 60*. Stanford, CA: Hoover Institution on War, Revolution and Peace.

⁷⁸ Pope John Paul II, 1981. *Laborem Exorcesus*. September 14, 1981. Retrieved from http://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_14091981_laborem-exorcens.html

⁷⁹ _____, 1987. *Sollicitudo Rei Socialis*. December 30, 1987. Retrieved from http://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_30121987_sollicitudo-rei-socialis.html

⁸⁰ _____, 1991. *Centesimus Annus*. May 1, 1991. Retrieved from http://www.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_01051991_centesimus-annus.html

⁸¹ Oliver F. Williams, 1993. “Catholic Social Teaching: A Communitarian Democratic Capitalism for the New World Order.” *Journal of Business Ethics*. 12: 919-932.

During John Paul II's pontificate (1981-2005) emerging economies experienced the end of Cold War aid programs, the *Planners* approach of Sachs and the *Searchers* approach of Easterly.⁸² Perhaps in 1987 *Sollicitudo Rei Socialis* was written when receding Cold War tensions provided an opportunity to re-evaluate foreign aid programs. Regardless of aid method, the importance of meaningful labor contributions to markets (whether at the macro\planner level or micro\searcher level) needed to be recognized. Further, as in Europe of 1891, worker needed a means to acquire an appropriate level of property and wealth.

In Pacioli's time, as with Europe of 1891 and emerging economies of today, an imbalance of wealth and capital existed, but capital was primarily property (land) as opposed to the capital of industrial and modern times, property, plant and equipment. In circa-1500 Italy, business (commerce) was a means (as called for by Leo XIII 400 year later) for common people to acquire property and wealth. Common people had skills or trades as well as the ability to transform their labor into product. However, business success also required knowledge; and this knowledge could be provided with education.

Knowledge and technology enhanced human capital (as articulated by John Paul II 500 years later). Pacioli understood that the value of labor was more than working the fields or the shop, labor's value was based on total human capital – skills and business education. To Pacioli, this business education was mathematics to plan and operate a business and accounting to model business transactions and measure performance.

Pacioli's students of 1500 Italy could be today SME entrepreneurs of emerging economies. Pacioli's students were not the wealthy merchants, the nobility or the Church leaders. The SME entrepreneurs are not major corporations, government leaders, or NGO officials. SME entrepreneurs are common labors with undeveloped human capital. They are those that will hire and mentor more common labors.

SUMMARY

Were Pacioli alive today and tasked to write a textbook for Foreign Aid, his life and background suggests that he would “steal shamelessly” from exiting theories in updating *The Summa*. He could likely be found in the “Trade and Education” camp and likely both *Planning* and *Searching* for a solution to economic development to benefit *the bottom billion*. And, of course, he would be found teaching in the schools of developing nations and not the Universities of Europe.

Pacioli would, at the very least, consider trade and commerce a major component of the Aid solution. But business education would be the precursor.

⁸² Easterly, William. 2006. *The White Man's Burden*. London: Penguin Books Ltd

Education could include substantially unchanged, but translated, mathematical and bookkeeping (accounting) lessons directly from *The Summa*, updated only for context. These lessons designed to support SMEs in planning, start-up, and growth. Pacioli would likely view SMEs properly supported with trade opportunities and capital (financing and human) as the best engine for sustainable, long term economic growth focused on *the bottom billions*. And while *Planning* may be the most efficient method to obtain financing and education infrastructure, *Searching* may be the most effective method to find SMEs.

A “Trade and Education” strategy based on lesson from *The Summa* would be consistent with a United Nations report advocating movement from “...centrally planned economies to a free-market economy...” to enhance economic development for the “forgotten people” (*the bottom billion*).⁸³

In conclusion, Pacioli’s *Summa* adds an interesting perspective to an Aid solution. The missing link in business success of SMEs, hence economic development for *the bottom billions*, may well be the math and accounting skills and abilities that Pacioli taught over 500 years ago. Interestingly, the need for such skills are consistent with 125 year of Church writings relating to economic development; writing that began 400 years after Pacioli. Pacioli’s *Summa* offered a means for the common persons to acquire property and wealth. And the mechanism was education, the development of human capital where the returns accrued to the person. Pacioli’s intellectual motivation from applied mathematics are likely guided by his spiritual motivation with the same 2,000 (or more) year old texts that motivate CST.

⁸³ United Nations, 1997. “Political, Social and Economic Realities in Developing Countries and in Countries with Economies in Transition.” *Group of Experts on the United Nations, Programme on Public Administration and Finance, Thirteenth Meeting*. May 27, 1997. At 2.