Implications of New Technology in Accounting of Business Cycles

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***Abstract*- Artificial intelligence (AI) is one of the nine national science missions identified by the Prime Minister's Science, Technology & Innovation Advisory Council (PM-STIAC) as declared on 06-March-2019. AI is the simulation of human intelligence processes by machines, especially computer systems.**

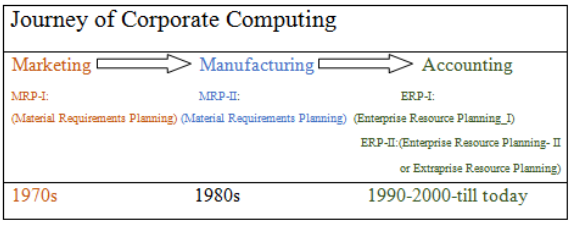
This exploratory paper on AI is intended to draw attention towards AI based applications of accounting unfolding newer opportunities for integrative modeling of AI based accounting, behavioral finance and cyclical fluctuations in trade, industry and business as a whole.

Financial institutions have long used artificial neural network systems to detect charges or claims outside of the norm, flagging these for human investigation. Banks use artificial intelligence systems today to organize operations, maintain book-keeping, invest in stocks, and manage properties. The use of AI machines in the market in applications such as online trading and decision making has changed major economic theories. AI has had impact include in rational choice, rational expectations, game theory, Lewis turning point, portfolio optimization and counterfactual thinking.

The economists have started speculating a few days earlier that the years 2019-21 are going to suffer depression worldwide. There are strong indications from the automobile and financial sectors. For smooth functioning of the production structure the smooth flow of money requires to be ensured. In this light, four measures have been suggested at the end regarding taxation, working hours, budgets of the business entities as well as the government and Money (liquidity) growth.

I.INTRODUCTION

Corporate computing earlier evolved from data processing systems in the 1960s to ERP in 1990 to AI in the current phase as depicted in Figure 1.



The Technology Scenario

Artificial intelligence (AI) is one of the nine national science missions identified by the Prime Minister's Science, Technology & Innovation Advisory Council (PM-STIAC) as declared on 06-March-2019[1]. These missions are aimed to address major scientific challenges to ensure India's sustainable development. These missions are:

- Natural Language Translation: Using a combination of machine and human translation to eventually enable access to teaching and research material bilingually i.e. in English and one's native Indian language.
- o Quantum Frontiers: It aims to initiate work in control of the quantum mechanical systems, and building excellence in the development of quantum computers, quantum chemistry, quantum communication, new materials, quantum sensors and quantum cryptography.
  o Artificial Intelligence: Focussing on addressing societal needs in areas such as healthcare, education, agriculture, smart cities and infrastructure, including smart mobility and transportation.
- National Biodiversity Mission: Establishment of a vibrant biodiversity based economy and enhanced options for agricultural production and livelihood security and the general well-being of society.

- Electric Vehicles (EVs)
- BioScience for Human Health
- Waste to Wealth: It aims to identify, develop and deploy technologies to treat waste to generate energy, recycle materials and extract worth. The mission will assist and augment the Swachh Bharat and Smart Cities project.
- Deep Ocean Exploration
- AGNIi (Accelerating Growth of New India's Innovations): on 9: AGNIi (Accelerating Growth of New India's Innovations): The mission aims to support the national efforts to boost the innovation ecosystem in the country by connecting innovators across industry, individuals and the grassroots to the market and helping commercialise innovative solutions. It will provide a platform for innovators to bring their technology ready products and solutions to industry and the market thereby helping propel techno-entrepreneurship which can usher a new era of inclusive socio-economic growth. It includes services across the techno-commercialization chain.

AI is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction.

Particular applications of AI include expert systems, speech recognition and machine vision.[2]

In computer science, artificial intelligence (AI), sometimes called machine intelligence, is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans. Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving"[3]

As machines become increasingly capable, tasks considered to require "intelligence" are often removed from the definition of AI, a phenomenon known as the AI effect.[4] A quip in Tesler's Theorem says "AI is whatever hasn't been done yet."[5] For instance, optical character recognition is frequently excluded from things considered to be AI, having become a routine technology. [6] Modern machine capabilities generally classified as AI include successfully understanding human speech [3], competing at the highest level in strategic game systems such as chess, autonomously operating cars, intelligent routing in content delivery networks, and military simulations.

Based on scope, AI can be categorized as either weak or strong. Weak AI, also known as narrow AI, is an AI system that is designed and trained for a particular task. Example is, Virtual personal assistants, such as Apple's Siri. Strong AI, also known as artificial general intelligence, is an AI system with generalized human cognitive abilities. When presented with an unfamiliar task, a strong AI system is able to find a solution without human intervention. [2]

Artificial intelligence can also be classified according to levels of working into three different types of systems: analytical, human-inspired, and humanized artificial intelligence. [7] Analytical AI has only characteristics consistent with cognitive intelligence; generating a cognitive representation of the world and using learning based on past experience to inform future decisions. Human-inspired AI has elements from cognitive and emotional intelligence; understanding human emotions, in addition to cognitive elements, and considering them in their decision making. Humanized AI shows characteristics of all types of competencies (i.e., cognitive, emotional, and social intelligence), is able to be self-conscious and is self-aware in interactions.

This exploratory paper on AI is intended to draw attention towards AI based applications of accounting unfolding newer opportunities for integrative modeling of AI based accounting, behavioral finance and cyclical fluctuations in trade, industry and business as a whole.

II. AI Applications

The traditional problems (or goals) of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception and the ability to move and manipulate objects. Approaches include statistical methods, computational intelligence, and traditional symbolic AI. Many tools are used in AI, including versions of search and mathematical optimization, artificial neural networks, and methods based on statistics, probability and economics. The AI field draws upon computer science, information engineering,

mathematics, psychology, linguistics, philosophy, and many other fields.

AI and Finance

Robotic process automation is being applied to highly repetitive tasks normally performed by humans. Machine learning algorithms are being integrated into analytics and CRM platforms to uncover information on how to better serve customers. Chatbots have been incorporated into websites to provide immediate service to customers. Automation of job positions has also become a talking point among academics and IT analysts. [2] AI in personal finance applications, such as Mint or Turbo Tax, is disrupting financial institutions. Applications such as these collect personal data and provide financial advice. Other programs, such as IBM Watson, have been applied to the process of buying a home. Today, software performs much of the trading on Wall Street.[2] Dalal Street is also no more an exception.

Financial institutions have long used artificial neural network systems to detect charges or claims outside of the norm, flagging these for human investigation. The use of AI in banking can be traced back to 1987 when Security Pacific National Bank in US set-up a Fraud Prevention Task force to counter the unauthorized use of debit cards. Programs like Kasisto and Moneystream are using AI in financial services. [8]

Banks use artificial intelligence systems today to organize operations, maintain book-keeping, invest in stocks, and manage properties. AI can react to changes overnight or when business is not taking place. [9] In August 2001, robots beat humans in a simulated financial trading competition.[10] AI has also reduced fraud and financial crimes by monitoring behavioral patterns of users for any abnormal changes or anomalies. [11]

AI is also being used by corporations. Robotic process automation (RPA) is already being used today in corporate finance. RPA uses artificial intelligence to train and teach software robots to process transactions, monitor compliance and audit processes automatically. [12]

The use of AI machines in the market in applications such as online trading and decision making has changed major economic theories. For example, AI based buying and selling platforms have changed the law of supply and demand in that it is now possible to easily estimate individualized demand and supply curves and thus individualized pricing. Furthermore, AI machines reduce information asymmetry in the market and thus making markets more efficient while reducing the volume of trades. Furthermore, AI in the markets limits the consequences of behavior in the markets again making markets more efficient. Other theories where AI has had impact include in rational choice, rational expectations, game theory, Lewis turning point, portfolio optimization and counterfactual thinking. [13]

Audit

For financial statements audit, AI makes continuous audit possible. AI tools could analyze many sets of different information immediately. The potential benefit would be the overall audit risk will be reduced, the level of assurance will be increased and the time duration of audit will be reduced. [14]

III. AI, BUSINESS CYCLES AND BEHAVIORAL FINANCE

The economists have started speculating a few days earlier that the years 2019-21 are going to suffer depression worldwide. There are strong indications from the automobile and financial sectors. This description is in the line with the more methodical law of social cycle by P. R. Sarkar based on systaltic principle, characteristics of the human mind & collective psychology and Kolbe's four fold typology of human competencies. [15] Sarkar thinks that each and every moment in this universe is systaltic or pulsative. Nothing ever moves in a straight line. Due to this systaltic motion, internal clash and cohesion take place. The ups and downs of socio economic life in different phases of the social order are sure to take place due to this systaltic principle.

Depressions occur every three years but have little impact. Every thirty years they occur to a much greater extent and every 360 years they are felt acutely. These 3; 30; 60; and 360 yearly economic cycles are in perfect coordination with earthly astronomical cycles of 2,160 years; and 25,920 years [16] as well as cosmic cycle of 3600 years or to be simple 3500 years. The earthly astronomical cycles are connected with shifting of poles as a cumulative effect of wobbling of the earth in its axis. [17] [18] Here, Sarkar has discovered a new regular or

rhythmical cycle quite different from all the other cycles discovered thus for displaying varying and irregular periodicity.

Prof. Ravi Batra has, in his famous work 'The Great Depression of 1990' elaborated Sarkar's approach in full detail with particular reference to the U.S. economy on the basis of a diagnosis of American history and economics. He finds an unmistakable conclusion from an in-depth study of four economic variables, namely money supply, inflation, regulation and depressions. Going as far back as the l750s he has discovered that all the variables have followed an amazing rhythmical pattern. Every third decade in the U.S. economy has been the peak decade of inflation for more than two centuries except during the trauma following the American Civil War of 1860s. [19] The high inflation of the 1970s, 1940s, 1910s, and so on was no fluke, it was part of an inflationary cycle that has crested every third decade. Furthermore, every peak decade of inflation was also the peak decade of money growth and regulation. All these variables last crested during the 1970s.

As regards economic contractions, the three decade pattern described above still holds, but with a modification. A steep depression has occurred every decade since the 1780s. Moreover, a depression, which is far worse than a recession, occurred every third or sixth decade in the sense that if the third decade managed to avoid the crisis, then the next third decade suffered a cumulative effect, an all-time economic disaster. Thus, a depression occurred in the 1780s but not in the 1810s. Hence, the next third decade, the 1840s, witnessed an unprecedented economic calamity. But the 1870s, thirty years later, also suffered the great depression instead of a mild one due to the disturbed cycle of inflation and again of deflation as a fallout of the American Civil War as mentioned in the last para. Then, the decade of 1900s had a mild depression and again a great depression in the 1930s. Hence, the American Civil War has changed heavily the course of inflation and depression in it own way. There was no such disaster in the 1960s. If the two century long pattern continues, then the 1990s had to experience a great depression in history and as this depression has prolonged and continues with even increasing deceptive intensity with accumulative effects of many non-economic factors like clash of civilizations, clutching dogmas, terrorism, violent natural changes, cultural perversion and so on, this estimation has proved true. Then the current depression of 2020s has to be mild in impact. [19]

It has also been observed that a high inflation usually occurs at a gap of ten years from the starting period of a depression as is clear from the facts given above. Further, both a high inflation and depression have a usual duration of six years each. For example, the depression of 1930s covered the period 1929-36 while the high inflation of 1940s covered 1939-45. To this I may add that the current depression since 1990 is quite different and much more deceptive as it is the fag end of the 360 yearly cycle which had started with the Christian Inquisition since 1630s; rejection of Christianity and adoption of Buddhism by Japan as well as with the building of Taj Mahal in India by Shah Jahan and gradual ascendance of Aurangzeb leading to inevitable downfall of the Mughal Empire. This is also the culminating point of cosmic cycle of 3600 years (rounded off to 3500 for the sake of simplicity) and earthly cycle of 2160 years as already detailed. Further the prescribed duration of the current depression of 2020s may be 2020-2026 and the subsequent inflationary pressure has to be during 2030-2036. [19]

Other interesting attempts on this line have been made by the technical analysts of the socioeconomic school like Ralph Nelson Elliott in the 1930s in his book—The Wave Principle(1938) and in full detail in his final major work, Nature's Laws – The Secret of the Universe (1946), (Elliott, 1994) [20] followed by Robert R. Prechter presently(Prechter, 2003) with mathematical generalization(particularly of Fibonacci series). [21]

Policy Aspect: Smoothening and Not Elimination

The amplitude of the aforementioned violent fluctuations can be reduced significantly for relatively longer time through certain fundamental measures as prescribed further and in this way smooth & harmonious movement of the economy can be ensured. But these measures cannot eliminate the fluctuations in toto. Nor is it desirable because straight-line evolution is not possible for any entity no matter what. These fluctuations are just as all living being cannot survive without breathing in and out in order, the overall system also cannot.

Here, I can propose two hypothetical assumptions. One is that there are many kinds of regular and non-regular (arising out of disturbing human interference)

cycles at the various levels of consciousness in the nature. They are basically responsible for formation of social cycles in direct combination with social factors. Similarly, the social cycles in direct combination with economic factors are responsible for formation of economic cycles. The social and economic cycles in direct combination with the political factors become responsible for changes and upheavals in the system of governance. The other one which is inherent in the first assumption is that the major part of the political system is a part of the economic system and the remaining part is non-economic in nature; the political and economic systems are part of the much wider social system and the social system is a part of the vast natural system. Thus the position of these systems may be just like the hands of clock. A slight movement in the hour hand results in manifold movement in the minute hand and same is the case with movement of the second hand in comparison to minute hand. Slight movement in the natural cycles may bring vast changes in social cycle and system. Sight movement in the social cycle may be responsible for vast changes in the economic system and slight changes in the socio-economic system may generate many upheavals in the political system. This phenomenon is shown in Figure 2. The size of each system in comparison to lower systems/sub-systems may be taken in logarithmic proportions. Sarkar has opened many vistas of further research in these fields.

So, within these complications and uncertainties what will happen to the shape of economic oscillations when the suggested reforms are adopted'? Figure 3 illustrates this case where the cycle of inflation and depression ABCDEFG is transformed into a controlled cycle ABSTUVW.

IV. IMPLICATIONS FOR BEHAVIOURAL FINANCE AND AI

In a money oriented market system all economic activities move around money. It is a primary determinant of economic activity under capitalism. Thus flow and distribution of money are indications of generation and distribution of income and wealth. If flow of money is blocked by its hoarding and underutilization by some acquisitors, it may lead to serious distortions in the system. Black money is a major blockade. Thus for smooth functioning of the production structure the smooth flow of money requires to be ensured. For this tax on labor & salaried income earnings/productive efforts which is a major factor responsible for black money should be minimized or even removed. Current production and consumption should be encouraged. Unproductive and non-productive income and wealth should be heavily taxed. Unreasonably iniquitous distribution of money leads to disparities in distribution of both income and wealth. In higher income groups the propensity to save and create assets or wealth increases more than proportionately. Suppose two households A and B have their annual incomes of $50,000 and $200,000 respectively. A with lower propensity to save might be saving just $5,000 in a year while B, with an income four times more than A, might be able to save up to $100,000, i.e., twenty times more than that by A. Thus, any improper distribution of income may lead to much more serious discrepancies in the distribution of wealth. People tend to keep a portion of their current income as well as permanent income or wealth in the form of money and the rest as near money assets and other assets. Thus money is not proportionately but closely associated with income and wealth. Even if we do not get exact estimates of individual income and wealth the distribution of money can be assessed much more easily and accurately by obtaining data about people saving and investment in the financial markets and reducing the size of black money.

The above discussion has certain implications regarding designing models for AI based accounting system:

1. To improve distribution of money the tax on earned income/productive efforts should be reduced heavily or even removed while inherited wealth, windfall gains, land and non-productive earnings should be heavily taxed. Remuneration system in the economy should have reasonable association with one's contribution—its nature and amount.
2. In times of a recession, no worker should be laid off, only working hours should be reduced, so that all will equally share the burden of business contraction.
3. The budgets of the business entities as well as the government may be kept balanced over the business cycle, that is to say, the budget should

be in surplus when the economy is booming, in deficit, when the economy is in a recession.

4. Money (liquidity) growth should equal the average growth of the economy over the business cycle. It should be raised during recession and reduced during booms. Yet this fine tuning should not be carried too far.

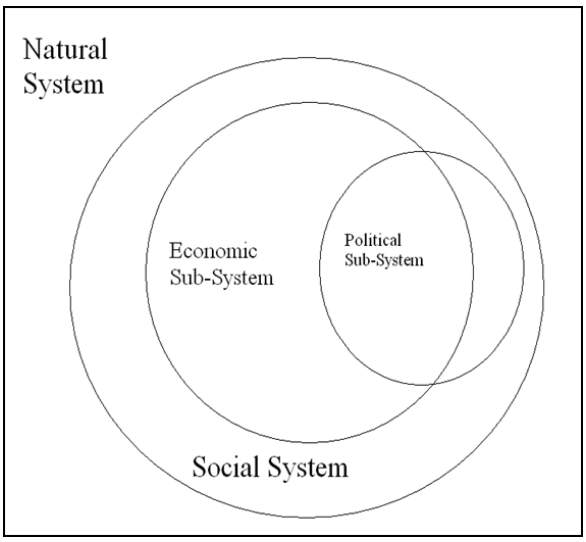
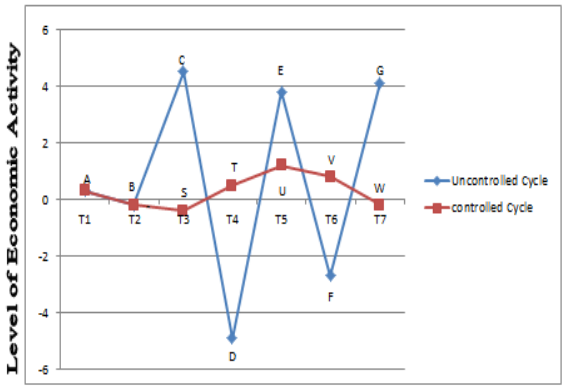


Figure2



TIME Figure 3

V. CONCLUSION

AI is unfolding newer opportunities for integrative modeling of AI based accounting, behavioral finance and cyclical fluctuations in the economy, sector wise and also as a whole. Proper security and ethical concern is also required for the potential for abuse of AI tools. For example, hackers may use sophisticated machine learning tools to gain access to sensitive systems, thus complicating the issue of security.

Behavioral accounting considers and integrates human behavior into accounting decisions in an organization. It cuts across financial, managerial and accounting research.

In behavioral accounting the valuation of a company goes beyond the numbers and attempts to include the human factor. Take the example of two companies, company X and Y, which have identical financial statements. If X has a more experienced workforce, and capable management than Y then X should be worth more. Behavioral accounting attempts to measure and record this aspect of a business. AI in convergence with Big Data, NLP, Fuzzy Logic and expert systems is providing sophisticated support to the recording mechanism.

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