INDUSTRY4.0: OPPORTUNITIES AND CHALLENGES A MANAGEMENT ACCOUNTING PERSPECTIVE

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Abstract

The steady evolution of last three industrial revolution over 200 years led the world to witness the advancement of digitalisation, which has given rise the rapid development of noble technologies referred to as Industry 4.0 "Fourth Industrial Revolution" concept primarily coined by German government. (Liu and Xu, 2017;Hofmann and Rüsch, 2017; Dalenogare et al. 2018). However, the concept is difficult to define due to the vast complexity, but it illustrates collective advancement of technologies to synchronise large amount real time data in a de-centralised fashion leading to the creation of "Smart Factories" (Lasi et al. 2014; Liu and Xu, 2017). Burns et al. (2013), emphasised the considerable advancement of technologies have delivered profound impact on information preparation and dissemination while the purposes of management accounting is to analyse financial and non-financial information to assist organisation in decision-making.

This article aims to present a critical analysis on the potential impact of Industry 4.0 subsequently on environment, manufacturing and circular economy in the context of management accounting practice leading into opportunities & challenges that countries and organisations may encounter in the future competitive business environment.

Key words: Industry 4.0, management accounting.

Industry 4.0 and management accounting

With cost accounting being an integral component in organisational decision-making, it is vital to understand the potential implication of industry 4.0 in the field of manufacturing, environment and circular economy through the lens of a management accounting practice. The following section will also encompass opportunities and challenges surrounding Industry 4.0.

Manufacturing and management accounting

Since the onset of Industry 1.0, the relationship between management accounting and manufacturing became complex due to mass production and business trading with emphasis on the development of techniques required for credible information for organisational decision-making (Burns et al. 2013). From the field of academics and practitioners, cost information analysis is fundamental for various

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aspects of firm, as Johnson and Kaplan (1987), called for innovation in management accounting that offers new tools and accurate costing information. Identifying the significance of generating and sharing information, management accounting led to development of powerful set of tools and techniques such as Kaizen costing (reducing cost from continuous improvement), Target costing (proactive costing approach at the Research & Development R&D stage), Activity-based costing (ABC) (allocation of overhead costs to activities), Balanced scorecard (analyse financial and non-financial information) which are capable of providing costing information (Ramos, 2004; Burns et.al., 2013).

Nixon and Burns (2005), postulated the integration of "knowledge economy" with the emergence of "Big Data" and "Cloud Computing" will allow the organisation to control intellectual capital and gain in-depth information about the product lifecycle. Hence, the intellectual capital and knowledge management will create opportunity allowing management accounting techniques to deliver continuous improvement from more accurate and relevant costing information on raw material, labour, overhead, activities and processes whether fixed or variable.

Environment and management accounting

The concept of eco-efficiency through sustainable development was popularised for integrating assessment of financial performance and corporate environment in the field of management accounting (Huppes and Ishikawa, 2005; Ciroth, 2009) despite receiving limited attention (Figge and Hahn, 2013). Porter and Linde (1995), accentuated pollution equates to economic waste which is caused by the ineffective, inefficient and incomplete use of environmental resources, therefore, hidden costs from wasted resources are buried throughout the product's life cycle.

Burritt and Christ (2016), postulated Industry 4.0 represents a future vision in combining advanced technologies from improved digitalisation to create opportunities through the development of smart objects such as IoT, IoS, CPS and ICT potentially enhance environmental accounting to have timely accurate, reliable, comparable data, furthermore, reduce the problem of green wash and brown wash which traditionally has been locked environmental accounting disclosure and minimised the discretion of management.

For example, in Industry 4.0 smart objects will transform invisible and poor-quality data surrounding environmental economic impact and cost of sales into visible and accurate insights, in support of *Material Flow Cost Accounting ISO 14051* through monitoring physical material, environmental

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resources and energy flow in real time to reduce environmental waste and material loss from actual and predicted inefficiencies linking economic and environmental performance (Lee et al. 2014).

Jabbour etal. (2018), identified eleven contributing critical success factor (CSF) in the context of resource constraints and competitiveness to make synergy between Industry 4.0 and environmentally sustainable manufacturing. These technologies integrate with CSF which unlocks the full potential of environmentally sustainable manufacturing through developing green product, manufacturing and supply chain.

Recently, Koilo (2019), highlights capability of smart technologies through exchanging and communicating autonomous information in manufacturing science to reduce carbon emission, natural resource consumption and waste generation along with ICT in order to maintain consistency between economic and sustainable development. Thus, Industry 4.0 not only allows companies to achieve greater economic performance in future but also to have environmental efficiency through creating sustainable value to offer a stable and secure society.

Circular Economy and management accounting

Circular economy (CE) has emerged as a new business mind-set which is geared to help societies move towards sustainability of energy and materials. The current economy operates with the perspective of “take, make, use and dispose” in the linear economy thus leading to the loss of value of resources. The ushering of new technologies through Industry 4.0, barriers relating to uncertainty are expected to nullify. The concept of IoT will allow businesses to track their products post-consumption to recover key components (Jabbour et al. 2018).

For management accountants, the concept of CE will allow their clients (businesses) to operate competitively and efficiently within industry 4.0. Suwaldiman(2005), argues that management accounting is changing from cost focus to value creation through its focus on Human Resource (HR) can be integrated with CE. Hopper etal. (2007), states that the key to value creation from management accountants is through “getting user connected” rather than “getting things right”. Ratnatunga (2015), highlights how new technologies (3D printing, Maglev, Fuel cells and Robotic vehicles) on management accountant and how this will lead to an overall reduction in the variable costs and further enhance the capacity of the business to reuse waste tying it into CE. Stock and Seliger(2016), states that Industry 4.0 technologies contribute towards great value chains and allow businesses for sustainable operations management which are the main principles behind Industry 4.0 and CE.

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Jabbour et al.(2018),has illustratedReSOLVE framework that would allow decision-makers to alter their business actions as they prepare their firms for the data-driven revolution of Industry 4.0. Organisations could opt to use the ReSOLVE framework as a guiding light to adopt new technologies accompanying Industry 4.0. The framework would impact tracing, tracking, packaging and other aspects within the product life cycle.

Industry 4.0 and potential challenges

The emerging concept of Industry 4.0 surrounding "self-awareness, self-prophesying, self-comparison, and self-maintenance" may represent enormous opportunities and benefits, however, it is essential to outline potential challenges or barriers that countries or organisation may encounter with regards to its adoption and implementation. Since the emergence of the concept, adoption of Industry 4.0 mainly focused on capital intensive market, where large manufacturing companies can be the catalyst for the development of environmental management accounting, in contrast, small and medium sized enterprises (SME) initially ignored considering required level of investment of acquiring such technologies (Burritt and Christ, 2016). As Jabbour et al. (2018), accentuated the need for extensive investment in training employees to equip with knowledge and skills to adopt Industry 4.0 technologies in order to understand and handle advanced information in environmental management accounting.

One of the most challenging for developing economies growth for manufacturing firms is the low-cost workforce, which results in cautious or late investments in computerisation and other technologies (Castellacci, 2008). Furthermore, supply chain of the manufacturing firm leading to be less cohesive, comparing the capital structure between emerging and developed countries. As Dalenogare et.al. (2018), stressed major difficulties arise from the adoption of Industry 4.0 technologies is due to the lack of investments in R&D, uncertainty in the political and economic and poor quality education and research institutions. Burns et al. (2013), highlights the concern over security, data protection, privacy and dependency on the service of protecting sensitive business information while adopting cloud computing facilities provided by third party.

A roadmap for organisation who would encounter challenges as they fully diffuse new tech on the onset of Industry 4.0. AsRatnatunga (2015) stated, management accountants must be aware of the potential upsides and downsides of new tech which would impact their decision-making for organisations. Challenges could rise in many forms predominantly under change such as technology diffusion, organisational structure and budget constraints. Essentially, companies are unwilling to accept this new regime due uncertainties in cost, Return on Investment (ROI) and life cycle of their

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products. Furthermore, risk appetite plays a major role in how firms handle change of adapting themselves to the new technologies accompanied by the arrival of Industry 4.0.

Conclusion

This report outlines the evolution of Industry 4.0 and their potential implication on management accounting techniques of cost management. Inferential analysis on opportunities and challenges has been drawn upon manufacturing, environment and circular economy in the context of management accounting practice.

Industry 4.0 has led to breakthroughs in innovation in terms data acquisition, data analysis and better predictive analytics. All of these will benefit the role of management accountants in their pursuit of cost reduction and decision-making. Industry 4.0 will have a profound impact on manufacturing, which is the genesis of a profitable business cycle. This speculative vision on automated manufacturing will have a strong influence on environmental accounting which is predicted to enhance waste management that ties strongly into the concept of circular economy and sustainability. Businesses could use the ReSOLVE framework during their encounter with challenges faced with the adoption of new technologies of Industry 4.0. The vision of Industry 4.0 is a few years away from commercialisation and management accountants have to take relevant steps to cope with this pioneering change.

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