Editorial

The Impact of New Technologies on the Management Accountant

Janek Ratnatunga*

Abstract

Factories at home or in a small business (3D Printing); costless travel over long distances (Maglev); generators powering all energy requirements (Fuel Cells); a farm in a high-rise building (Hydroponics); driver-less taxis (Robotic Vehicles) are all technologies that are already with us, and only a few years away from commercialisation.

A few years further into the future may see life expectancies increase via the advances in biological response modifier therapies. Wireless electricity will enable a user to access to power the same way as a mobile telephone call. Hot fusion will have an enormous impact on the waste-management and recycling costs in industries. Finally, the biggest game changer that will affect many facets of our life will be cultured meat, i.e. meat without livestock that will not only have a major impact on many industries but also on our religious belief systems.

As a profession that prides itself as dwelling in the future, management accountants need to be aware of the dramatic changes to business models that these technologies will bring.

Keywords

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* Calwest University

Introduction

Computers, cell phones, the internet, and other new technologies have changed our lives and revolutionized business and industry in the last two decades. E-business, b2b, b2c, cloud computing have all changed the very business models of major corporations. Google, Facebook, Amazon, e-Bay could not have come into existence without such technologies. Here are some new technologies with the potential to make even greater changes to the way we do business and run our lives. Management Accountants must be aware that these technologies will have a major impact cost management and decision making.

3-D Printing

This could potentially be the most disruptive technology introduced since the personal computer. 3D printing is any of various processes to make a three-dimensional object. In 3D printing, additive processes are used, in which successive layers of material are laid down under computer control. These objects can be of almost any shape or geometry, and are produced from a 3D model or other electronic data source. A 3D printer is a type of industrial robot.

3D printing in the term's original and technically precise sense refers to processes that sequentially deposit material onto a powder bed with inkjet printer heads (Freedman, 2012). More recently the meaning of the term has expanded to encompass a wider variety of techniques such as extrusion and sintering based processes. Technical standards use the term Additive Manufacturing (AM) for this broader sense.

A 3-D printer is literally a factory in a box; a person puts in raw material, pushes a button, and the box makes an object. Today's 3-D printers make plastic models or metal parts for machines. They're called printers because they make three dimensional objects the way printers put images on paper. In the future, when you go to the garage, instead of ordering parts, the mechanic could look them up online, and then download the designs into a 3-D printer that could make them. Huge numbers

of inventors and engineers all over the world are working on 3-D printers. There are plans for printers that make food, clothing, chemicals, and drugs. A pharmacist using a drug printer could manufacture your prescription while you wait. A company named Contour Crafting (linked to the University of Southern California) even has plans to make buildings with 3-D printed components. If 3-D printing works out, the changes it brings could be vast. Instead of factories in China making our clothes and a vast transportation structure, there could be a machine in a shop at the mall that makes clothing. There's also a dark side to this; for example, how will gun control laws be enforced if anybody can download the plans to an AK-47 and make one using a 3-D printer?

The management accountant must be aware of the significant changes to cost structures that result in 3-D printing. The old concept of direct materials and labour and indirect overhead allocated based on activities will need to be replaced by a costing model that recognizes the chemical elements of components. As these chemical elements can be used for a number of products; the concept of direct materials becomes a thing of the past. All costs are indirect. Also, the concept of set-up costs, transportation costs and quality control costs will need to be rethought. The benefits of mass production would be eliminated with the advent of 3D printing. Every product will be a customised product. In addition, there will be an impact on international trade. A design done in one country can be emailed to another without any shipping costs, insurance, customs duties or import taxes being paid.

Maglev

Magnetic levitation uses magnetism to literally levitate a train right above a track. The theory behind this technology has been available for yours (Gharabegian, 2000). It is only of recent times that it has been successfully put into practice in a commercially viable way, and is referred to as a Maglev train.

Maglev technologies enables a train to move across the ground at speeds of over 300 miles per hour using minimal energy and few moving parts. That means it provides high speed ground travel at little or no cost. A person using one would be able to travel from Las Vegas to Los Angeles in about an hour. The Transrapid combine from Germany has perfected maglev and built a 19-mile long maglev that carries commuters between Pudong International Airport and the Chinese City of Shanghai. A 10-mile long Maglev commuter line is under construction in Beijing. The Japanese government has given preliminary approval for the Chuo Shinkansen, the world's first Maglev bullet train, which would travel between Tokyo, Osaka, and Nagoya at speeds of 505 kilometers (313 miles) an hour. Current plans call for service to begin in 2027. Several other maglev lines are planned around the world, including some in the U.S. and Australia.

The effects of Maglev travel could be as disruptive as earlier transportation advances like cars. Maglev could allow a person to live in Canberra, Australia and commute to a job in Melbourne or Sydney on a daily basis. It could also greatly reduce the cost of shipping and travel. The only thing blocking this technology would be the high cost of building Maglev lines. Several Maglev projects have been proposed in Germany, but cancelled due to costs. Successful lines in Japan, China and elsewhere could change that.

The management accountant must be aware of the significant changes to transportation cost structures that Maglev will result in. Whereas in 3-D printing the product was manufactured on the spot (thus requiring no delivery costs); a Maglev train can bring the product (or the person to do a particular service required) for very little variable cost to the location at which the product or service is required. The main cost will be a sunk cost; i.e. the depreciation of the cost of building Maglev lines. This is much like the Telecommunications industry today. The main cost is the infrastructure, i.e. the Telecommunications network. The variable cost of a telephone call is almost zero.

Fuel Cells/Energy Servers

Imagine a future without power lines or an electric power grid. That's what these advances could promise. Instead of thousands of miles of wire, all the energy needed for your home could be produced by a box in your basement. Other advances could be electric cars that could run for a year or more on a

unit. That's the promise of a fuel cell, a device that converts fuel such as hydrogen, natural gas, or gasoline directly into electricity (Larminie, 2003).

The technology has been around for a long time, but it is getting perfected. Big companies like Wal-Mart are now buying devices called Bloom Boxes that employ fuel cells as backup power generators. The gas company in Great Britain is readying home fuel cells that operate on natural gas; these would produce both heat and electricity. A company in the U.S. called Clear Edge Power is promoting a home fuel cell that would serve as a hot water heater and an electric generator that would run on propane or natural gas, and it is being sold online right now. The effects of this technology could be interesting if a large percentage of its former customers unplug from it and start making their own power at home.

The management accountant must be aware of the significant changes to energy cost structures that will result with this technology. The business model of power companies would need to be re-thought. They will no longer be generating power via a coal fired plant and transporting this power 1,000s of miles to business and household end-users. Also, as the emission of green-house gases will be minimised; this technology has the potential to impact Climate Change legislation. Governments may provide subsidies to businesses and homes that change to fuel cells.

Hydroponics

Hydroponics is the science of growing plants in water and liquid fertilizer in a greenhouse instead of a farm's field (Thiyagarajan, et. al., 2007). This method could produce better fruits and vegetables, and it's been around a long time since World War II. The only thing that's prevented its adoption has been the high cost of energy. New technology, some of it interestingly enough developed by illegal marijuana growers, is making it viable again. Also, the fuel cells and energy savers discussed in the earlier section has the potential of reducing the high cost of energy.

One advantage such Hydroponics operations have, would be lower transportation costs. Food could be grown in warehouses and other buildings in large cities and provide vegetables all year long. Another advantage is that hydroponics does not require pesticides or herbicides, so it uses fewer chemicals and is healthier. There is no risk of cancer or other side effects caused by pesticides because none are used. It could also be used to grow large amounts of food in areas where extra land is not available or cropland has been exhausted by overfarming. If energy costs are kept down, it would be competitive with food shipped over long distances. Hydroponics is already being tested in America. A company called Gotham Greens is pioneering hydroponics in New York City with a large scale greenhouse in an old bowling alley in Brooklyn. It produces organic lettuce and basil for sale to the city's restaurants. If energy costs can be kept down, this could be the agriculture of the future.

The management accountant must be aware of the significant changes to food production and food transport cost structures that will result with this technology. If crops can be grown 12 months a year in a climate controlled greenhouses that are in the local area of the end-user, how will traditional farms compete?

In addition to food transport costs, this technology has the potential to reduce the emission of green-house gases from both farm equipment (carbon dioxide) and farm animals used as beasts of burden (methane). As such, this technology has the potential to impact Climate Change legislation. Governments may provide subsidies to farm businesses using Hydroponics.

Robotic Vehicles

Remote-controlled drones and robot planes are already changing the face of warfare and will soon be moving into other fields. Some examples could be buses and taxi cabs that drive themselves (Thrun, 2010). Drones could soon be doing surveillance for the police and covering news stories for TV stations in our cities. Imagine a rental car that drives back to the Avis or Hertz location when you no longer need it. Or delivery trucks without drivers. Or fully equipped medical ambulances (without staff), that can get emergency life saving equipment for a layman to administer to a patient; with a doctor giving instructions via

the drone. Such an ambulance drone can cut response time by 90%, and could mean the difference between life and death.

Another potential development would be pilot-less air shuttles that could pick people up and take them where they want to go. Other examples could be construction machines like bulldozers that run themselves. Or even robot tanks to patrol the battlefield of the future. Smaller robotic vehicles, including robotic fish that actually swim underwater and mini drones that fly like hummingbirds, could have even other uses we are not aware of. These devices could be used for surveillance or to deliver bombs in warfare. More peaceful uses could be robotic street sweepers to keep our cities clean or robotic lawnmowers in public parks.

The management accountant must be aware of the significant changes to labour cost structures and human resource management that these robotic vehicles will bring about. Programming and specialist costs at central locations will increase, but the labour costs of those involved in the actual moving (truck drivers, pilots, ambulance drivers, etc.) will be reduced. In addition, all of the service stations, cafés, motels, and adult entertainment venues set up to service the long-haul drivers will have a reduction in clientele.

Biological Therapy

Also called vaccine therapy, biotherapy or biological response modifier therapy is an approach that literally reprograms the human immune system to fight disease and its symptoms (Staren, et., al., 1989). It does this with substances made by the body itself, rather than drugs. The immune system is reprogrammed by adding biological modifier substances that change the operation of cells. Some of these substances can program white blood cells to destroy cancer cells or destroy cancer cells on a molecular level. They can even alter the growth patterns of cancer cells so they operate like healthy tissue. Today it's being used as a cancer treatment, but in the future, it could be used as a treatment for other diseases.

Some biological therapies can counteract the symptoms of cancer. It is possible that someday biological therapies that could counteract or even reverse some of the symptoms of aging could be developed. New treatments are being developed, include cancer vaccines. Doctors at the Hassadah University in Israel are even testing a new cancer vaccine that could keep 90 percent of cancers from coming back. The vaccine is being developed by a company called Vaxil Bio Therapeutics. Future developments in this field could be vaccines for allergies, infections, viruses (including AIDS and the common cold), and the effects of diseases such as Parkinson's and Alzheimer's.

The management accountant must be aware that such biological response modifier therapies have the potential to significantly increase life expectancies. Recently, the Australian government stated that it needs to reconsider the cost structures of government subsidies for its Medicare benefits scheme as Australians were expected to live to an age of 150 years. This increased life expectancy will also affect retirement ages, and services provided after retirement. If compulsory retirement (as in some countries) is 60 or 65 years; then one can look forward to 85 to 90 years of retirement! The management accountant should consider the impact of this in terms of productivity; the work-life balance; youth unemployment and what individuals can do with all that leisure time.

Wireless Electricity

We are all familiar with the wireless internet in which you can access the web through radio signals. Wireless electricity takes this one-step further by where electronic devices literally pull power out of the air. Instead of extension cords, you would have an electric hotspot that would provide power to your gadgets. In the future, phones could draw power from the cell phone network in the way they draw signals today. Long-term electric cars could draw power from transmitters by the road. Or electricity could be transmitted like microwave signals are today, eliminating the need for an expensive power grid (Leyh and Kennan, 2008).

Wireless electricity is not a new idea. Nikola Tesla, Thomas Edison's great rival and the inventor of the electric grid, tried to develop it in the last century. Companies like Powercast and WiTricity are developing it now. WiTricity uses technology developed at MIT.

WiTricity already has light bulbs that can run off radio waves, and is currently working on two applications of the technology, direct wireless power, in which devices will be powered only by wireless, and automatic wireless charging, in which device recharges itself when it gets in a wireless electric hotspot. With this technology, an electric car could recharge itself in a parking lot without being plugged in. WiTricity currently has contracts to work on wireless charging for electric vehicles with companies like Toyota and Mitsubishi. It's also working on the wireless charging of medical implants, such as pacemakers. The only thing stopping it is the lack of power; if it could be perfected, it could be as big a game changer as Hot Fusion (discussed next).

If this technology is perfected, management accountants in power companies must rethink their pricing strategies. Like in the case of the internet, in which subscribers pay a monthly rental to download a certain amount of data; electricity will be delivered to customers, wherever they are, by subscription. They should also be aware of potential class actions if such electricity generation is found to be a health hazard. Even non-subscribers may sue the Power Company for 'passive' wireless electricity risks; much like the tobacco industry faced with passive smokers.

Hot Fusion

Hot fusion basically attempts to recreate the process that the sun uses to generate heat and light (Chen, 2011: Clery, 2013, and Dean, 2013). Hot fusion would generate vast amounts of heat and could be used to run steam turbines to generate electricity. It could also be used for waste disposal, particularly the burning of hazardous waste. An example of the use of hot fusion would be a plant under the streets of Manhattan that would provide all the heat and electricity the skyscrapers above need and burn up all the garbage they produce without producing any pollution. Governments and big corporations have been working on it for decades with little or no success. A consortium of nations called the ITER is building a demonstration hot fusion plant in France that could prove its feasibility. Currently, its plant is supposed to start making super hot plasma and demonstrate the viability of hot fusion in 2019. Unfortunately, its plans do not call for large scale power generation by hot fusion until the 2030s.

The private sector might beat ITER to the market. Several private companies, including General Fusion in Canada and Lawrenceville Plasma Physics in the U.S., are also working on fusion and could beat ITER to the punch. These companies have not achieved success yet, but they have high level support. Bill Gates and Steve Bezos of Amazon are among the wealthy investors who have invested money to support their work. If it works, hot fusion could make electricity production cheaper, and it would apparently be safer than traditional nuclear reactors.

If this technology becomes accepted and widespread, the management accountant must be aware of the significant changes it will have in an organisation's life-cycle costing (LCC) models, especially in the area of solid waste disposal. The energy obtained by burning waste, can significantly reduce both energy cost structures and yield-loss recovery. If hot fusion can be undertaken with very little green-house gases being emanated this technology also has the potential to impact Climate Change legislation.

Meat Without Livestock

This game-changing idea is so new and radical, that it does not even have a proper name yet. Terms used for it include "carnaculture," "cultured meat" and "in-vitro meat." The idea is a simple one, grow meat in a tank or vat the way yeast is grown.

Scientists such as Mark Post, a physiology professor at the Eindhoven University of Technology in the Netherlands, are trying to grow meat from stem cells, but so far, their efforts have not been very successful. Post estimates that it would cost about $250,000 to grow enough meat to make a sausage with his process. People who have tasted Post's meat have described it as chewy and tasteless. Any commercial application of this process is years away because scientists have not figured out how to produce something that looks like meat. Yet there could be some real benefits from in-vitro meat if it could be perfected.

It could help reduce the greenhouse effect because cattle are a major generator of

greenhouse gases. It would also end the damage livestock grazing does to the land and eliminate the vast amounts of pollution created by big cattle and chicken farming. Another benefit of cultured meat is that cultured fish could provide protein and the overfishing of the oceans. A final benefit would be that the vast amounts of grain now fed to livestock could be used for food for the poor or as the ingredients for biofuels. Carnaculture could also provide meat for future space travellers.

These promises have led to the formation of a group of European scientists for the development of cultured meat. It would also end the practice of slaughtering animals for meat, which many people find inhumane. There are religious implications as well. If cultured meat is not the same as real meat, can Jews and Muslims eat cultured pork and Hindu's cultured beef?

Even if the process could be perfected, there are hurdles, such as people finding the idea disgusting, and it could even be illegal under the U.S. Food and Drug Administration regulations. There's also the cost, and one of the scientists developing it, Dr. Vladimir Mironov of the Medical University of South Carolina, estimates it would cost $1 billion to develop carnaculture. Yet, he hasn't been able to get any steady funding for his work. So the future of meat grown in a vat is questionable (Siegelbaum, 2008).

As one can see, this technology is a real game changer. The management accountants in industries as wide ranging as widespread as livestock; grain; fishing; transportation; hospitality and travel will need to re-think their business models. For example, McDonalds needs approximately 65,000 cows to be slaughtered per day to feed its customers their daily intake of beef burgers. As cattle take between 12 to 24 months to mature for slaughter (depending on the amount of grain added to their feed), there needs to be a stock of approximately 45 million heads of cattle being fed daily just to meet McDonalds' beef burger demand. All of these cows are emitting large quantities of methane which has about 25 times the potency for global warming as carbon dioxide. This means that as there will be a significant reduction in green-house gas emissions when this carnaculture technology is perfected, this technology also has the potential to impact Climate Change legislation.

Summary

Factories at home or in a small business (3D Printing); costless travel over long distances (Maglev); generators powering all home or small business energy requirements (Fuel Cells); a farm in your local city neighbourhood in a high-rise building (Hydroponics); driver-less taxis, ambulances and aircraft (Robotic Vehicles) are all technologies that are already with us, and only a few years away from commercialisation. The management accountant of today will need to be thinking of the strategic implications of such technologies in terms of cost management and business analysis.

A few years further into the future may see life expectancies increase to 150 years via the advances in biological response modifier therapies. This will cause significant and dramatic changes in the work place. This technology too is already with us, as is wireless electricity, in which you can get access to power the same as a telephone call.

Converting solid waste into electricity is already happening in a small scale, but if the technology is perfected via hot fusion, it will have an enormous impact on the waste-management and recycling costs in industries. Finally, the biggest game changer that will affect many facets of our life will be cultured meat, i.e. meat without livestock that will not only have a major impact on many industries but also on our religious belief systems.

Management accountants may feel that it is not that important to look that far into the future, but these changes could be with us in the next 25 years. As a profession that prides itself as dwelling in the future – as against financial accountants that scorekeep the past – it needs however, to be aware of the dramatic changes to business models that these technologies will bring.

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