Employment in a Tech Savvy Waste Industry

A look at future employment trends considering advancing technology

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Not unlike other industries, the solid waste industry has, in recent years, embarked on a quest to include "smart technologies" in everyday processes and programs. The objective for most municipalities and private haulers is fulfill the mantra: providing services cheaper, quicker, and better to their customers. This article will highlight the types of technologies that have been implemented to date and others, which are only showing up on the drawing boards of technology designers. The article will conclude with a brief discussion on the author's opinions on the impact upon future employment trends within the solid waste industry.

Waste Collection

Automation. Statistics from waste collection programs suggest that rear-loader collection crews lift on average, over 6 tons (13,000 pounds) per worker per day. This heavy, repetitive, manual lifting combined with an aging workforce has resulted in a higher rate of staff injuries.

Automated side-loader trucks were first implemented in the city of Phoenix in the 1970s with the aim of ending the back-breaking nature of residential solid waste collection, and to minimize worker injuries. Since then thousands of public agencies and private haulers have moved from the rear-loader method of residential waste collection to automated collection, providing the customer a variety of choices in standardized, rollout carts.

Rather than slogging through rain and high-temperature environments, operators of automated refuse collection systems spend their shifts in climate-controlled comfort. The reduced physical requirement increases the diversity and longevity of the workforce that is able to collect waste. Automated collection has proven to significantly reduce collection worker injuries resulting in reduced workers compensation costs, decreasing disability claims, decreasing the number and cost of light duty assignments, and reducing salary fringe benefit costs.

A phased-in approach to automated program deployment is typically employed to plan for staff reductions through attrition: in this way, retiring employees are not replaced. As standard turnover occurs, employees are also not replaced, or are replaced with temporary staffing until which time the conversion to automation reduces staffing permanently.

Driverless Collection. The next phase of automation for solid waste collection appears to be "self-driving trucks." That is, trucks that can navigate, stay in their lane, and slow or stop in response to traffic conditions completely without human intervention. What seemed futuristic and 30 or 40 years off into the future is now upon us. It seems highly likely that competition between the various companies developing these technologies (Tesla, Google, Apple, Carnegie Mellow University, etc.) will probably produce practical, self-driving trucks within the next five to 10 years. Once the technology is proven, our opinion is that the incentive to adopt it for the waste industry will be powerful. In the US alone, waste collection vehicles are involved in thousands of crashes a year, resulting in 33 fatalities in 2015, according to the US Bureau of Labor Statistics. Virtually all of these incidents can be traced to human error. The potential savings in lives, property damage, and exposure to liability will eventually become irresistible to both public and private waste haulers.

Customer Accounting Software. Accounting software is currently used by public and private operators to help in logistics, dispatch, manage customer communications and contracts, as well as billing and payments. When these accounting software tools are integrated with some of the smart technologies discussed in the paragraphs below, the organization can use the "Big Data" generated by these software programs to create efficient workflows and set efficient pricing for waste management services.

Routing Optimization. Since its introduction in the early 1990s, innovative route optimization technology has been used throughout the US by both private and municipal operations to streamline solid waste collection and monitor fleet performance. Saving on significant operating expenses like equipment costs, labor, and fuel, drives the need for waste collection operations to increase efficiency by reducing the number of routes, labor hours, and mileage through route optimization technology.

The three benefits of solid waste routing include improving efficiency, potentially reducing the number of vehicles out on the road and also future replacements, and improving morale through balancing routes across a solid waste collection system. Three challenges include data and information availability, buy-in by staff to help implement the results, decisions on the software to be used, whether it is a purchased or cloud-based, or delivered as a periodic service.

Waste routing software is typically complex to implement and has a high rate of failed implementations by municipalities. Typical complaints include that the software is too complicated to be adopted into daily operations; it is too expensive to purchase outright or procure through a monthly service fee; or the system maintenance requirements are too extensive. Nonetheless, routing is being implemented by many agencies and haulers to help optimize their collection routes and gain efficiency, and therefore, help drive improved economics of these collection programs.

Smart Electronics. Collection vehicles are not easy to maneuver and this is in part responsible for many accidents that they are involved with every year. To solve this driver safety issue, private companies and municipalities are installing high-tech camera systems in all of their vehicles. The 3rd Eye camera technology provided by Alliance Wireless Technologies (AWTI) enables a 360 degree external video system.

Municipal solid waste departments and private waste management companies are also increasingly buying radio frequency identification (RFID) tags and embedding them in solid waste and recycling bins. An RFID tag is like a barcode that can transmit its identifying numbers as a radio signal. This means that it is not necessary to see an RFID tag or even be close to it to scan it, as opposed to a barcode, which must be scanned with a handheld reader.

Instead, small readers placed on waste and recycling trucks can automatically detect and read RFID tags. The readers are small radios with antennas that constantly emit a signal. When an RFID tag comes within range, the reader's signal supplies the tag with the tiny bit of power required to activate it. The active tag transmits its data and the reader records it.

The data on an RFID tag is a series of numbers that identify the object to which it is attached. A tag may also store the name and address of a trashcan's owner as well as other information. The reader passes the information on the RFID tag to a computer database where software applications can put the data to use. Further, with the RFID system, a waste collection manager can view on the server when a truck is falling behind, based on the number of carts that have been emptied (contrasted with the number of carts on that vehicle's route), or based on the address at which the cart is expected to be, thereby indicating the truck's current location. The advantages to the waste collection operator is potentially substantial:

- Asset management—ability to track the location of the agency's carts
- Data tracking and enhanced real-time productivity measurements
- Route visualization and intelligence
- Ability to target needed education and outreach for individual homeowners or neighborhoods

Material Recovery Facilities

MRF design has evolved over the past several decades due to a number of important drivers, principally changes in governmental policies, expanding recyclables markets, and recyclable material end-user specifications. To improve the quality of the products recovered from the recyclables stream, MRFs have become more highly automated as well as increasing in design throughput capacity. Recent surveys of the recycling industry have shown more reported application of optical scanners, drum and eddy current separators, and air classifiers, as well as increasing retrofits of dual-stream systems to handle single-stream recyclables. This application of technology has resulted in a reduction of manual sorting labor on the picking lines, although manual sorters appear necessary in many facilities to ensure quality control over the recovered products.

Industrial robots have increasingly taken on routine tasks of many operations in a variety of manufacturing situations as well as in surgical settings. More advanced robots are gaining sensors and software, allowing them to perform non-routine, manual, repetitive tasks such as welding, cutting, and suturing. As mentioned in the discussion above, most MRFs already use a combination of advanced sorting technologies followed by hand separation.


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The first advanced sorting robotics is currently being offered by the finish engineering firm, Zen Robotics with its Zen Robotics Recycler. The system has been installed in MRFs in Asia to reclaim multiple potentially recyclable fractions from mixed construction demolition debris simultaneously with the help of industrial robots and smart machine learning technology. Lines installed in Sweden have proved adaptable to recover formerly unrecoverable streams of materials as well as being powered by onsite wind generators and operating during nighttime hours.

Landfill Operations

The life of a landfill is dependent on three things: the volume of the permitted landfill, the amount of waste received, and the density to which the waste is compacted. The compaction is the variable that is most readily influenced by the landfill operators. For this reason many landfills have their active area surveyed anywhere from once a year to meet regulator demands to as often as monthly to assess the compaction that is achieved. Before GPS surveying equipment became available, it was prohibitively expensive and time consuming to survey frequently. However, with GPS survey equipment more readily available and less expensive, having the active area of a landfill monitored on a monthly basis is not out of the question anymore. On landfills that are owned by a municipality and operated by a private companies, it is common to require the contracted company to meet a required level of compaction on a monthly or quarterly basis. Once gathered the GPS data is analyzed to confirm that the requirements were met.

GPS systems are utilized in other ways at landfills. Adding GPS to the heavy equipment itself can pay huge dividends. Having a GPS system in the landfill compactor or landfill bulldozer can provide real-time data on the current location and elevation of the working area. The onboard GPS system can also be used to make sure that the top of waste elevations and slopes are achieved before moving the active area. Without a GPS system a surveyor must come onsite and stake the area. This process is time consuming and often must be repeated several times before the proper elevations are achieved. Onboard GPS takes out the guess work while improving the efficiency of landfill operations.

A drone can be employed to gather the required topographical information by flying over the site on a programmed path.

GPS is not the only technology seeing use either. Today, drones are seeing an active role as well. Drones are now being used to monitor the landfill by gathering video, aerial photos, and topographical information. Instead of performing a ground survey, a drone can be employed to gather the required topographical information by flying over the site on a programmed path. Or they can be used to fly more remote parts of the site to check the perimeter fence, or remote monitoring well locations. Does the landfill have a construction project underway? Why not have daily aerial progress photos, or set the drone to fly a programmed path to produce a video of the construction areas? The drones can be programmed to fly a path or can be controlled by a pilot for smaller, less routine flights. If the drone is used to capture aerial images of the landfill, it can capture them more frequently than a manned aircraft could fly the site and at a fraction of the cost. As the technology improves and as people come up with more creative ways to use them drones, we will see more and more use in the industry in years to come. Many landfill operators are using GPS to reach better compaction and more effectively meet construction grades, how long till the compactors and bulldozers are drones too?

Environmental Monitoring

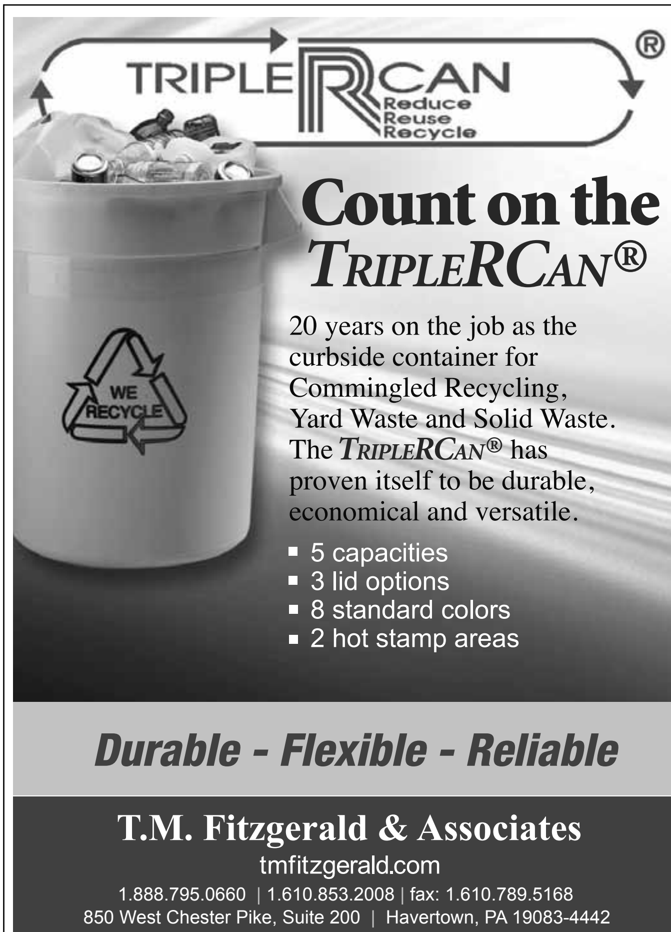
Automation is not limited to groundwater or trucks, the whole landfill gas collection system can be automated as well. Several companies offer "well-mounted" wireless sensor and control systems that feature a whole range of options when paired with one of their software applications. The systems work in real time and can show everything from flowrate of each individual well to the gas composition on each well in the collection system. The wells can be wirelessly adjusted to increase or decrease pressure or vacuum in order to increase the amount of methane collected and decrease odor. These systems can be monitored via any computer with an internet connection or anywhere you have cell service. In the event that something does go wrong, alerts generated by the software can be sent to the users by text or email. The individual alerts can be set by the user and happen automatically without the need for full-time monitoring of the system by landfill personnel. This level of automation can significantly reduce the number of hours and personnel required to monitor and control a landfill gas system.

Automation is going to become more prevalent in the next few years, but one of the new challenges will be in adapting to managing an application aiming to assist facilities with their data management as automation gains ground. SCSeTools and similar applications assist in collecting, storing, and managing data with the end goal of helping the facility become more efficient, spot reoccurring trends, and assist in planning for the future. This type of web-based application provides an around-the-clock, nearly real-time view of the systems it monitors and controls. With software monitoring, controlling, and linking the facility together, what happens to the people who currently provide those services?

Impacts to Employment

All of these smart technologies offer communities and private haulers enormous opportunities in terms of helping them to do things quicker, cheaper, and faster. It is a well-worn statement that the future of technology is extremely hard to forecast. For example, try to imagine explaining a tractor to a farm worker in pre-industrial America. It would be challenging.

Today, the challenge is to imagine that tractor being completely driverless. Yet, that time is almost at hand with most industries or



with daily applications we are familiar. For example, what about driverless Teslas picking up passengers in Tampa, giant combines without drivers mowing wheat in Fargo, ND, or automated equipment turning off lights, air conditioning units, or security systems in our homes?

Does that mean that human labor in the solid waste industry will "go the way of the horse," as Nobel laureate economist Wasilly Leontief famously predicted? Perhaps. If one looks at industries that have been early adopters of automation and artificial intelligence (AI) or machine learning, it is clear that there has been a significant downsizing of labor already. Technology is advancing exponentially and threatening to disrupt many industries including medical testing, finance, auto making, pizza delivery, and even steelmaking, said Vivek Wadhwa, a futurist and the director of research at Duke University during a recent conference sponsored by the World Steel Association. Even in countries like India with high populations, the move towards automation and reduced labor per ton of steel has been a dominant trend as they attempt to stay completive in the world market.

By no means do we have the answer for the solid waste industry, because technology has always been a disrupter. Our goal was to begin the conversation on the social costs that will soon have to be addressed in the solid waste industry. It is easy to adopt technology, but what about the people we currently employ? With less employees and more productivity, the inconvenient truth is that the revenues for the social safety net as we know it (Social Security, Medicare, Unemployment Compensation Insurance, and Worker's Compensation) may be significantly underfunded with less employed workers.

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A recent article by Bill Gates on the subject suggests that governments should tax companies' use of robots, as a way to at least temporarily reduce their application. Gates says that a robot tax could finance jobs taking care of elderly people or working with kids in schools, for which needs are unmet and to which humans are particularly well suited. He argues that governments must oversee such programs rather than relying on businesses, in order to redirect the jobs to help people with lower incomes slow the spread of automation and to fund other types of employment. The idea is not totally theoretical. For example, European Union lawmakers recently considered a proposal to tax robot owners to pay for training for workers who lose their jobs, though in February the legislators ultimately rejected it.

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How can we in the solid waste industry begin this discussion about the impact of smart technologies? Maybe taxes are not the answer. How will we deal with the workerless future? Please write in and tell your thoughts about this most important subject.

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