

Volkswagen and an aging workforce: the demographic changes of the German population

Riley Paddock

2016

Bachelor of Commerce Best Business Research Papers

UVic Libraries ePublishing Services

© 2016 Paddock.

Original citation:

Paddock, R. (2016). Volkswagen and an aging workforce: the demographic changes of the German population. *Bachelor of Commerce Best Business Research Papers*, 9, 82–92.

Downloaded from UVicSpace Research & Learning Repository

dspace.library.uvic.ca



**University
of Victoria**

Libraries

Volkswagen and an Aging Workforce: The Demographic Changes of the German Population

Riley Paddock

ABSTRACT

The population of Germany is aging, resulting in blue-collar labour shortages across the country. In a country known for car manufacturing, this has profound implications on the company that is arguably the most recognized German company worldwide: Volkswagen. The Volkswagen factory in Wolfsburg, Germany is faced with finding solutions for the demographic situation that is gripping the country so that they can continue to produce vehicles at an efficient rate. As the production facility's workforce continues to age, due to a lack of young employable people, the factory managers have been forced to find ergonomic solutions that make the work load easier on individuals whom can no longer work to the same efficiency level of their younger days. Technological innovations have had to be implemented in the factory so that production levels do not fall. Volkswagen is faced with finding a solution to a nationwide problem, so that they can continue to produce vehicles when their workforce lowers beyond needed capacity.

INTRODUCTION

Volkswagen (VW) is a company that has been tasked since day one with producing vehicles that are affordable for people while not straying from the engineering piou expected from German products. Interestingly, when translated into English, the word Volkswagen means "people's automobile". Founded in 1937, the Volkswagen company was part of a project lead by the Deutsche Abreitsfront, which was attempting to provide all people throughout Germany with an affordable automobile. While in power, Adolf Hitler wanted to provide the German people with an affordable car that everyone could drive (Bowler, 2015). As a result, the Volkswagen company was born and the automotive industry changed forever. No longer were automobiles only a luxury item the rich in Germany could afford: cars became a family oriented product. The automobile brand is intertwined in the history of the country it comes from and has since become a household name around the globe.

The massive production capabilities of the Volkswagen Group are evident at the headquarters and location of the original VW Factory in Wolfsburg, Germany. The four large smokestacks of the original power plant still, to this day, reach towards the sky showing the power of the company, which began during a dark time in German history. The factory is regarded as one of the largest worldwide, occupying more than six square kilometers and boasting an output of approximately 815,000 vehicles in 2015 (Volkswagen AG, 2016). The Wolfsburg facility includes the company headquarters, the production facility, and the Autostadt (a museum to the history of the company). By December 2015, the facility employed 73,730 individuals in both white-collar and blue-collar jobs. Over fifty percent of the population of Wolfsburg is employed by the Volkswagen group (Volkswagen AG, 2016). The production facility acts as a city within the city, which only existed because of the factory, by holding medical clinics and restaurants for the employees.

Baby-Boomer Generation

A mass influx of childbirths occurred shortly after the Second World War. As a result, this “baby-boomer” generation led to a major accumulation of individuals suddenly entering the workforce. This generation is known to have worked the less than glamorous jobs, because of a great supply of workers available; therefore, a major blue-collar workforce was possible (Taylor, Pilkington, Feist, Dal Grande & Hugo, 2014). As a result, production facilities were able to massively expand and create technological innovations using a workforce that could supply their needs. However, the social landscape has changed since the “baby-boom” and the excess supply of workers willing to work in blue-collar positions has decreased to a supply shortage. The new generation does not want to work assembly line jobs; this has a major impact on the production capabilities of companies such as Volkswagen (Roberts, 2012). As the “baby-boomer” generation has aged there has not been enough new generation replacement to sustain major production facilities, a problem that is progressively growing worse. Especially in a country known for large scale industrial factories.

The median age of employees at the Wolfsburg factory is continually increasing. This trend does not seem to be slowing, as it is a country wide problem across Germany. Each year the average age increases as current employees are growing older and new employees are not entering the workforce in large enough numbers (Paddock, 2016b). Volkswagen has hit a demographic challenge and must develop solutions to combat its aging workforce. The majority of jobs at the factory itself are blue-collar jobs held by experienced employees who have worked for many years in the company. Such employees are aging and replacement has proven increasingly challenging: the younger generation in Germany is not interested in spending their life working along an assembly line (Paddock, 2016b). Rather, according to Roberts (2012), there is an influx of university graduates looking for white-collar work in the new generation entering the workforce, an area that VW does not have a shortage of workforce supply. Employee turnover from old to young employees is not happening at a fast enough rate to keep up with the production demands of such a large factory. Departments within the production facility must implement technological innovations that will make the labour-intensive environment a feasible workplace for an aging workforce. Over the course of the next 10 years, Volkswagen expects to lose a major portion of its workforce, on the basis of retirement alone (Paddock, 2016b). The generation of people who made mass-production of cars possible in Germany will cause its demise if there are not changes made to either keep them working longer or changes in technology that make it possible to produce mass volume of specialized products with a smaller workforce.

Why not use Automation?

The idea of using robots to replace human labour has been greatly considered by Volkswagen, but currently, in the Wolfsburg factory of the early 21st Century, this is not possible. The use of robotic enhancements in every stage of production is not an efficient production capability that VW can implement. During the 1970s, the VW factory in Wolfsburg was an almost completely automated production line, using robots at almost every stage of producing VW products (Paddock, 2016a). During that time, there was a belief that the use of machines would result in less human error and less money being spent on employees. Limited employees were needed, as robots could be programmed to do the same thing over and over again, without growing tired. However, the practice of using only robots is not possible in the car manufacturing industry of today, rather the most economical mixture of robots and humans is needed (Gorlach & Wessel, 2007). Back in the 1970s, much of the production process was uniform and the use of robots was possible because there was not as much variety between vehicles as there is today. Cars would all look identical, making it feasible to use robots that continuously completed

the same motions with the same automotive components. It was, therefore, efficient on an assembly line to use robots instead of human labour. The initial investment was higher, but the cost of maintenance was much lower than human capital labour costs. Today, however, car variety is too vast for the use of robots that can only perform one task over and over again. Customers are able to choose between variations of models and instruments within the vehicles, leading to differentiation on the assembly line instead of uniformity. Costs, quality, and quantity must all be studied when determining the effective level of automation along the assembly line of a vehicle manufacturing plant (Gorlach & Wessel, 2008). For example, on any given day in Wolfsburg, thousands of Golf class cars will be produced at the VW factory. Out of the thousands of cars, no more than two will be identical to one another (Paddock, 2016a). Each vehicle must be specially crafted to meet all chosen requirements and the quantity of identical vehicles is too low to warrant a high level of automation. Human capital is necessary to ensure the proper production of a wide variety of models. Machines would not be able to differentiate on such a massive scale, leading to an inefficient factory. In today's vehicle marketplace, human labour is ultimately more cost-effective for Volkswagen. The cost of producing and maintaining machines, that could handle the large scale product variation, would be too high; ultimately, affecting the bottom line of the company. The use of humans gives VW the ability to give customers options within their vehicles, leading to a happy and sustainable customer base.

German Labour Law

Despite the necessity for variation along the assembly line, Volkswagen is still faced with a workforce that is slowly not able to perform all tasks. As a result, automation will become necessary, and with advances in robotic technology, it may soon be possible to use them under the circumstances of VW. However, when determining future steps for an organization to take, it is critical to look at the labour law of the country in which they operate. The Wolfsburg factory is located in Germany, a country with many different laws and policies in regards to employment compared to Canada. In Germany, a company cannot lay off workers because of work shortages or lack of new employable areas, rather they must find a fit for employees within the organization so that they are able to continue working (Jung, 2001). In contrast, North American employment practices involve moving factories to more efficient locations and leaving thousands of individuals without employment, as is common practice in the Ontario automotive industry (CBC, 2008). Volkswagen cannot do similar things in Germany because of the employee legal protections. In addition, the two countries differ on the issue of forced retirement based on aging. The age of retirement in Germany is 67 years-old and employees cannot be forced out of employment based on age or lowered ability, caused by the aging process, any sooner (Jung, 2001). Volkswagen has no grounds to terminate employment if someone could no longer perform a task within the VW factory that they once could. Rather, it is the organization's responsibility to find a new task that said employee could perform and move them to the department.

There are great implications present based on the labour law surrounding the removal of aging employees. The removal of employees and replacement with highly technical robots is not possible for some time. Since employees cannot be forced out of their jobs, the return to automation in certain departments where it is possible and effective will not be a realistic option for VW for quite some time. Volkswagen must prepare for gradual reduction of staff caused by retirement and uncover the areas where automation is possible within the facility. Long-term planning is necessary for successful manoeuvre through labour laws.

Transfer to Logistics

Since there are laws dictating what can and cannot be done in regards to aging employees, the common practice within large manufacturing facilities is to move employees to logistics: an area deemed as easier work (Paddock, 2016b). The concept of logistical work being easier on the body is, however, a flawed idea across most of the production world. Currently, at the Volkswagen factory in Wolfsburg it is common to move aging employees, who can no longer work on the production line, into the Logistics department. The Logistics department has suffered from the misconception that logistical work is easier on the body than assembly line production work, leading to a decrease in efficiency. While there is less repetitive motion in logistics, therefore, leading to less strain on one particular area of the body, logistical work within an automobile manufacturing facility is not easy work. Employees working in logistics at the VW factory in Wolfsburg are on a strict timeline, as every part that is stored within their department must reach its destination on the assembly line at the precise time it is needed (Paddock, 2016b). This is not easy work as massive carts, weighing approximately 50 kilograms when empty, must be moved within the factory and filled with parts. Figure 1 is an example of a smaller cart used within the department; carts are often double or triple the size of the one depicted (Paddock, 2016a). Pushing these carts up and down isles of automotive components will cause strain on any individual, let alone an aging one. Therefore, because the department requires physical labour, the concept of moving aging employees to logistics is not sustainable and will not solve the problem Volkswagen is facing.

The logistics department is currently working to produce a plan that will project the areas of the department that must change now, areas that must change soon, and areas that can change in the future in regards to accommodating an aging work force (Paddock, 2016b). This plan will complement Volkswagen's current plans, which are used around the assembly process to rate the ergonomic level of areas in the facility to determine where changes must be made. Employee aging has become a company-wide issue and Volkswagen is taking many steps to ensure the success of the company in spite of problems that will affect the company for many more years.

The Benefits of an Older Workforce

While there are problems that come from a workforce aging, there are major benefits that a successful firm will recognize and leverage. Older employees have more experience in the working world and because of these years of experience working in the professional world, Volkswagen has a workforce that knows what it takes to be successful. In the working world it is imperative to have a knowledgeable workforce; only then will success be possible. Since Volkswagen has an older workforce, there is a vast amount of knowledge that the company must leverage from employees. The knowledge-based theory of the firm, as described by Spender (1996), lays out knowledge as the vital strategic asset for the success of a firm. He argues that knowledge is the most strategic asset leading to the success of an organization. Therefore, because Volkswagen has such a knowledgeable workforce, the company has the opportunity to gain a competitive advantage in the automotive sector, because of their knowledge development capabilities. While most of the workers within the vehicle-manufacturing factory are blue-collar workers, there is still a great opportunity for the passing of knowledge around the complex of the company. And because the years of experience of employees, this knowledge has can benefit the company greatly by leading to new knowledge creation. Knowledge can be described as what is learned through experience and what is learned through theoretical understanding (Spender, 1996). In the case of Volkswagen, there is a vast amount of knowledge in the first category: knowledge based on experience. Every aging worker at VW has knowledge that leads to the success of the car manufacturing process. This means that there is a great opportunity for Volkswagen to leverage this knowledge to make the company better. The aging

employees cannot be seen as a burden, rather, they are an opportunity for the company. The vast knowledge of these employees can be leveraged for the success of the organization, making the company more competitive over time.

Over time, employee knowledge at VW has increased. This is a result of knowledge increasing over time within the dynamic setting of a firm, through the sharing and developing of information across employees (Spender, 1996). At Volkswagen, employee knowledge has increased and therefore the knowledge of the company as a whole has increased. Over time, the knowledge of the company has become a strategic asset that is imperative for the successful operations of the company. Volkswagen must work to protect their current aging knowledgeable workforce and keep them employed in positions that will benefit the company. Older employees are often seen as burdens to a company, yet, to be successful, a company cannot look at older employees as burdens but as strategic assets. Since knowledge is a strategic asset, and older employees hold knowledge, these employees are therefore a strategic asset. Physical limitations of an older employee lower their ability to be productive in matters of strength and physicality, but their knowledge has proven vital to the success of the company. Thus, action must be taken to keep the knowledge within the company.

At Volkswagen, it is imperative that the knowledge of the older employees is held onto long enough that it can transfer to the much smaller younger workforce. Since the number of employees will drastically decrease over the next years, the transfer of knowledge must take place so that a younger generation will be able to carry out the tasks that make the company the success it is today. This means that technology must be created to keep an aging workforce happy and healthy within the workplace long enough for the transfer of knowledge between generations of workers. Only once the transfer of knowledge takes place will the next generation of VW employees be in a strong enough state that will allow for the success of the company in the future.

Volkswagen is currently in the place where if their strategic asset is not protected, in the form of employee protection, they will not have a good chance at being successful. The aging employees are vital to the success of the car manufacturing giant's Wolfsburg factory. The company has recognized this and is taking major steps to ensure that the successful past that the company has been building for decades does not deteriorate.

Role of Leadership at Volkswagen

Leaders within the firm have the role of creating a corporate culture or team atmosphere that is conducive to the effective transfer of knowledge. It is the role of the leader to create an organizational system that flows and moves with the needs of employees to create a culture that employees fit into and work productively in (Martín-de-Castro & Montoro-Sánchez, 2013). Within the context of Volkswagen, this means that it is management's job to ensure that an aging workforce has the necessary technology at their disposal so that tasks can be done efficiently. The role of the leader is to show employees that becoming integrated in the routines of the organization will better spread the wealth of knowledge that they collectively have and thus benefit the collective organization. This is evident within VW as a leadership style has been implemented allowing the opportunity for teams to get together and discuss not only problems, but also successes. What works and what does not work are equally important to Volkswagen and using leaders to convey this message is what makes the factory in Wolfsburg successful. Daily, within the logistics department alone, meetings take place between teams and their leaders and those leaders and the other leaders. These meetings are often short and are focused on getting the entire

department up to speed. The meetings have led to the successful passing of knowledge from lower employees, who are extremely knowledgeable, to management, who need the expert knowledge of the front line employees in able to make strategic decisions (Paddock, 2016b). The expert knowledge of the aging employees who work on the front-line of the production facility is being passed along successfully so that the company can be made more productive. These daily meetings create a bond within each team and further between teams. Each person is on the same page and knows what must be done for the department to be successful. The creation of this culture has led to a cohesive unit that works together to solve problems, no matter the job title of employees (Paddock, 2016b). A team exists and this means that the employees have a better chance to be successful.

When a leader is able to promote trust, and a sense of belonging within the firm, the firm has a better chance to be successful. Employees will be motivated to share their knowledge to the group for the betterment of the organization (Martín-de-Castro & Montoro-Sánchez, 2013). A competitive advantage can arise within a firm with a strong cohesive culture, because all employees are working on the same page to spread already developed knowledge and create new knowledge as a group. Leaders must recognize that creating a team atmosphere is imperative to the transfer of large amounts of knowledge and without a strong culture within the firm, there would be no chance of turning individual knowledge into collective knowledge. It is the role of leaders within VW to find the information they need to make the company better, and this is only possible if the facility is improved so that aging workers are able to continue working and thus benefiting the company with their years of experience and knowledge.

Importance of Ergonomic Solutions

Since Volkswagen has made a commitment to providing specialized automobiles to its customers, the company has had to make the manufacturing workplace safe and ergonomic for the necessary human employees. Because the use of manual labour is a necessity at the Volkswagen factory in Wolfsburg, focus has had to be placed on ergonomically improving each work place (Volkswagen Aktiengesellschaft, 2015). When workstations are not designed and positioned in a way that is carefully constructed to make the movements of the workforce ergonomic, injuries occur. There is a strong correlation between workplace injuries and repetitive motion. Since an assembly line forces employees to constantly be making the same movements over and over again, it is important for the company to focus on limiting the areas in which injuries can occur (Paddock, 2016a). Workplace injuries cost the company money in the form of injury compensation and missing workforce. For a company to be successful in the long run, taking care of employees is a necessity.

Volkswagen has an aging workforce, which means that there had to be steps taken to ensure that workplace injuries do not take place. It is unfortunately easier for an older employee to get injured than a younger one and this means that the Wolfsburg factory is in danger of losing valuable human resources to injury if the right steps are not taken when improving the workplace and specifically the ergonomics of the workplace (Volkswagen Group, 2015, June 17). Each change that Volkswagen makes to ensure ergonomic standards are improved do more than just fix the problem for an aging workforce: the benefits reach the younger generation of workers as well. Younger employees can put less strain on their bodies in their youth, translating to fewer injuries that will affect their working capabilities when they are older. Each beneficial change will help the older generation of workers today and of tomorrow. While the aging process is not going to slow down at the Wolfsburg VW factory, the rate of injuries will and thus workers will be able to carry out tasks longer and the company will be able to meet each goal that is set. It is the responsibility of the management to invest in developing new technologies to make the factory work

place a better environment so that workers can feel safe and thus succeed in their daily tasks without added risk of repetitive motion injuries. Dr. Horst Neumann, board member for Human Resources, Volkswagen Aktiengesellschaft is quoted as saying.

Every ergonomic improvement is an investment in the health and performance of our workforce. At the same time, each improvement enhances quality and productivity. That is why Volkswagen sets great store by good ergonomic working conditions. That includes both individual improvements at the workplace as well as ergonomic shift models. We also foster teamwork and individual commitment to preventive healthcare, training and fitness
(Volkswagen Aktiengesellschaft, 2015).

Factory Improvements at Volkswagen

The Volkswagen Factory in Wolfsburg is constructed of many large concrete buildings. A reminder of the history of the German company. These buildings are very old and hold historical significance to the company, while also providing economic benefits in the form of functional buildings. However, the floor material is not conducive to an ergonomic workplace. The hard concrete that runs the length of the building is not a material that is comfortable to be standing or moving along for extended periods of time (Paddock, 2016a). Thus, the flooring material can result in injuries to individuals who are forced to stand all shift long. To combat this problem, Volkswagen has installed raised wooden floors along the assembly line, as seen in Figure 2, for workers to walk along. Wood flooring offers a level of cushion for workers and is better to walk along than concrete. The more ergonomic platform reduces the chance for injuries to muscle joints due to excessive pounding and strain. To improve this system further, VW introduced the concept of having slow moving areas installed within the raised flooring, providing workers with a platform where they can stand still and work on vehicles as they move down the assembly line (Figure 3). This means that the body can stay in one proper position and there is not any over stretching or sudden movements that can result in injuries due to forced multitasking of moving while assembling the vehicle. Rather the worker just has to move to the beginning of their work area once one vehicle is done and they can start on the next vehicle. Tilting of vehicles to make them easier to work on for employees is another improvement done for the assembly line. As shown in Figure 4, rather than unnatural bending and moving, in ways that will put the body in non-ergonomic positions, the vehicle does all the moving and employees can focus solely on getting their job done properly. The chance for muscle strain diminishes greatly when the body is able to stay in natural positions (Paddock, 2016a).

Volkswagen has recognized that older employees need special changes that make hard jobs possible. Manipulators, as Volkswagen refers to the technologies implemented to make the work of employees less strenuous have been implemented around the factory (Volkswagen Group, 2015, November 27). Each place where an essential production activity poses a threat to personal safety and health is a place where manipulators can be implemented (Volkswagen Group, 2015, June 10). The use of robots along with humans has become quite common as robots are able to move much heavier components, while humans are able to make sure that each process is being done properly. Human and robot interaction allows for the health and safety of employees to be increased while productivity increases as well (Volkswagen Group, 2015, August 20). Work can be done and there isn't a risk of injury based on being in a non-ergonomic position. It is necessary to implement technology to make the workplace efficient despite changes in demographics.

Risk of Technological Introductions

Volkswagen has recognized that there is a major need for improving technology if the aging workforce is to be effectively and efficiently used to produce vehicles in Wolfsburg. The introduction of the technological advances along the assembly line have been widely accepted and appreciated by employees at Volkswagen; however, when introducing technology to an older generation there are risks that it won't be accepted. Volkswagen's logistics department has introduced the use of Google Glass for the use in picking parts for the production process (Volkswagen AG, 2015). The idea behind the introduction of the technology is that employees can use this technology to scan barcodes and reduce picking errors while carrying less papers and scanners, as is seen in Figure 5. The technology essentially frees the hands of logistics department workers so that they can do their job faster and more efficiently. The technology has been accepted and appreciated by the younger generation of workers at the factory who like to see new technology implemented. However, the older generation has taken more time to accept the technology, preferring to do things the way they have always been done (Paddock, 2016b). When dealing with an older work force, it is essential that the workers and management both see technological advances as a productive addition to the workplace. There cannot be a disconnect between management and the employees on the front-line. While this technology has since been widely introduced and accepted at the Wolfsburg facility, Volkswagen is in a position where they are forced to work with the aging workforce to find solutions to problems that not only work, but also do not alienate the workforce and cause them to become frustrated. Technology can be a good addition for making a workplace friendlier for an aging employee. The implementation of the right technological device has the ability to make the job of an employee better and leave them more satisfied with their productivity levels. But, there is a fine line between making a problem better or making it worse based solely on the introduction of a new technology. Management must work with employees to determine which technology is beneficial and which technology is not.

CONCLUSION

Volkswagen is faced with major obstacles in its future at the Wolfsburg factory. The workforce is not getting any younger and will become a major problem for production moving forward. Aging, experienced long-term employees are extremely valuable to Volkswagen, but the manufacturing facility is faced with the fact that changes will have to be made in the future. As the number of employees decrease over the next years, the management at VW will rely on the introduction of new technology that will make the factory run smoothly and productively so that they can continue to be the leader of car production in Wolfsburg that they are today. Volkswagen changes the way car manufacturing takes place, and in a country such as Germany, where the workforce is not growing younger, technological innovations are a must.

The company recognizes the importance of its currently aging workforce, knowing that each aging employee hold a vast wealth of knowledge that is critical for the successful operation of the production facility. Knowledge increases with time and is valuable for companies when it is spread throughout the corporation through a collective community. Volkswagen has taken steps to ensure that the knowledge of each worker in the facility can be passed throughout the company so that the facility in Wolfsburg can be successful. Employee knowledge is key for the future success of the organization. While the company transitions to an older and smaller workforce, each individual is forced to work for the betterment of the organization. Employees will move on, but it is Volkswagen's management's responsibility to work with aging experts to find solutions to problems that will leave the company in a state to succeed. Every

technological improvement that Volkswagen has and will implement is a direct result of working with employees to make the factory a safer and more productive work place.

Volkswagen is a symbol of Germany that employees are proud to be a part of, as reflected through their vast knowledge, loyalty and commitment to the company. Volkswagen was founded during a dark time but has proven it can succeed through difficult circumstances and rise to the top. Through its support to the aging workforce, implementation of technology and transfer of knowledge to the upcoming generation of workers, Volkswagen will be able to sustainably continue to succeed for many years to come.

REFERENCES

- Bowler, T. (2015, October 02). Volkswagen: From the Third Reich to emissions scandal. *BBC News*. Retrieved April 03, 2016, from <http://www.bbc.com/news/business-34358783>
- CBC News (2008, October 21). *A timeline of auto sector layoffs*. Retrieved April 03, 2016, from <http://www.cbc.ca/news/canada/a-timeline-of-auto-sector-layoffs-1.721556>
- Gorlach, I. A., & Wessel, O. (2007). Case Study: Automation Strategies at Volkswagen. *World Congress On Engineering 2007 (Volume 2)*, 21062-1067.
- Gorlach, I., & Wessel, O. (2008). Automation or De-automation. *AIP Conference Proceedings*, 1045(1), 133-142. doi:10.1063/1.2991345
- Janssen, C. I. (2013). Corporate Historical Responsibility (CHR): Addressing a Corporate Past of Forced Labor at Volkswagen. *Journal Of Applied Communication Research*, 41(1), 64-83. doi:10.1080/00909882.2012.731698
- Jung, L. (2001, April). National Labour Law Profile: Federal Republic of Germany. Retrieved April 03, 2016, from http://www.ilo.org/ifpdial/information-resources/national-labour-law-profiles/WCMS_158899/lang--en/index.htm.
- Koplin, J., Seuring, S., & Mesterharm, M. (2007). Incorporating sustainability into supply management in the automotive industry – the case of the Volkswagen AG. *Journal Of Cleaner Production*, 15(11/12), 1053-1062. doi:10.1016/j.jclepro.2006.05.024
- Leinwalla, M. (2015, November 25). *Volkswagen Employees Appear To Be Using Google Glass In Factory*. Retrieved March 27, 2016, from <http://www.techtimes.com/articles/110662/20151125/volkswagen-employees-appear-using-google-glass-factory.htm>
- Martín-de-Castro, G., & Montoro-Sánchez, Á. (2013). Exploring Knowledge Creation and Transfer in the Firm: Context and Leadership. *Universal Business Review*, (40), 126-137. Retrieved from <http://web.b.ebscohost.com.ezproxy.library.uvic.ca/>
- McCandless, K. (2015, July 20). *Taking care*. Retrieved March 27, 2016, from <http://www.automotivemanufacturingsolutions.com/focus/taking-care>
- Paddock, Riley (2016a). Personal tour to Volkswagen headquarters. Wolfsburg, Germany. February 4, 2016.
- Paddock, Riley (2016b). Meeting with Christoph Hartmann, Volkswagen Logistik Nord. Wolfsburg, Germany. February 4, 2016.
- Roberts, K. (2012). The end of the long baby-boomer generation. *Journal Of Youth Studies*, 15(4), 479-497. doi:10.1080/13676261.2012.663900
- Spender J.-C. (1996). Making Knowledge the Basis of a Dynamic Theory of the Firm. *Strategic Management Journal*, 17, 45–62. Retrieved from <http://www.jstor.org/stable/2486990>
- Taylor, A. W., Pilkington, R., Feist, H., Dal Grande, E., & Hugo, G. (2014). A survey of retirement intentions of baby boomers: an overview of health, social and economic determinants. *BMC Public Health*, 14(1), 1-17. doi:10.1186/1471-2458-14-355
- Volkswagen AG. (2015, November 23). *Volkswagen rolls out 3D smart glasses as standard equipment*. Retrieved March 27, 2016, from https://www.volkswagen-media-services.com/detailpage/-/detail/Volkswagen-rolls-out-3D-smart-glasses-as-standard-equipment/view/2906206/6e1e015af7bda8f2a4b42b43d2dcc9b5?p_p_auth=sdY0ctB4
- Volkswagen AG. (2016, March 01). *Volkswagen AG Werk Wolfsburg*. Retrieved March 27, 2016, from https://www.volkswagen-media-services.com/detailpage/-/detail/Volkswagen-Plant-in-Wolfsburg/view/3297289/6e1e015af7bda8f2a4b42b43d2dcc9b5?p_p_auth=sdY0ctB4

Volkswagen Aktiengesellschaft. (2015, November 06). *Force measurement - Group's production ergonomics department*. Retrieved March 28, 2016, from http://www.volkswagenag.com/content/vwcorp/info_center/en/themes/2015/06/Force_measurement.html

Volkswagen Group. [Volkswagen Group]. (2015, June 10). *Ergonomics: Force measurement*. [Video file]. Retrieved March 27, 2016, from <https://www.youtube.com/watch?v=RAI5bjgdA0c>

Volkswagen Group. [Volkswagen Group]. (2015, June 17). *Ergonomics in the Volkswagen Group*. [Video file]. Retrieved March 27, 2016, from <https://www.youtube.com/watch?v=05ChaWGJ0-A>

Volkswagen Group. [Volkswagen Group]. (2015, August 20). *Industry 4.0 in the Volkswagen Group*. [Video file]. Retrieved March 27, 2016, from <https://www.youtube.com/watch?v=JTI8w6yAjds>

Volkswagen Group. [Volkswagen Group]. (2015, November 27). *How a car is made: Part 4 - The assembling*. [Video file]. Retrieved March 27, 2016, from <https://www.youtube.com/watch?v=d1e8m-qLn2A>

Webzell, S. (2015, February 03). *The rise of robotics*. Retrieved March 27, 2016, from <http://www.automotivemanufacturingsolutions.com/technology/the-rise-of-robotics>

APPENDIX

Figure 1: Small component cart



(http://www.volkswagenag.com/content/vwcorp/info_center/de/news/2013/11/p/roduction_logistics.html)

Figure 2: wooden flooring along assembly line



(http://onlineathens.com/sites/default/files/imagecache/full/Germany%20Volkswagen_Mor a.jpg)

Figure 3: Moving floors along assembly line



(http://vistanews.ru/uploads/posts/2016-02/1455857016_201301281124_no_copyright_passat_plant.jpg)

Figure 4: Rotated vehicles



(<http://www.goauto.com.au/mellor/mellor.nsf/story2/7C658CB5CE2D2726CA257F18000B3D3E>)

Figure 5: Google Glass introduced in logistics



(<http://www.digitaltrends.com/wearables/vw-makes-high-tech-specs-standard-issue-for-logistics-staff/>)