The Role of LEED Certification in Consumer Major Purchase Decisions:

A Case Study of the Chattanooga Volkswagen Manufacturing Facility

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ABSTRACT

The Leadership in Energy and Environmental Design (LEED) certification program serves as a benchmark for ‘green’ construction in the U.S. Although considerable research has investigated the marketability of LEED-certified buildings, no direct attention has been given to assessing if the benefits of LEED certification filter down to the profitability of products manufactured in those buildings. To investigate this potential influence, I conducted a large-scale survey of regional owners of the Volkswagen Passat, which is manufactured in the world's first automobile plant to achieve LEED Platinum status. Results suggest that manufacturing facility LEED certification does not influence product purchasing decisions regardless of knowledge of LEED, other car feature preferences, and demographics. Results of this research may help to guide marketing of products manufactured in LEED-certified buildings and provide additional incentive to manufacturers to consider LEED certification as a viable business practice.
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LIST OF ABBREVIATIONS

LEED, Leadership in Energy and Environmental Design

BREEAM, Building Research Establishment’s Environmental Assessment Method

U.S., United States

U.K., United Kingdom

USGBC, United States Green Building Council

GBCI, Green Business Certification, Incorporated

ASHRAE, American Society of Heating, Refrigerating, and Air-Conditioning Engineers

V, Version

PA, Pennsylvania

HVAC, Heating, ventilation & air conditioning

VOC, Volatile organic compounds

VW, Volkswagen

CEO, Chief Executive Officer

W, Watts

TNT, Trinitrotoluene

CFC, Chlorofluorocarbon
LEV, Low emission vehicle

Km, Kilometer

C0₂, Carbon dioxide

EPA, Environmental Protection Agency

NC, North Carolina

MIT, Massachusetts Institute of Technology

IRB, Institutional Review Board

Mpg, Miles per gallon

URL, Universal resource locator

USD, U.S. dollar
CHAPTER 1 INTRODUCTION

1.1 What is LEED Certification?

Leadership in Energy and Environmental Design (LEED) certification is a well-known benchmark for environmental construction (Lee and Kim 2008, Al-Ghamdi and Bilec 2015, Cheng and Ma 2015, Tisak 2015, van der Heijden 2015, Szibbo 2016). For a building project to become LEED certified it must meet certain criteria used to define ‘green’ construction based on universal and measurable standards (Suzer 2015, van der Heijden 2015, USGBC 2016). Points are earned in various categories: Location and Transportation, Materials and Resources, Water Efficiency, Energy and Atmosphere, Sustainable Sites, Indoor Environmental Quality, Innovation, and Regional Priority credit (Lee and Kim 2008, Long 2011, Montanya and Keith 2011, Al-Ghamdi and Bilec 2015, USGBC 2016). Green construction generally involves the use of products and practices that minimize harmful environmental impacts (Matisoff et al. 2014). The non-profit U.S. Green Building Council administers the LEED program for buildings, homes, and communities; in this capacity it guides the design, construction, and operations and maintenance plans of buildings proposed for LEED certification (Al-Ghamdi and Bilec 2015, van der Heijden 2015). This guidance includes information for building design, including the use of recycled materials, as builders often incorporate recycled debris and demolition waste into new construction (Lindsay Smith 2009, Smith 2009, USGBC 2016). It also includes information for building construction, focusing on construction methods that minimize negative impacts on soil and other natural resources as a common LEED practice (Lockwood 2006). Building maintenance could include energy-efficient heating, ventilation...
and cooling (HVAC) units, the use of energy-efficient or natural lighting, and other environmentally sound measures (Lindsay Smith 2009, Smith 2009). For building operations, technology often is a key component of green building, as installation of motion-sensing lighting sensors and programmable climate control, for example, can help save money in operating costs and allow builders to take advantage of the many incentives offered (Lockwood 2006). To receive LEED certification, building projects must earn points (Lee and Kim 2008, Montanya and Keith 2011, Suzer 2015). Depending on how many points a building project receives, the building can be awarded certification at one of the following levels: Certified, Silver, Gold or Platinium (Montanya and Keith 2011, Suzer 2015, van der Heijden 2015).

At the heart of LEED certification is the promotion of buildings and building practices that support environmental sustainability – an inarguably worthy cause (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Singh 2011, Medici 2014). Nonetheless, the construction of compliant buildings and the LEED certification process can involve upfront investments that may be cost-prohibitive for individuals and businesses alike (Hoffman 2010). However, within the context of business in particular, it is possible that sales from consumer interest in products manufactured in LEED facilities could offset such costs and potentially even contribute to increased profits (Hoffman 2010). To determine whether or not LEED certification is a practical benchmark for the manufacturing industry, I conducted research in the manufacturing sector – specifically the motor vehicle industry – by assessing the effects of LEED certification on automobile sales and profits. Throughout this chapter, I provide an in-depth review of the history, process, environmental benefits, criticisms, and reported consumer interests in LEED certification. This review provides a foundation for understanding the broader context of my research. There are more than 79,600 total commercial LEED certified projects across the world, as of July of 2016 (USGBC 2016). In 2013, there were more than 44,000 LEED-certified projects in the
U.S. alone (Suh et al. 2014). This number has grown substantially since the inception of the USGBC’s LEED certification program (Newsham et al. 2013, van der Heijden 2015, USGBC 2016). In September of 2011, the Green Building Certification Institute signed off on the 10,000th LEED certified commercial building (Murray 2011). In October of 2014, 1,672 federal buildings were LEED certified, up from 821 in 2012 and the prior year’s data notes 5,710 federal buildings were registered and waiting for certification (Hardcastle 2012). During that time, approximately 1.4 million square feet of existing multifamily and commercial buildings obtain LEED certification every day (Murray 2011). To date, more than 135 countries and territories have adopted LEED (Al-Ghamdi and Bilec 2015, van der Heijden 2015).

1.2 History of LEED Certification

As an all-encompassing approach to green building in the U.S., LEED certification was initiated in 1993 with the advent of the U.S. Green Building Council by three environmentally minded businesspersons with the mission of promoting sustainable construction standards (Kay 2007, USGBC 2016). Initially these founders – Rick Fedrizzi, David Gottfried and Mike Italiano– brought together 60 firms and non-profit organizations to hammer out the ideas for creating a green building rating system (USGBC 2016). Currently the USGBC is made up of 12,870 member organizations including builders, environmentalists, educators, lawmakers and private citizens organized into 76 chapters in the United States (USGBC 2016) and more than 18,000 member companies and organizations worldwide (Suzer 2015). They work together in committees nationwide to design strategies that can be implemented by staff and expert consultants to help influence change in the building industry (Lee and Kim 2008).

In 1998, the original LEED Green Building Rating System (i.e. version 1.0) was released as a pilot program for LEED certification by the USGBC (Lockwood 2006) to serve as a framework primarily for the construction industry to achieve sustainable design goals (Lee and Kim 2008, Boschmann and Gabriel
2013). Through a process of evaluation, the USGBC awarded credits for building site selection, energy and water use efficiency, indoor environmental quality, and materials used (Nyikos et al. 2012). Depending on how many credits were earned, a building could achieve LEED Bronze, Silver, Gold or Platinum certification (USGBC 2016). LEED standards have evolved through time, which has resulted in periodic revisions to the original standards (Lee and Kim 2008, Nyikos et al. 2012, Al-Ghamdi and Bilec 2015, USGBC 2016). All building types including commercial and residential, and even entire neighborhoods can be LEED certified (USGBC 2016). There are slightly different rating systems that exist depending on which type of project is seeking LEED certification (Lee and Kim 2008, Nyikos et al. 2012, Al-Ghamdi and Bilec 2015).

The first significant modifications to the pilot program resulted in the LEED Rating System version 2.0 (Lee and Kim 2008, Al-Ghamdi and Bilec 2015). Some significant changes to the original program involved replacement of the Bronze level terminology with a 'Certified' level and modifications to the weight of the total credits required to achieve certification (Nyikos et al. 2012). Specifically, credits related to water conservation were decreased because the plumbing fixture requirements of the 1992 Energy Policy Act already helped to considerably reduce water use, while energy-efficiency credits were increased (Nyikos et al. 2012). Since the adoption of version 2.0, more changes have occurred (Nyikos et al. 2012, Al-Ghamdi and Bilec 2015, USGBC 2016). For example, one change that took place in 2002 (i.e. version 2.1) involved an administrative update to the rating system for new commercial construction, major renovations, and high-rise residential buildings (USGBC 2016). Three years later, another change (version 2.2) involved updating the LEED energy-efficiency standards to new American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) standards (Lee and Kim 2008, USGBC 2016).
The next major incarnation of the LEED system (i.e. LEED 2009) consisted of three substantial changes (USGBC 2016). The first major change was an increase in the total number of points possible to 100 points, from the previous 69 point total, however the weight put on the various categories remained the same as LEED versions 2.0-2.2 (Nyikos et al. 2012). The second change in LEED 2009 was that it included upgrades to the online tool used by individuals seeking LEED certification, while the third major change involved the consolidation of reference guides used by individuals seeking LEED certification (USGBC 2016).

Currently, the USGBC is touting a bolder, more specialized approach to LEED certification with its newest version (version 4.0) which debuted at the 12th Greenbuild International Conference and Expo in Philadelphia in November of 2013 (Al-Ghamdi and Bilec 2015, USGBC 2016). The overall goal of Version 4 (V4) was to build on the fundamentals of the past while offering a new set of support tools designed to help streamline the certification process by reducing the number of forms required by applicants and providing online credit calculators (USGBC 2016). LEED V4 also includes some additional considerations in its definition of 'green' (USGBC 2016), such as consideration of building occupant comfort in its analysis of indoor environmental air quality (Al-Ghamdi and Bilec 2015, USGBC 2016). Since its release, LEED V4 has undergone six public comment periods (Roberts 2013). LEED V4 is now the only operational version at the time of this thesis (USGBC 2016).

Although the USGBC’s LEED-certification process represents the first formal standards adopted for green building practices in the U.S., the U.K. deserves credit for taking green building mainstream (Potbhare et al. 2009). Specifically, the U.K. government launched a system of reliable standards and evaluation criteria known as the Building Research Establishment's Environmental Assessment Method (BREEAM) at the request of the British real estate industry in 1991 (Lockwood 2006). BREEAM continues to call itself the world's leading design and assessment method for sustainable buildings (Building
Research Establishment Ltd. 2016). Like LEED, BREEAM also has evolved in many ways involving its use and/or consideration of technology, construction standards, industry practices, marketplace needs, and stakeholder experience change (Building Research Establishment Ltd. 2016). The U.S. and U.K. are not alone in their support for green building with more than 20 countries at present also having formalized green guidelines for development and construction (Potbhare et al. 2009), including Austria, Germany, the Netherlands, Norway, Spain, and Sweden (Building Research Establishment Ltd. 2016). The LEED International Roundtable brings together the knowledge of green building councils or organizations representing the impact and application of LEED around the globe (USGBC 2016). The 41 member countries serve as an advisory group to USGBC in advancing the relevancy and application of the LEED rating systems internationally (USGBC 2016).

1.3 The Process of LEED Certification

The LEED certification process includes many steps and can be time consuming (Lockwood 2006, Potbhare et al. 2009, Long 2011). As such, it can be a daunting endeavor, especially for those new to the process (Lockwood 2006, Long 2011). A builder, architecture and design teams, or a certified LEED AP can purchase LEED reference guides to help navigate the certification process from start to finish (USGBC 2016).

To begin the process of seeking LEED certification, an applicant must determine the LEED rating system most relevant to his or her project (Lockwood 2006, Long 2011). There are currently five distinct rating systems for LEED certification that apply to different types of projects: 1) Building Design and Construction for newly constructed buildings or those going through a major renovation, 2) Interior Design and Construction for complete interior fit-out projects, 3) Building Operations and Maintenance projects for existing buildings undergoing improvement work with little to no construction, 4)
Neighborhood Development for new development or redevelopment projects that protect the environment, overall health, and quality of life that includes at least one LEED certified building, and 5) LEED for Homes for single- and multi-family homes (Blocker and Eckberg 1997, Lee and Kim 2008, USGBC 2016).

After identifying the appropriate project type, the candidate needs to register the building project with the USGBC through an online system (USGBC 2016). This registration requires a detailed description of the project including its name and address, identification of the rating system (LEED version 4) that the project will use, its start and end date for the project, owner information, if the building owner is different than the applicant, and payment of a registration fee (USGBC 2016). Registration fees vary across the different LEED rating systems and rating system versions; the fee starts at $900 for USGBC members and $1,200 non USGBC members respectively, as of September 2016, but USGBC warns registration and certification fees are subject to change and are calculated on the dates of registration and certification submission (USGBC 2016).

Once a project is registered with the USGBC, an applicant is granted access to a suite of computer-based educational and informational tools and resources provided by the USGBC (USGBC 2016). By default, the individual who registers the project is considered the project administrator by the USGBC (USGBC 2016). Following registration, the candidate is encouraged to formally identify a project team of associated individuals who will also have access to LEED Online and to begin the documentation process (USGBC 2016). LEED Online is a rating system selector that manages project details (USGBC 2016). Although there are no hard-and-fast rules about who needs to be on a LEED project team, LEED certification and building experts advise it include key stakeholders like the contractor, owner, architects or designers, and mechanical, electrical and plumbing (MEP) engineers who will collaborate on an integrative project design (Bonelli 2009, Samarasekera 2013). Samarasekera (2013) further suggests that
team members represent five types of people -- believer, pragmatist, expert, doer, and a diplomat - to lend their various strengths to a team (Samarasekera 2013). A believer traditionally is an out-of-the-box thinker who can come up with innovative ideas and can also serve as team cheerleader when others lose hope (Samarasekera 2013). A pragmatist grounds all ideas in the real world, and complements the believer by taking only realistic approaches (Samarasekera 2013). A doer would facilitate detailed documentation to the project of the project, making them invaluable to quality control (Samarasekera 2013). A diplomat could motivate the other team members to work cooperatively toward a common goal (Samarasekera 2013).

After a team is assembled, the project administrator can focus on identifying specific LEED credits that a project can endeavor to earn (USGBC 2016). Each rating system involves a combination of credit categories, which include Location and Transportation, Materials and Resources, Water Efficiency, Energy and Atmosphere, Sustainable Sites, Indoor Environmental Quality, Innovation, and Regional Priority credits (USGBC 2016). A scorecard may be downloaded from the LEED Online website to help the administrator to determine specific credits for his or her project (USGBC 2016).

Following registration and identification of LEED credits, the candidate should identify and then collect all relevant information and documentation to include in the LEED certification application process (USGBC 2016). LEED Online will explain to an applicant which exact documents must be completed during the application process since this will differ from project to project; therefore, it would be very difficult to list every possible piece of documentation an individual seeking LEED certification must submit at this time (USGBC 2016). Most LEED application processes will require at least one narrative description of the strategies the project team plans to use to pursue the various credits (USGBC 2016).
When the application is complete, the user can submit the complete application. (USGBC 2016) At this point the certification fees are due to the USGBC, which are based on the size of the project and applicable rating system (USGBC 2016). For non-USGBC members, certification fees start at $2,750 as of September of 2016, though at some point in the future this price could change (USGBC 2016). Businesses and organizations can become members of the USGBC on the organizations website, paying to become organizational, silver, gold, or platinum level members (USGBC 2016). For Silver, Gold and Platinum level USGBC members, certification fees begin at $2,250 as of September 2016, though at some point in the future this price could change (USGBC 2016). These fees cover the cost of a required third party review of the project by technical experts employed by the Green Business Certification, Incorporated (GBCI), to ensure that the project meets the standards set forth in LEED guidelines (van der Heijden 2015, Green Business Certification Inc. 2016).

If a project successfully achieves LEED certification, the applicant will be informed of the points earned and the level of LEED certification achieved (Lockwood 2006, Kay 2007, Newsham et al. 2009, Easton 2011, Singh 2011, Burt 2014, Matisoff et al. 2014). The length of time it takes to earn LEED certification varies across the different LEED rating systems and rating system versions, but generally range between three to five months after initial submittal of an application for preliminary review (USGBC 2016). There is an appeals process that applicants can initiate if a project owner or administrator wishes to challenge the GBCI’s assessment of the project (USGBC 2016). The total number of points possible is 100, with LEED Certified projects earning 40-49 points, LEED Silver projects earn 50-59 points, LEED Gold means 60-79 points earned and finally those projects that are awarded 80 or more points get the highest, LEED Platinum certification (USGBC 2016).
1.4 Tangible Benefits

There are numerous, multi-faceted advantages to LEED certification, ranging from monetary gains to improved environmental sustainability to human health benefits (Lockwood 2006, Kay 2007, Butler 2008, Young 2008, Fuerst 2009, Newsham et al. 2009, Potbhare et al. 2009, Easton 2011, Singh 2011, Burt 2014, Matisoff et al. 2014, Medici 2014, Reichardt 2014). Some of the most tangible benefits involve cost savings associated with building operations and maintenance (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Easton 2011, Singh 2011, Nyikos et al. 2012, Burt 2014, Matisoff et al. 2014, Medici 2014). For example, Nyikos et al. (2012) found that operating costs were $0.70 USD less per square foot and overall energy costs were 31% less in LEED-certified buildings than in their conventional counterparts. Another study of 100 LEED-certified buildings in North America found that, on average, LEED buildings used 18—39% less energy than their conventional counterparts (Newsham et al. 2013). The PNC Firstside Center Bank building in Pittsburgh, PA provides a good example of the savings in operating costs that can be associated with LEED certified buildings (Lockwood 2006). It features a unique hybrid HVAC system that allows ventilation air to be distributed beneath a raised floor as well as overhead air volume units that re-circulate the conditioned air in addition to the incorporation of a completely automated system that monitors and regulates temperature, humidity and carbon dioxide concentrations, which all mean that the building demands lower energy costs (U.S. Department of Energy 2016). Overall this building has been associated with a 20% reduction in operating expenses per square foot than a traditional, non-green sister building in Philadelphia (Lockwood 2006). Federal tax credits may also be available for LEED certified buildings (U.S. Department of Energy 2016). A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who reduce the building’s total energy costs by 50% through new lighting, building envelope or new HVAC systems (U.S. Department of Energy 2016).
Future operational cost savings are attractive (Matisoff et al. 2014) and the process of going through LEED certification can help boost pre-sale interest in a building project (Natural Resources Defense Council 2016). A related monetary benefit often associated with LEED certified buildings is that they typically demand higher real estate values (Newsham et al. 2009) and generate higher sales prices than their conventional counterparts (Magraby 2012, Natural Resources Defense Council 2016). For example, an analysis of Class A office buildings, defined as the newest and highest quality office buildings, (BOMA 2016) found that LEED-certified buildings also tend to demand higher average prices than their non-certified Class A building peers (Fuerst 2009).

Rent prices also tend to be influenced positively for LEED landlords, and occupancy rate in certified buildings tends to be higher than in traditional buildings (Matisoff et al. 2014). As an example, a 2008 study of data from commercial real estate company CoStar Group found that LEED-certified properties garnered 15.2 to 17.3% higher rents than traditional buildings, and sustained 16 to 18% higher estimated occupancy rates than traditional buildings (Wiley et al. 2010). A similar study of 7,140 buildings from the CoStar database found that LEED-certified buildings demanded rent premiums of at least 2.9% higher than traditional buildings over long-term time periods (Reichardt et al. 2012).

The increased energy efficiency responsible for much of the operational cost savings associated with LEED-certified buildings not only significantly reduces utility bills but also promotes environmental sustainability through decreased use of natural resources and carbon emissions (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Easton 2011, Murray 2011, Singh 2011, Boschmann and Gabriel 2013, Burt 2014, Matisoff et al. 2014, Medici 2014, Olinzock et al. 2015). According to the U.S. Department of Energy, buildings used 74% of all electricity and contributed to 40% of all carbon dioxide emissions in the U.S. in 2010 (Olinzock et al. 2015), but LEED-certified buildings are significantly more energy efficient than their conventional counterparts (Murray 2011). As an example, the LEED-Platinum
certified Genzyme Center in Cambridge, MA used 42% less energy and 34% less water than comparably sized buildings in its first year alone (Lockwood 2006). Genzyme took advantage of the newest technology on the market to help save energy over the long run, dedicating $23 million of its $140 million budget to advanced energy-conserving systems (Lockwood 2006). One of the advanced systems in place there is the computer-controlled window blinds that track the sun's position and automatically adjust to maximize light while deflecting heat, minimizing the building's dependence on electricity for lighting and cooling (Genzyme Corporation 2015). Other features, such as the use of natural light in the Genzyme Center’s 12-story open atrium lobby and prismatic chandelier that reflects the skylights to the interior offices mean less electricity is needed for building lighting (Genzyme Corporation 2015). This is of particular note, since 76% of emissions from commercial buildings come from purchased electricity (Boschmann and Gabriel 2013).

The overall health and well-being of employees who work in LEED certified buildings also can be a significant benefit to LEED certification (Butler 2008, Smith 2009, Millar and Baloglu 2011, Singh 2011, Matisoff et al. 2014, Reichardt 2014). U.S. citizens currently spend as much as 90% of their time indoors, and LEED-certified buildings often feature improved indoor air quality relative to conventional buildings (Singh 2011). Specifically, improvements associated with features like conscientious air intake placement and the use of low or no VOC floor and wall coverings, sealants and adhesives (Butler 2008, Smith 2009) have been linked to improved employee productivity and retention as well as reduced absenteeism (Reichardt et al. 2012). In contrast, a 2004 study found that poor indoor air quality (very low levels of indoor humidity) decreased productivity when participants typed a copy of a printed page onto a computer, proof-read a printed text for spelling, grammatical, and logical errors, and completed number addition (Wyon 2004). Wyon (2004) determined that poor indoor air quality can reduce office
worker productivity by 6-9% and that the relationship between the percent of workers dissatisfied with indoor air quality and measured decrement in job performance is linear (Wyon 2004).

1.5 Common Criticisms of LEED Certification

Despite its many benefits, LEED certification is not without criticism (Lockwood 2006, Newsham et al. 2009, Hoffman 2010, Montanya and Keith 2011, Quirk 2012, Rosiak 2013, Schnaars 2013). Common criticisms include the increased cost of LEED construction relative to conventional construction, over-inflation of potential energy savings of LEED-certified buildings, and the focus of builders on certification rather than construction best practices (Lockwood 2006, Newsham et al. 2009, Hoffman 2010, Montanya and Keith 2011, Quirk 2012, Rosiak 2013, Schnaars 2013, Peterson and Ulferts 2014). Although LEED certified buildings have been associated with significant cost savings in the long term, some critics assert that the cost of achieving certain benchmarks can make a new construction project cost-prohibitive and that the costs may outweigh the benefits of certification (Hoffman 2010). It also has been reported that the costs associated with green building may be underestimated (Nyikos et al. 2012), which could result in an overestimation of potential benefits to builders and eventual operators (Nyikos et al. 2012). For example, a study examining environmental assessment tools showed that most projects using LEED’s U.K. counterpart BREEAM exceeded their original budgets due to higher construction costs and overruns (Abdalla 2011).

However, it has been counter-argued that sustainable building materials, mechanical systems, and furnishings are now more readily available and affordable than ever, which can minimize such costs (Lockwood 2006). This argument has been supported by a study showing that the cost of constructing LEED certified buildings across the U.S. is just 0.8%, on average, than standard construction (Lockwood 2006). But, related criticisms have argued that building projects can be environmentally friendly without
paying for the consultants, administration, and other fees associated with the LEED certification process (Lockwood 2006). For example, Hoffman (2010) referenced a green building retrofit in Appleton, Wisconsin involving the renovation of a large retail department store to create a corporate headquarters for which achieving LEED certification would have amounted to an additional $150,000 investment. He explained that although a less expensive fix did not meet LEED certification criteria, it represented the best business decision given the circumstances (Hoffman 2010).

Within the realm of environmental sustainability, it has been argued that LEED certification does not necessarily amount to increased energy efficiency (Montanya and Keith 2011, Rosiak 2013). For example, a 2009 study of more than 120 LEED-certified buildings across the U.S. found that in some cases LEED certified buildings used more energy than their traditional counterparts (Newsham et al. 2009). To determine this, Newsham et al. (2009) compared the energy-use intensity, which is a measure of a building’s energy use in relation to its size or other characteristics (Star 2016), of LEED-certified buildings with the initial baseline and design models submitted as part of their LEED certification applications and with similar buildings listed in the 2003 Commercial Building Energy Consumption Survey database. Another study of buildings in New York City found that LEED-certified buildings used more energy on a per unit area basis than all buildings in general (Rosiak 2013). This study described a LEED Gold certified office building in New York City that ranked 113 on a list of the most-polluting office building of the nearly 1,200 buildings assessed (Rosiak 2013). This study concluded that one reason LEED certification does not necessarily result in reduced greenhouse gas emissions is that LEED certification points are given for a very large array of activities, such as using recycled materials in carpeting or installing bicycle racks on company property, rather than prioritizing energy-efficiency (Rosiak 2013). In fact, in 2011 a building could achieve LEED Gold certification without any of the energy points (Montanya and Keith 2011). Critics also argue that there is a large discrepancy between simulated and
actual energy use, and the LEED system evaluates energy performance based on simulated energy use (Montanya and Keith 2011).

1.6 The Evolution of LEED in Response to Criticisms

The USGBC has taken and continues to take steps to address the criticisms of LEED certification (Montanya and Keith 2011, Suh et al. 2014, Suzer 2015). One of the most common criticisms was that LEED certification does not always mean increased energy efficiency (Montanya and Keith 2011, Rosiak 2013). During the first two versions of LEED, each credit received one point, even though each factor did not decrease environmental loads at the same level (Suzer 2015). For example, rather than complete an expensive overhaul of HVAC systems resulting in increased energy efficiency, project designers could install bike racks to earn points even if no employees bike to work (Quirk 2012). Newer versions have used scientific data to create a more justified weighing system (Suzer 2015). The new system depends on the US EPA’s Tools for the Reduction and Assessment of Chemical and Other Environmental Impacts (Suze 2015) which includes factors quantifying specific impact reduction categories including ozone depletion, acidification which means increased acid deposition, and eutrophication due to water pollution, smog formation, and negative human health impacts (EPA 2016).

Currently the USGBC is taking steps to combat criticism by updating LEED criteria through an open process that encourages participation from project designers and other stakeholders (Suh et al. 2014). The newest version of LEED is moving toward the use of performance-based criteria for projects submitted for LEED certification, rather than those projects only being evaluated during the design process (Montanya and Keith 2011). The USGBC’s LEED 2009 Weightings Tool (USGBC 2016) acted as the first step toward such a context-dependent weighting system (Suzer 2015). Each project now submitted for LEED certification also must include measures of whole building energy use (Tweed 2013). USGBC continues to update and refine LEED certification standards with recent changes as recent as October

1.7 Do Consumers Care about LEED or is 'Green' Good Enough?

Many modern consumers seem to acknowledge and appreciate products and amenities that are environmentally conscious (Lockwood 2006, Potbhare et al. 2009, Mapp 2011, Millar and Baloglu 2011, Burt 2014, Matisoff et al. 2014, Medici 2014). For example, a 2009 J.D. Power and Associates survey reported that 66% of hotel guests were aware of hotels' conservation efforts, such as their replacement of inefficient HVAC systems (Millar and Baloglu 2011). Additionally, more than 70% of respondents to the 2009 North American Hotel Guest Satisfaction study said they actively participated in their hotels' conservation programs, such as participating in a linen-reuse program during a multi-day stay (Millar and Baloglu 2011). LEED certification also seems to be important to hotel guests, with 571 surveyed business and leisure travelers ranking hotel LEED certification as the most influential single attribute to selecting a hotel (Millar and Baloglu 2011). This study which drew respondents from a database of more than 4 million people willing to be contacted about online surveys also looked at the more general sustainability preferences of business and leisure travelers who stay frequently at different hotels in different cities and states and determined that most travelers additionally wanted a hotel room that incorporated non-LEED green attributes such as refillable shampoo dispensers, energy-efficient light bulbs, towel and linen reuse programs and key cards that control power use, as well as recycling bins in the hotel lobby (Millar and Baloglu 2011).

Beyond general awareness of environmental concerns, consumers have been shown to make purchase decisions based on greenness for various specific reasons (Lockwood 2006, Bonini 2008,
Perhaps the most tangible of these reasons involves cost savings (Bandyk 2009, Magent et al. 2009, Nayeem 2012, Kok 2013). For example, the need for green vehicles has long been a selling point for consumers, presumably driven by the desire to save money at the gas pump (Kok 2013). Similarly, consumers seem willing to spend additional money upfront for energy-efficient appliances, if this will provide energy-related cost savings over time (Bandyk 2009). A recent report measuring market penetration of products endorsed by the U.S. Environmental Protection Agency's Energy Star program found that energy-efficient products dominated in categories like electronics 96% of televisions and 75% of laptop computers carried the Energy Star rating for example – but lagged in other areas like large home appliances e.g., only 21% of freezers sold carried the Energy Star rating (Wieczner 2012). One reason Energy Star rated computers sell well is that a perk of the more energy efficient laptops is longer battery life (Wieczner 2012).

Fiscal concerns are not the only reason consumers opt to 'go green,' (Bandyk 2009, Nayeem 2012). Numerous studies suggest that personality traits and cultural influences may also play a role (Bandyk 2009, Nayeem 2012). For example, it has been reported that altruism may drive consumers to purchase green products, that green consumers buy ideals when making purchases and that the ideological benefit of a green product can outweigh the practicality of the purchase (Bandyk 2009). Social approval from others also could encourage consumers to consider greenness when making highly visible purchases (Bandyk 2009, Nayeem 2012). One study found that this was especially true for individuals born into cultures that put great emphasis on both greenness and collectivism, or the prioritization of a group over each of its individual members(Nayeem 2012). Specifically, Nayeem (2012) found that in a collectivist society (Asian-born), consumers were most likely to gravitate toward products made by companies known to be environmentally sound if environmental friendliness is...
favored by the collective. Similarly, Bandyk (2009) described that 'me too' consumers—those who pay close attention to the decisions of others when making choices for themselves—tend to purchase green products if others in their network also buy green products.

For businesses inherently focused on profitability, consumer interests in green products and practices can be an important factor to consider (Bandyk 2009, Matisoff et al. 2014). LEED certification takes this marketability one step further by offering a nationally-known signal of environmental awareness to potential customers (USGBC 2016). A 2014 analysis suggested that there can be considerable marketing benefits to LEED certification for buildings (Matisoff et al. 2014). To determine if companies seek LEED certification for enhanced marketing benefits versus performance benefits, Mastioff et al. (2014) looked at LEED points as indicative of performance benefits versus certification levels (Certified, Silver, Gold or Platinum) as relevant to marketing of more than 5,000 total LEED-certified projects. It was assumed that companies prioritizing marketing benefits would be associated with projects that scored near the baseline threshold level for a given certification level, but that companies interested in performance benefits would be associated with projects that scored higher than just above the cutoff point for a given certification level (Matisoff et al. 2014). Because a large number of the projects studied consistently clustered at or above the certification level cut-off, it was determined that enhanced marketing benefits likely play a role in LEED certification (Matisoff et al. 2014).

Although research has investigated the impact of LEED certification on building sales, which affects real estate profits, similar investigations studying the sales of products manufactured in LEED certified buildings have not been conducted. However, it is possible that the influence of LEED certification on the direct sales of buildings to consumers could filter down to a more indirect influence of LEED certification on the sales of products manufactured in LEED facilities to consumers (Lo 2010,
Millar and Baloglu 2011). A study examining U.S. firms on the Standard & Poor's 500 list reported that sustainable firms generally have a higher profitability than their non-sustainable counterparts (Lo 2010).

Ultimately a combination of green building practices and green products could be advantageous to gaining the "green" consumer. In 2012, the Volkswagen Group introduced the Passat TDI as its greenest vehicle, with an average of 44 miles per gallon (18.71 kilometers per liter) on the highway (Volkswagen 2016). That same year Volkswagen Chattanooga (the Passat manufacturing facility) became the first automobile manufacturing plant in the world to achieve LEED Platinum certification (Blanco 2011). However, in September of 2015, Volkswagen admitted to illegally installing software in its diesel-power cars to cheat emissions tests, and it is not clear if mileage data was falsified as well (Tuttle 2015). To increase understanding of how LEED certification may influence product marketing and sales, I conducted a large-scale survey of regional Passat owners to determine the potential role of LEED certification or overall greenness influenced decisions to buy a Chattanooga-built Volkswagen Passat. The following chapter of this thesis provides information and background on the LEED certification process of the Chattanooga Volkswagen plant and why officials opted to seek LEED certification. Chapter 3 contains a full description of my survey and its findings as well as conclusions and recommendations for Volkswagen and other large manufacturing facilities based on my research and survey findings.
CHAPTER 2 LEED CERTIFICATION IN THE MANUFACTURING SECTOR: A CASE STUDY OF VOLKSWAGEN CHATTANOOGA

When its production of the Passat began in spring 2011, Volkswagen Chattanooga (VW Chattanooga) made history as the first major automotive assembly plant operating with LEED Platinum certification (Blanco 2011). I learned about the LEED certification process of this facility through a combination of available literature and personal interviews conducted as a both a student and a journalist. My experience as a working member of the media, in particular, afforded me a unique view of the automotive assembly plant from its inception to its inauguration and put me in close communication with VW executives and other plant personnel. As an environmental graduate student interested in LEED certification, I had the opportunity to utilize this background knowledge and connection toward an investigation of the potential benefits of LEED to the manufacturing sector. In particular, I wanted to investigate more deeply the potential influence of LEED certification on consumer perceptions and decision-making. In my review of the literature available on this topic, I learned that research exploring the relationship of LEED certification in the manufacturing sector and the sales of products made in those facilities was extremely limited. Around the time that I was planning my thesis research, I met with a project manager and learned that VW Chattanooga managers were planning the construction of an addition to the original plant. This provided an application for my research, as my findings could help to elucidate the costs and benefits of seeking additional LEED certification for the plant addition in terms of the company’s bottom line. More recently, the planned addition of a second manufacturing line at
VW Chattanooga to build the Cross Blue sports utility vehicle (WDEF-TV 2016) has provided a related application. In this chapter, I present my journalistic ties to the Chattanooga Volkswagen plant, distinguish the facility as a pioneer of LEED certification in the manufacturing sector, comprehensively describe Volkswagen Chattanooga's LEED certification process, describe associated recognition that the plant has accrued, and question the extent to which consumers were taken into consideration as part of VW’s decision to achieve LEED certification.

2.1 My Journalistic Focus on Volkswagen Chattanooga

Every Chattanooga, Tennessee, media outlet had July 15 marked on its calendars during the early summer of 2008. This was the date that automotive insiders said the Volkswagen Automotive Group would announce the North American city chosen to house its first U.S. plant since a short-lived plant in Pennsylvania closed in the late 1980s. The Chattanooga area had been through the drill before. Specifically, the city's Enterprise South Industrial Park made the short list for a Toyota manufacturing plant a few years earlier, but ultimately lost to Blue Springs, Mississippi. Despite that setback, Chattanooga community leaders remained confident that Enterprise South could become home to a major manufacturing facility and that the VW decision could represent such an opportunity.

The weeks leading up to the announcement were characterized by a frenzy of speculation in not only my newsroom at WDEF News12, and other media outlets in Chattanooga, but also those in other sites in contention to house the new VW facility. In particular, Limestone, Alabama ranked high on the list of potential sites, and rumors of a huge delegation of Alabama governmental officials in Limestone on the morning of July 15 had many of us believing this competitor to the southwest would be chosen – until an Associated Press wire service alert flashed across our computers. While I cannot recall the exact
wording of the alert, I do remember that it announced that VW had decided on the location of its new American plant. Immediately, I picked up my newsroom phone and dialed the marketing manager for the Chattanooga Area Chamber of Commerce J.Ed. Marston. Almost as soon as he answered, Marston confirmed that Chattanooga had been chosen to house the new facility. After reporting live for our noon broadcast that day, I had three short hours to file a report about the day's announcement, locate elected officials who could come to the television station for a special hour-long broadcast set to air that evening after the regular evening news broadcast, and get to Enterprise South for our evening news broadcast. It was just the first day of reporting on what eventually would become the world's first LEED Platinum certified automobile manufacturing plant.

In the weeks, months, and years that followed the announcement, I filed numerous stories about the plant's manufacturing progress. For example, I reported live from the Enterprise South site in the January 2009 cold and sleet, as excavation work began on the first building. During the following November, I gave viewers a first peek of construction of the weather-tight paint shop; a follow-up tour was broadcast in January 2010 when the paint shop was nearly completed. Finally, in May of 2011, I covered the grand opening of the plant. The event was a huge celebration for the greater Chattanooga area and included a ceremony featuring several prominent politicians and dignitaries, including then U.S. Transportation Secretary Ray LaHood, then Chairman of the Volkswagen Board of Managers Martin Winterkorn, German Ambassador to the U.S. Klaus Scharioth, then-President and CEO of Volkswagen Group of America Jonathon Browning, and Tennessee state leaders, followed by a tour of the brand new plant. One memorable highlight of the event for me was meeting and interviewing the 6-year-old boy dressed as Darth Vader who appeared in VW's famous Super Bowl advertisement earlier that year. That September, the first Chattanooga resident to buy a Passat picked up her vehicle, and our station covered the moment she was handed the keys.
Although I was not the reporter assigned to its coverage, one particularly newsworthy aspect of the VW Chattanooga facility was its earning of LEED Platinum certification about six months after its grand opening. This news become public knowledge on the morning of December 1, 2011, when VW hosted an associated media briefing plant tour to detail and evidence the achievement of this benchmark in sustainable construction. Resulting media reports featured many aspects of the plant, including a paint shop designed to save 50 million gallons of water in ten years, a 66-acre solar array that creates one-eighth of the power used at VW Chattanooga, and the media center that uses compressed air and cold water for energy (WDEF-TV 2016).

Recently, I interviewed President/CEO of VW Chattanooga Christian Koch, and asked him about VW's role as a 'pioneer' of LEED certification for major manufacturing facilities. He credited VW Group's longstanding, worldwide commitment to sustainable mobility and environmentally responsible manufacturing. He continued to say that he and other company officials were proud of the plant's LEED Platinum certification, and described it as the fulfillment of a promise that VW has made around the world and in Chattanooga to work in harmony with the environment (personal communication, 5 June 2015). The fact that Volkswagen recently admitted to developing software that renders full vehicle emissions control systems operational only during diesel vehicle testing – thereby allowing cars to emit up to 40 times the legal limit of pollutants allowed by the Clean Air Act (Davenport 2015) – suggests that Volkswagen may have considered its image as an environmentally-conscious company over the actual environment in its LEED certification. However, prior to the current questioning of its environmental commitment, VW Chattanooga had been considered for years as a leader in sustainable design within the manufacturing sector.
2.2 Volkswagen’s LEED Certification Process

Volkswagen Chattanooga achieved Platinum LEED status under the United States Green Building Council (USGBC) rating system for new construction Version 2.2. I talked extensively with Volkswagen Manager of Construction and Planning David Calfee in early May 2013 to learn more about this process. Unless otherwise referenced, the information contained in this subsection was derived from our conversation. VW’s LEED process began almost as soon as the company announced its decision to build in Chattanooga and continued until the certification process was completed in fall 2011 (WDEF-TV 2016a). Because Volkswagen does not discuss the costs of this project, it is unknown exactly how much the plant spent on the process of obtaining LEED Platinum certification. However, statistics suggest that the certification process alone can account for 5 to 15 percent of the total construction costs of new buildings seeking LEED certification (Randall 2010). Because the VW plan comprised $1 billion investment (WDEF-TV 2016a), statistics suggest that its LEED certification could have cost Volkswagen somewhere between $50 million to $150 million.

To achieve LEED Platinum status, the VW facility had to earn 52 of 69 total possible points for green building initiatives under LEED for New Construction version 2.2. In total, Volkswagen achieved 52 points across six LEED categories. The category with the most points earned was Energy and Atmosphere, which recognizes efforts taken to improve electrical and mechanical systems to conserve energy (USGBC 2016). VW earned all of the 17 possible points that could be earned in this category. Perhaps most notably is the state’s largest solar array on site, which has the capacity to produce 9.5 million W of power, while comprises one-eighth all power used at the plant (Volkswagen 2016). The 66-acre array of 33,000 solar panels was completed in 2013 (Volkswagen 2016). Koch told me that the main obstacle to LEED certification that Volkswagen faced was the challenge of onsite power generation. The
company explored several options including wind, solar and landfill gas and ultimately decided to use solar energy, in a partnership with Silicon Ranch (personal communication with C. Koch, 5 June 2015). VW Chattanooga also earned points in the Energy and Atmosphere category because it did not use any chlorofluorocarbons (CFCs) as refrigerants in HVAC equipment associated with the plant and installed a system to monitor and track the facility’s energy use. Another initiative for which VW Chattanooga earned points in this category was its agreement to purchase Renewable Energy Certifications for nearly half of its annual electrical consumption.

In the Sustainable Sites category, Volkswagen Chattanooga earned 11 of the possible 14 points, representing another significant contribution to its total earned points. Sustainable Sites is a broad category designed to minimize the impacts of development and construction on the local environment (USGBC 2016). Credits in this category are awarded when projects mitigate their impact on local geology, hydrology, and microclimate. Sustainable Sites also considers occupant effects on the environment, like automobile use, and awards points for storm water control (USGBC 2016). In this category, Volkswagen mostly earned credit for choosing to build its facility on a Brownfield site that previously housed the Volunteer Army Ammunition Plant, which produced nearly three billion tons of explosives between World War II and the Vietnam War (Anonymous 1997). Selection of a Brownfield property means that there was no destruction of untouched natural areas where Volkswagen chose to build its facility. Although land was deforested and graded to build the facility, this land was not considered to be untouched due to the high number of contaminants remaining in the soil from the nearly 40 years that trinitrotoluene (TNT) was produced there. The dedication of one-fifth of the newly constructed site to open space also earned VW points in this category.

Points in the Sustainable Sites category also were earned in recognition of VW’s assignment of preferred parking to employees using Low Emission Vehicles (LEVs) and bicycles for commuting to
minimize air pollution and its use of erosion-control measures like sediment ponds, check dams, and seeding and matting activities during construction to prevent water pollution. As an example of associated pollution reduction, stormwater runoff is collected in natural filtration bioswales built into green spaces on the VW campus. By slowing and cooling the runoff, these bioswales help to trap and decrease algae and unwanted bacteria growth that could lead to eutrophication and/or harm wildlife. Points in this category also were earned for energy-use efficiency initiatives, such as VW Chattanooga’s campus-wide minimum lighting approach, which uses skylights to naturally light common spaces and motion sensors to control the use of fluorescent lighting in smaller spaces. Mitigation of the heat-island effect (Guindon and Nirupama 2015) often associated with development also was considered in the determination of VW’s Sustainable Sites credits. Specifically, the use of highly-reflective building materials, concrete and landscaping around buildings help to minimize local warming (Guindon and Nirupama 2015). VW Chattanooga earned an additional 7 LEED certification points in the Materials and Resources category, which represented about half of the total possible points that could be earned in this category. This category considers the environmental impacts associated with the production of building materials used in construction projects (USGBC 2016). Volkswagen Chattanooga earned points in this category based on use of recycled materials and recycling efforts during plant construction, the use of local goods instead of materials requiring long-distance transport to the construction site, and the planned prioritization of recycling programs on campus. In terms of specifics, nearly half of all building materials used in construction of the plant were manufactured from recycled materials and all steel, wood, cardboard, plastic, and concrete construction waste, amounting to three-quarters of the total waste generated during construction, was recycled. In addition, about half of the construction materials were procured within a 804.67 km radius of the construction site. Within office space in the facility, receptacles for aluminum, plastic, and paper recyclables are available.
VW Chattanooga also earned 7 points in the Indoor Environmental Quality LEED category, which represented almost half of the possible points that could be earned in this category. This category acknowledges that people typically spend the majority of their time indoors and recognizes efforts to provide high indoor air quality (USGBC 2016). In considering related initiatives, VW considered both employee health and comfort. Specific examples include the integration of ventilation systems in manufacturing areas designed according to ASHRAE 621-2004 standards that provide air 30% cleaner than minimum filtration requirements and the installation of CO₂ monitors and air flow control devices in all office areas. In addition, the entire VW campus is smoke-free and adhesives, sealants, paints, coatings, carpet systems, composite wood, and agrifiber products all comprised of materials that emit low-concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment (USGBC 2016).

In the Water Efficiency category of LEED certification points, which recognizes measures to conserve this natural resource, VW Chattanooga earned 5 out of the 5 total possible points. One contributing initiative involved the incorporation of locally adapted native vegetation in campus landscaping to minimize irrigation needs. Within site buildings, low-flow fixtures with no-touch sensors were used in kitchens and bathroom sinks to reduce demands for potable water. In addition, rainwater collected from the plant roof is pumped into bathrooms for flushing. In total, these water efficiency measures result in 30% less water usage in the VW Chattanooga plant than in comparable buildings of its size. VW Chattanooga also earned 5 points in the Innovation and Design Process category for innovative strategies, exemplary performance, and team expertise in sustainable design.
Figure 2.1
Photograph of Volkswagen Chattanooga’s solar array taken January 2013 by Mike Dunne. This photograph of the 33-acre solar farm was taken facing west.

Figure 2.2 Photograph of the Brownfield site on which Volkswagen Chattanooga was built. This photograph courtesy of Volkswagen Chattanooga in early 2012.
Figure 2.3
Photograph of open green spaces with natural filtration at Volkswagen Chattanooga, courtesy of Volkswagen Chattanooga. This photograph taken in early 2012 faces north-northeast.

Figure 2.4
Photograph of the skylight 'spine' that provides natural lighting in common spaces throughout Volkswagen Chattanooga. This photograph courtesy of Volkswagen Chattanooga, taken in 2012.
Figure 2.5
Photograph of Volkswagen Chattanooga's white roof, which reflects sunlight to minimize the heat island effect and reduce building cooling costs. This photograph courtesy of Volkswagen Chattanooga, taken in early 2012.

Figure 2.6 Photograph of recycling bins of the type found throughout the office spaces in the facility. This photograph courtesy of Volkswagen Chattanooga, taken in 2012.
Figure 2.7
Photograph of air monitors that monitor CO₂ and air flow used in assembly shop at Volkswagen Chattanooga. This photograph courtesy of Volkswagen Chattanooga, taken in 2012.

Figure 2.8
Photograph of storm water capture bins located in assembly shop that capture storm water runoff from the roof at Volkswagen Chattanooga. This photograph courtesy of Volkswagen Chattanooga, taken in 2012.
2.3 Recognition of Volkswagen Chattanooga's Environmental Initiatives

The U.S. Environmental Protection Agency (EPA) recently recognized VW Chattanooga for its commitment to excellence in the implementation of storm water projects with the regional 2014 Rain Catcher Award in the Commercial category, which honors businesses committed to green infrastructure in EPA region 4 (i.e., Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and six tribes, (EPA 2016). Volkswagen Chattanooga was the only winner of this award in the Commercial category in 2014. Grocery store-anchored retail chain development company Regency Centers won this award in 2015 for its Market at Colonnade Project in Raleigh, NC.

VW also recognized its own achievements with limited local advertising. When VW Chattanooga earned LEED certification in December 2011, the company put up two to three billboards near the plant advertising the LEED-certified status of the facility (Figure 2.9). Since there was no official advertising plan detailing this campaign, specific information about the location, duration, and costs of the costs of these billboards is not available. During the next few months, small copies of the billboard image would also be included in booklets and during video presentations at VW-sponsored events.

Officials at Volkswagen Chattanooga say consumer opinions in particular did not play a role in their decision to LEED certify, but that this decision reflected the more general commitment of the company to the environment (personal communication with C. Koch 5 June 2015). However, the environmental ‘friendliness’ of vehicles can be an important selling point for consumers. Some estimates suggest that about one-third of the cars bought worldwide within the next few years will be hybrids due to the marketability of green vehicles (Huhn 2013). This marketability could be influenced by multiple factors, including long-term cost savings due to fuel efficiency and personal values or attitudes about the environment, and these factors can be complex. As an example, a recent shift in the
Netherlands away from large, heavy and powerful vehicles has been attributed to factors ranging from fiscal incentives offered to promote fuel-efficient cars to a reflection of the types of vehicles available for purchase (Kok 2013). Demographic factors such as age, marital status, and number of children also may play a role in vehicle purchasing decisions (He et al. 2012).

While previous research has examined consumers’ attitudes about green products and buildings, studies have not looked at consumers’ attitudes about the products that are produced in green facilities. To determine if LEED certification plays a role in consumers’ car-buying decisions, I surveyed Chattanooga-area Volkswagen Passat owners. I chose to focus on this group since they likely would have been exposed to extensive media coverage of the plant and its LEED certification, which would give them at least a working knowledge of the concept of LEED certification. The next chapter of my thesis will detail my survey objectives, methodology, and findings. In the final chapter of my thesis, I will make recommendations based on the survey findings to the large goods manufacturing sector about LEED certification with consideration of profitability.

Figure 2.9
Image of Volkswagen Chattanooga’s billboard meant to recognize the VW auto manufacturing facility’s LEED Platinum certification. This image of the billboard designed in late 2011 courtesy of Volkswagen Chattanooga. Since this was not part of a formal advertising campaign, little information is available.
3.1 Introduction

In the world of business value drives profits and investment, without which companies would not be successful (Nyikos et al. 2012, Lazonick 2014, Matisoff et al. 2014, Smith 2016). To remain viable, businesses routinely consider ways to maximize profits and increase shareholder returns (Lazonick 2014). Common practices include marketing and other measures like networking and building partnerships to attract a large number of customers (Lazonick 2014), and/or decreasing manufacturing costs (Lockwood 2006, Nyikos et al. 2012, Lazonick 2014, Matisoff et al. 2014). Incorporating new technologies can help streamline manufacturing processes such as molding, forming, or joining to reduce labor expenses or to increase the energy-efficiency of manufacturing facilities (Lockwood 2006, Nyikos et al. 2012, Lazonick 2014, Matisoff et al. 2014). Other ways to help ensure economically viability are to sell more products or services (Lazonick 2014) and/or to raise the prices of existing products or services to increase overall profits (Bandyk 2009, Wieczner 2012, Lazonick 2014). However, this latter strategy may be risky since supply and demand generally dictate, that if all other factors remain equal, less people will demand a good if its price is raised (Smith 2016). This means that companies generally must find a way to offer a "better" product if they want to raise prices (Bandyk 2009, Wieczner 2012, Smith 2016).
Offering 'green' or 'eco-friendly' products and services to consumers can help companies earn more money by both increasing the attractiveness of those products and services while improving savings on the production bottom line (Lo 2010, Nyikos et al. 2012, Lazonick 2014, Matisoff et al. 2014). When it comes to products, environmental friendliness can mean many things, including using recycled and/or renewable materials in the product themselves and/or producing them in more energy efficient facilities and/or with more conservation of natural resources (Donnelly and Boyle 2006). In addition to production-associated monetary gain, a 2011 review conducted by the MIT Sloan School of Management reported that more than two-thirds of 3,000 global commercial sector executives surveyed identified environmental friendliness as a permanent fixture in their production practices as part of a broader sustainability movement (Lo 2010), — and in some cases, to attain associated marketing benefits (Kiron 2012). One-third of the survey respondents reported that such environmental friendliness contributed to their overall profits (Kiron 2012). More generally, the Standard and Poor's 500 List evidenced that green practices have contributed to the profitability of many companies, as evidenced by the number of firms that appear on the Dow Jones Sustainability Indices (Lo 2010), which evaluate the sustainability of the largest 2,500 companies listed in the markets, including World, North America, Europe, Asia Pacific, Korea, Australia, Chile and Emerging Markets (S&P Dow Jones Indices 2016).

Customer preferences also are a big driving factor behind many companies' decisions to offer green or environmentally friendly products (Donnelly and Boyle 2006). The recent MIT Review reported that more than 40% of surveyed executives identified their customers' preferences for sustainable products and services among their reasons for prioritizing environmentally friendly practices (Kiron 2012). Consumers may care about environmentally friendliness for many reasons, including the belief that it is the right thing to do based on their cultural influences and education (Nayeem 2012), the
importance for some people to identify themselves as someone who cares about the environment (Laroche et al. 2001), the long-term cost savings associated with environmentally friendly purchases (Bandyk 2009, Wieczner 2012, Kok 2013, Jacobsen 2015), and even demographic data such as number of children (He et al. 2012). One study examining cultural ties and consumer habits determined people born into cultures that put a higher emphasis on collectivism may look for social approval from others when making highly visible purchases like automobiles (Nayeem 2012). Self-identity as a “green consumer” may make a consumer more likely to buy more environmentally-friendly options like organic produce (Sparks and Shepherd 1992). Studies have shown that consumers will spend additional money upfront for energy-efficient appliances because they can result in lower energy bills over the long term (Bandyk 2009). The U.S. Environmental Protection Agency’s Energy Star program — which identifies and promotes energy efficiency in products, homes and buildings — confirms that energy-efficient products also sell in large enough numbers to be considered successful in categories like electronics, clothes dryers, dishwashers, refrigerators, and air conditioners (Wieczner 2012, Jacobsen 2015).

Relevance to LEED

As an analog to Energy Star labels for appliances, the Leadership in Energy and Environmental Design (LEED) certification program administered by the non-profit U.S. Green Building Council provides a benchmark for green buildings (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Smith 2009, Singh 2011, Matisoff et al. 2014, Medici 2014). For a building to earn LEED certification, it must meet various green-building criteria based on universal and measurable standards that consider factors such as minimizing the environmental impacts of construction activities, improving electrical and mechanical systems to conserve energy, and installing specialized plumbing and fixtures and incorporating locally adapted vegetation in campus landscaping to conserve water (USGBC 2016). Four
The rankings of LEED certification can be earned — from the lowest-ranking "Certified" level, to the highest-ranking "Platinum" level with intermediate "Silver" and "Gold" levels (Montanya and Keith 2011, Suzer 2015, van der Heijden 2015). Because LEED certification is a well-recognized standard for buildings (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Smith 2009, Singh 2011, Matisoff et al. 2014, Medici 2014), there can be considerable marketing benefits to LEED certification when it comes to building sales (Matisoff et al. 2014). Initially, the process of becoming LEED certified can help to boost pre-sale interest in building, and thus enhance the marketability of such real estate (Natural Resources Defense Council 2016). In addition, LEED-certified buildings often are able to demand higher appraisal values and sales prices than their non-certified counterparts (Newsham et al. 2009, Magraby 2012, Natural Resources Defense Council 2016). Landlords of LEED-certified buildings also typically can receive higher rent prices and achieve higher occupancy rates than in traditional buildings (Matisoff et al. 2014).

Although considerable research has investigated the marketability of green- and LEED-certified buildings, we could not find any direct studies that assess if the benefits of LEED certification filter down to the profitability of products manufactured in LEED buildings. Yet, such influence is possible, particularly when the LEED status of a building is well publicized and thus recognized. Knowledge of these potential benefits of LEED certification for manufacturing facilities could be valuable to the companies that produce products in LEED facilities. To investigate the potential influence of LEED certification on the potential profitability of products made in LEED facilities, I conducted a large-scale survey of regional owners of vehicles made in the world's first and only automotive manufacturing facility to achieve LEED Platinum status. Specifically, my survey targeted local owners of the 2012-2015 Volkswagen (VW) Passat manufactured in the VW Chattanooga (TN) Assembly Plant about their knowledge of LEED and its influence on their car-buying decisions. Because local media spent several months covering the LEED certification of the Chattanooga VW plant with hundreds of articles printed or
broadcasted, I surmised that Passat owners in the area would be familiar with the LEED status of the plant.

3.2 Methods

Survey Data Collection

To assess if the benefits of LEED certification filter down to the sale of the products manufactured in those buildings and to learn a bit more about Chattanooga-area VW Passat consumers, I conducted a survey of all local owners of the Chattanooga-built Passat (i.e., those representing model year 2012 or newer through the survey end date in 2015). This 12-question anonymous survey hosted by Qualtrics software (Qualtrics, LLC, Provo, UT, USA) included an assessment of respondents’ knowledge of LEED certification with a 4-point Likert item, because it was important to gauge whether or not survey respondents felt they had any kind of understanding of LEED certification, because for LEED to impact car buying decisions, consumers would need to have basic knowledge of LEED (Figure 3.1). I also included assessments about the influence of general environmental greenness (Figure 3.2) and LEED certification (Figure 3.3) on Passat owners’ car-buying decisions to help to determine if the benefits of LEED certification impact consumer car-buying choices, both when they purchased their Passats and on any future car purchases. Determining whether or not LEED certification played a role in consumer car-buying choices was achieved through with 5-point Likert items by asking how much respondents agreed with a statement declaring they considered LEED certification when purchasing their Passats. In addition to addressing my research goal, I also chose to assess general driving habits to gauge how often survey respondents drove their VW Passats, since there may be a correlation between how much a driver pollutes and if they would like to make some sort of amends for that pollution (Agrawal et al. 2010) or if the decision to drive a more fuel efficient car was a purely monetary decision.
The driving habits question was addressed with multiple choice questions and the option to fill in “other” choices to assess what other features played a big role in consumer purchases (Figure 3.4). Because previous research has shown that demographic factors can be especially influential to environmental purchasing decisions, I also included questions to characterize the demographic representation of my survey respondents with categorical multiple choice questions to gauge respondents’ gender, age, marital status, household income and education level (Figure 3.5). Previous research has shown that demographic factors can be especially influential when it comes to self-identifying as a person who cares about the environment (Blocker and Eckberg 1997, Laroche et al. 2001). For example, studies exploring the connection between environmental attitude and gender, have suggested that women tend to have greater concern for the environment than men (Arnocky and Stroink 2011). However, to our knowledge research to date exploring if demographics influence opinions or feelings about LEED certification is limited.

<table>
<thead>
<tr>
<th>How would you best describe your familiarity with Leadership in Energy and Environmental Design (LEED) certification?</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] I have never heard of LEED certification</td>
</tr>
<tr>
<td>[ ] I have heard of LEED certification, but I don’t know what it means</td>
</tr>
<tr>
<td>[ ] I have some knowledge of the definition of LEED certification, but do not know all of the details</td>
</tr>
<tr>
<td>[ ] I have full understanding of LEED certification</td>
</tr>
</tbody>
</table>

Figure 3.1
Knowledge based question asked on an anonymous survey of Volkswagen Passat owners to assess the potential influence of LEED certification on their vehicle purchases
Figure 3.2
Questions to assess the influence of car company general environmental greenness asked on an anonymous survey of Volkswagen Passat owners to assess the potential influence of LEED certification on the vehicle purchases

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you agree with this statement? “I considered Volkswagen’s environmental stewardship when I purchased my car.”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much do you agree with this statement? “I will consider a car company’s environmental stewardship when I purchase my next car.”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.3
Questions to assess the influence of LEED certification asked on an anonymous survey of Volkswagen Passat owners to assess the potential influence of LEED certification on the vehicle purchases

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much do you agree with this statement? “I considered Volkswagen’s LEED certification in particular when I purchased my car.”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much do you agree with this statement? “I will consider a car company’s LEED certification in particular when I purchase my next car.”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.4
General car habits questions asked on an anonymous survey of Volkswagen Passat owners to assess the potential influence of LEED certification on their vehicle purchases.

How often do you drive your Passat on average?
[ ] Less than 2 Days per Week
[ ] 3-5 Days per Week
[ ] More than 5-6 Days per Week
[ ] Daily

Please indicate all factors you take into consideration when buying a new car:
[ ] Price
[ ] Safety
[ ] Reliability
[ ] Appearance
[ ] Storage
[ ] Technological Features (i.e. Stereo System, Navigation System, Wireless Communications, etc.)
[ ] Other (please describe)
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your gender?</td>
<td>[ ] Male</td>
</tr>
<tr>
<td></td>
<td>[ ] Female</td>
</tr>
<tr>
<td>How old are you?</td>
<td>[ ] Under 18</td>
</tr>
<tr>
<td></td>
<td>[ ] 18-35</td>
</tr>
<tr>
<td></td>
<td>[ ] 36-49</td>
</tr>
<tr>
<td></td>
<td>[ ] 50-65</td>
</tr>
<tr>
<td></td>
<td>[ ] Over 65</td>
</tr>
<tr>
<td>What is your current marital status?</td>
<td>[ ] Single</td>
</tr>
<tr>
<td></td>
<td>[ ] Married without Children</td>
</tr>
<tr>
<td></td>
<td>[ ] Married with Children</td>
</tr>
<tr>
<td></td>
<td>[ ] Living with Partner without Children</td>
</tr>
<tr>
<td></td>
<td>[ ] Living with Partner with Children</td>
</tr>
<tr>
<td>What is the highest level of education you have completed?</td>
<td>[ ] Some High School</td>
</tr>
<tr>
<td></td>
<td>[ ] High School/GED</td>
</tr>
<tr>
<td></td>
<td>[ ] Some College</td>
</tr>
<tr>
<td></td>
<td>[ ] 2-year College Degree</td>
</tr>
<tr>
<td></td>
<td>[ ] 4-year College Degree</td>
</tr>
<tr>
<td></td>
<td>[ ] Master’s Degree</td>
</tr>
<tr>
<td></td>
<td>[ ] Doctoral Degree</td>
</tr>
<tr>
<td></td>
<td>[ ] Professional Degree (JD, MD)</td>
</tr>
<tr>
<td>What is your household income?</td>
<td>[ ] Less than $20,000 per year</td>
</tr>
<tr>
<td></td>
<td>[ ] $20,000 - $40,000 per year</td>
</tr>
<tr>
<td></td>
<td>[ ] $40,000 - $60,000 per year</td>
</tr>
<tr>
<td></td>
<td>[ ] $60,000 - $80,000 per year</td>
</tr>
<tr>
<td></td>
<td>[ ] More than $80,000 per year</td>
</tr>
</tbody>
</table>

Figure 3.5
Demographic questions asked on an anonymous survey of Volkswagen Passat owners to assess the potential influence of LEED certification on their vehicle purchases
The University of Tennessee at Chattanooga’s Institutional Review Board approved the survey and resultant data collection prior to its distribution (IRB # 14-093). The survey was initiated in July 2014 and remained open for one year. My goal was to receive at least 80 responses to represent 10% of the total number of Passats sold by Village VW of Chattanooga, which is the Chattanooga area’s only VW dealership and sells primarily to the local market (personal communication with B. Cobb, President of Bowers Automotive Group, 2 June 2014). I chose 10% as a target number of responses with a given sample size of 800, and used a 95% confidence interval with a 10% margin of error (SurveyMonkey 1999-2016). This number of responses also seemed to be an attainable goal, given my survey distribution methods. Because Village VW understandably would not disclose personal information about its customers, I used social media, web pages, and flyers placed on Passat windshields in the Chattanooga area to reach potential survey respondents. Specifically, links to the survey were posted on the Village VW Facebook page, VW Club of America website, and VW Chattanooga Facebook page and website. I also posted links to the survey on my personal and professional Facebook pages and Twitter accounts because they generate high traffic given my profession as a local television meteorologist and news anchor. Re-posts of the survey were made regularly throughout the survey period to ensure its continued publicity.

Analysis and Interpretation

To assess directly the influence of LEED certification and car company general environmental greenness, I examined mode values and distribution of categories of 5-point Likert items. Since survey respondents’ knowledge of LEED certification may provide insight into their answers, mode values and distribution of categories also were examined for the knowledge-based 4-point Likert item to determine what level of knowledge respondents had about LEED certification. Since driving habits may influence
survey respondents’ answers to how much LEED certification and car company general environmental greenness influence their car-buying decisions, I examined the mode values and distribution of the categorical driving habit question to determine how often survey respondents drove their Passats. Since demographics may influence survey respondents’ answers to how much LEED certification and car company general greenness influence their consumer car-buying decisions, I also examined the mode values and distribution of the categorical demographics questions addressing demographics. Modes, rather than medians, were used to examine the responses and perform associated statistical analyses since medians do not accurately describe categorical data since they are not nominal or ordinal in nature. Chi-square analyses were used to assess if knowledge of LEED certification influenced consumers’ consideration of general greenness or LEED certification when purchasing their Passat or future cars, and if demographic factors like gender or education level influenced knowledge of LEED certification, as well as consumers’ consideration of general greenness or LEED certification when purchasing their Passat or future cars with SPSS (version 22.0, IBM Corporation, Armonk, NY, USA). Specifically, the influences of demographic and knowledge-based categorical data on consumers’ consideration of general greenness and LEED certification consideration for Passat purchases and any other future car purchases were analyzed by Pearson chi-square tests with Fisher exact tests used to perform appropriate post hoc analyses (Ott and Longnecker 2008). A $p$ value $\leq 0.05$ for chi-square tests and adjusted residual of $\geq 1.96$ were regarded as statistically significant.
3.3 Results

Survey Responses and Respondents

A total of 90 Passat owners submitted at least partial responses to my survey, resulting in an overall response rate of about 11% of total local Passat owners. The survey drew responses from Passat owners in the Chattanooga area. The greatest numbers of survey respondents were male, by more than a 2:1 ratio. The majority of survey respondents were between 36-65 years of age (Figure 3.4) and more than three-quarters were married with children. More than half of all survey respondents reported having at least some college education (Figure 3.5) and nearly two-thirds of all survey respondents reported a household income ≥ $80,000 per year.

Figure 3.6
Ages of respondents to an anonymous survey of Chattanooga-built Volkswagen Passat owners
about the potential influence of LEED certification on that purchase

Figure 3.7
Education level of respondents to an anonymous survey of Chattanooga-built Volkswagen Passat owners about the potential influence of LEED certification on that purchase

Influence of Environmentalism and LEED Certification

Overall, respondents expressed being mostly neutral in their consideration of LEED certification or general greenness when purchasing vehicles. In contrast, very few respondents reported that VW’s environmentalism was a strong consideration in the decision to buy a Passat, while more than twice as many people reported that this consideration was very unimportant (Figure 3.8). The vast majority of respondents also reported being neutral about any car company’s environmentalism, when they purchased their VW Passat or on any future car purchases they may make. I chose to ask if survey respondents would, in the future, consider car company general environmental greenness or LEED
certification on future car purchases to determine survey respondents’ decisions about the influence of LEED certification and car company general environmental greenness on future car purchases, to determine if these would be considerations in the future, instead of just when they purchased their Passat. Of those respondents with non-neutral responses to this question, about three times as many reported that they would consider company-environmentalism at least somewhat when purchasing a new car in the future, rather than those who would not consider this factor at all (Figure 3.9). Only 3% of respondents reported that VW’s LEED certification was a strong consideration in their decision to buy a Passat; more than one-third of respondents were neutral about the influence of LEED on this decision (Figure 3.10). Nearly half of survey respondents were neutral (42%, n = 59) about the importance of LEED certification and if it would play a role on future car purchases, however, the second greatest numbers of respondents agreed LEED certification will play a role in the future (Figure 3.11).

Figure 3.8
Consideration of VW’s environmental stewardship as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification
Consideration of any company’s environmental stewardship on future car purchases.

Figure 3.9
Consideration of any car company’s environmental stewardship as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification on that purchase.
Consideration of LEED certification as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification on that purchase.

Figure 3.10
Consideration of any car company’s LEED certification as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification on that purchase

Knowledge of LEED Certification and Preference for Car Features

Most survey respondents reported familiarity with the concept of LEED, but results did not demonstrate that LEED certification played an influential role in their decisions to buy a Passat. Specifically, more than two-thirds of all survey respondents reported having full knowledge of LEED (28%, n = 60) or some knowledge of LEED certification without knowing all of its details (40%, n = 60) with roughly even amounts of respondents never having heard of it or not knowing at all what it means (Figure 3.12). Knowledge of LEED was not influenced statistically by demographic factors. When given the option to choose their own reason for purchasing their Passat, the largest number of respondents who chose to explain their choice of “other” included gas mileage (59%, n=17), resale value, local
manufacturing, performance and warranty (Figure 3.13). Of the nine people who listed mpg or gas mileage as a selling point, nearly half said they agree with considering VW’s environmental stewardship and two-thirds said they will take car company environmentalism into account when they make future car purchases.

![Respondents' Knowledge of LEED](image)

**Figure 3.12**
Knowledge of LEED certification as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification on that purchase
Consideration of features manually entered as ‘other’ considerations as reported anonymously by Volkswagen Passat owners in Chattanooga surveyed to explore the potential influence of LEED certification on that purchase.

None of the demographic factors included in my survey (Table 3.1), knowledge of LEED certification, or driving habits significantly influenced Passat-buyers’ consideration of environmentalism and LEED certification (Table 3.2). However, consideration of VW’s environmentalism and general car company environmentalism of Passat owners did influence consideration of VW’s LEED certification and general car company LEED certification (Table 3.3).
Table 3.1 Results of chi-square analysis of influence of demographic factors, including gender, age, family status (family), education and income of those surveyed owners of the Passat who responded on consideration of Volkswagen’s environmentalism and the LEED platinum certification of the Passat manufacturing when the vehicle was purchased, consideration of general company environmentalism and LEED certification on future car purchases, and knowledge of LEED (LEED Knowledge). A p value ≤ 0.05 was regarded as significant.

<table>
<thead>
<tr>
<th></th>
<th>Volkswagen (VW) Environmentalism</th>
<th>VW LEED Certification</th>
<th>Company Environmentalism</th>
<th>Company LEED Certification</th>
<th>LEED Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>X²</td>
<td>p</td>
<td>n</td>
<td>X²</td>
</tr>
<tr>
<td>Gender</td>
<td>58</td>
<td>6.882</td>
<td>0.142</td>
<td>59</td>
<td>5.202</td>
</tr>
<tr>
<td>Age</td>
<td>58</td>
<td>20.215</td>
<td>0.063</td>
<td>59</td>
<td>6.260</td>
</tr>
<tr>
<td>Family</td>
<td>58</td>
<td>7.201</td>
<td>0.513</td>
<td>59</td>
<td>10.257</td>
</tr>
<tr>
<td>Education</td>
<td>59</td>
<td>25.398</td>
<td>0.600</td>
<td>58</td>
<td>28.179</td>
</tr>
<tr>
<td>Income</td>
<td>59</td>
<td>21.770</td>
<td>0.970</td>
<td>55</td>
<td>23.682</td>
</tr>
</tbody>
</table>

Table 3.2 Results of chi-square analysis of influence of knowledge of LEED certification (LEED Knowledge) of those surveyed owners of the Passat who responded on consideration of Volkswagen’s environmentalism and the LEED platinum certification of the Passat manufacturing when the vehicle was purchased, consideration of general company environmentalism and LEED certification on future car purchases. A p value ≤ 0.05 was regarded as significant.

<table>
<thead>
<tr>
<th></th>
<th>Volkswagen (VW) Environmentalism</th>
<th>VW LEED Certification</th>
<th>Company Environmentalism</th>
<th>Company LEED Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>X²</td>
<td>p</td>
<td>n</td>
</tr>
<tr>
<td>LEED Knowledge</td>
<td>58</td>
<td>13.639</td>
<td>.324</td>
<td>59</td>
</tr>
</tbody>
</table>
Table 3.3 Results of chi-square testing the influence of consideration of environmentalism on consideration of LEED certification within the context of Volkswagen and car companies in general as assessed by a survey of Passat owners in the Chattanooga, TN area. A p value ≤ 0.05 was regarded as significant.

<table>
<thead>
<tr>
<th></th>
<th>Volkswagen LEED Certification</th>
<th>Company LEED Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>X²</td>
</tr>
<tr>
<td>VW Env</td>
<td>58</td>
<td>104.692</td>
</tr>
<tr>
<td>General Env</td>
<td>59</td>
<td>67.901</td>
</tr>
</tbody>
</table>

3.4 Discussion

Consideration of LEED Certification

The results of my survey of VW Passat owners suggest that LEED certification does not strongly influence consumer car-buying purchases. Specifically, responses demonstrated that LEED certification did not influence the majority of Chattanooga-area Passat owners to purchase their Passats and that these owners would not consider LEED certification in future car-buying purchases. My survey results also did not seem to indicate that a lack of overall understanding of LEED certification played into consumers’ unwillingness to consider LEED certification because most survey respondents reported familiarity with the concept of LEED. It was not surprising that most respondents’ indicated a familiarity with LEED certification, because LEED certification is a well-recognized standard for buildings (Lockwood 2006, Kay 2007, Young 2008, Potbhare et al. 2009, Smith 2009, Singh 2011, Matisoff et al. 2014, Medici 2014) and print, online and broadcast news organizations in the Chattanooga area covered the LEED certification of the VW plant. But knowledge of LEED certification did not significantly influence Passat-buyers’ consideration of environmentalism and LEED certification (Table 3.2). However, it seems likely
that survey respondents who characterized themselves as having a full understanding of LEED certification may have overestimated their knowledge. Because my survey did not include questions to directly assess respondents’ knowledge of LEED certification, it relied on respondents’ ability to evaluate their own understanding of LEED certification to gauge this factor, and studies have shown it may be difficult to properly estimate ones’ own understanding of complex ideas (Gabriel et al. 1994, Bipp et al. 2012). LEED remains a complicated topic, and programs that allow people to achieve status as credentialed LEED professionals exist because of the highly complex nature of this system. There are three levels of LEED professional status that an individual can earn. LEED Green Associates must pass an online exam and maintain their credential with 15 hours of continuing education hours within two years of earning their credential (USGBC 2016). LEED AP credentialed professionals must pass the full exam as well as one that tests their expertise in the specialty they chose to pursue (Building Design and Construction, Operations and Maintenance, Interior Design and Construction, Neighborhood Development, and Homes) and then maintain credentials with an additional 30 hours of continuing education during the next two years (USGBC 2016). LEED Fellows have ten or more years of professional green building experience (USGBC 2016).

There was a connection between those survey respondents who reported that they agree with considering both VW and general car company greenness and LEED certification during their Passat purchase and when they make future car purchases (Table 3.3). This can lead to the conclusion that those who already proclaim to care about environmental issues will give extra consideration to LEED certification (Lo 2010, Kiron 2012). Although LEED certification encompasses three pillars of sustainability—environmental, social and economic aspects (Hansmann et al. 2012)— the connection between respondents’ feelings about environmentalism and LEED suggested that they considered this aspect of LEED to be primary.
Consideration of General Greenness

Survey responses also suggested that most VW Passat consumers did not consider VW’s more general environmentalism when deciding to purchase their Passats and that they similarly would not consider such environmentalism when making future car purchases. Since a large number of survey respondents cited fuel efficiency as a selling point (Figure 3.11), these consumers may be interested in reducing their environmental impact because buying more fuel-efficient cars and light trucks is a large step consumers can take to reduce climate change (ACEEE 2002-2016). However, buying more fuel-efficient cars and light trucks may just be about spending less money when filling up the gas tank, because people like to spend less money on gasoline (Hill 2012).

The Influence of Demographic Factors on Consideration of LEED Certification

Previous research has shown that demographic factors can be especially influential when it comes to embracing environmentalism (Blocker and Eckberg 1997, Arnocky and Stroink 2011, Milfont and Sibley 2016). For example, studies exploring the connection between environmental attitude and gender, have suggested that women tend to have greater concern for the environment than men (Arnocky and Stroink 2011) because women typically have higher levels of empathy (Milfont and Sibley 2016). Zelezny et al. (2000) found this difference in environmental attitude and gender across different age groups and several different countries. The authors determined socialization theory played a role in the connection between environmental attitude and gender, that is, that females are socialized to be more expressive and to be compassionate care-givers (Zelezny et al. 2000) which may contribute to their higher levels of empathy. However, this did not appear to be the case for Chattanooga area Passat owners, possibly because the studies exploring the connection between gender and environmentalism did not investigate this connection when it comes to car purchases.
Limitations and Future Directions

Although my study suggested that LEED certification was generally not considered for consumer purchases, interpretation of my findings was limited in several ways. For example, since a customer list was not made public, survey responses were limited to those who either saw the link on social media, or who successfully typed in the long URL I printed on the flyers placed on cars in area parking lots. An online survey may not reach every type of Chattanooga-built Passat owner since not everyone owns a computer or has the ability to get online. A recent Pew Research poll found 84% of all U.S. households own a computer but only 73% of U.S. households have a computer with a broadband connection to the internet (Center 2016). Also, older Americans may not use the internet as often as their younger counterparts. A study of low socio-economic group individuals determined that those older than 55 years were as much as 10 times less likely to use the Internet than respondents between the age of 15 and 34 years (Aerschot and Rodousakis 2008). In addition, a study of older Chinese computer users found that Chinese internet users above age 50 has been consistently < 5% of the total Chinese Internet population (Xie 2008). Such reports suggest that the online distribution method may have led to the targeting of younger Passat owners. Future studies may opt to attempt to reach a larger sampling of Chattanooga-built VW Passats by distributing the survey both online and through mailings to help reach those who may not have the ability to get online.

Including questions to more directly assess respondents’ knowledge of LEED alleviates the need to rely on respondents’ ability to evaluate their own understanding of LEED certification. Since my study did not ask respondents to specify why they considered factors when purchasing their vehicles, future studies also may opt to ask questions specifying if consumers considered fuel efficiency as a major selling point because of the cost-savings associated with a high fuel efficiency, or because it helps create
a smaller carbon footprint for that consumer. Also, open-ended questions could also be included to allow respondents the ability to write, in their own words, why they purchased their VW Passats.

To further explore the potential marketability of LEED-manufactured products to consumers, further research also could focus on consumers of products in other markets since Chattanooga is a region of the U.S. which votes for Conservative candidates for legislative and Federal offices (Greenhouse 1994), and environmentalism has become politicized and associated with Progressive candidates (Kim 2011). For example, research has suggested that climate change acceptance is largely a partisan issue (Hamilton and Keim 2009) because in 2010, 47% of Democrats called global warming a “major priority” compared with 12% of Republicans (Kim 2011).

Expanding my research question to include other LEED-certified vehicle manufacturing facilities and their LEED-certified vehicle-manufacturing facilities and their consumer bases could allow for potential generalization of findings. Such studies could include purchasers of the Saturn Outlook, GMC Acadia, and Buick Enclave built in General Motors’ LEED Gold certified Lansing Delta Township Assembly Plant (Selko 2006), or Toyota and Lexus vehicles sold by LEED-certified Toyota and Lexus dealerships stretching from Maryland to California (Toyota 2012). Future studies also could focus on manufacturers of other products, since automobile purchases may be dictated by a different set of rules than those of smaller, less expensive purchases. Beckman, Gustafson and Golob (1973) found automobile ownership is a decision based on transportation needs, more so than emotion-based impulse buys (Beckmann et al. 1973). Such studies could consider the LEED Platinum-certified Method factory in Chicago, IL that produces green cleaning products (Business 2014), a LEED-certified factory that manufactures woven clothing in Sri Lanka (Ravindu et al. 2015), a flexible floorcovering factory in Thailand (Interface 2016), and Colgate’s LEED Silver-certified manufacturing facility outside of Ho Chi Minh City, Vietnam where toothbrushes are made (Hung 2009).
Potential Implications for Manufacturers Considering LEED Certification

Since most survey respondents reported that they did not consider LEED certification at all when purchasing a Passat manufactured in the LEED Platinum-certified plant, VW and other large manufacturing facilities could lack incentive to strive for LEED certification. Specifically because statistics suggest that the LEED certification process alone can account for 5-15% of the total construction costs of new buildings seeking LEED certification (Randall 2010), companies may consider if such certification is worth the additional expense. Benefits of facilities built to LEED standards include monetary gains associated with reduced operating costs of $0.70 USD less per square foot and overall energy costs of 31% over conventional construction—improved environmental sustainability— and potential human health benefits (Lockwood 2006, Kay 2007, Butler 2008, Young 2008, Fuerst 2009, Newsham et al. 2009, Potbhare et al. 2009, Easton 2011, Singh 2011, Burt 2014, Matisoff et al. 2014, Medici 2014, Reichardt 2014). However, if a company’s primary focus is product marketing and sales, LEED certification may not be the best use of company funds for automobile manufacturing facilities.

However, since VW Chattanooga invested considerable money and effort to become the world’s first and only LEED Platinum-certified auto manufacturing facility, company leadership could better advertise this fact. Although my findings do not suggest that consumers consider LEED certification in vehicle purchasing decisions, this may not always be the case. As future generations put a greater emphasis on protecting the environment, VW may be perceived as a pioneer in green building and manufacturing.
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Amy Katcher-Dunne was born in Euclid, Ohio to parents William and Marlene Katcher. She is the youngest of four children, with three older brothers. She attended Glenbrook Elementary School until her parents moved to Solon, Ohio where she attended Orchard Middle School, Forest Park Junior High and then Solon High School. After graduation, Amy attended Ohio University for a year and a quarter before transferring to Kent State University where she earned a Bachelor of Arts in Radio and Television Production in December of 2000. Amy developed her love for meteorology when she began presenting daily weather forecasts during her college television newscasts. Once Amy began her career in television, she began her second degree at Mississippi State University, eventually earning a Bachelor of Science in Geosciences in August of 2007. Amy began her Masters coursework at the University of Tennessee at Chattanooga in early 2011, while working full time as a meteorologist and then prime time news anchor at the CBS affiliate in Chattanooga, Tennessee. Amy graduated with a Masters of Science degree in Environmental Sciences in December of 2016. She recently left broadcast news to work as Communications Coordinator at the Hamilton County Department of Education.