ISO 14001: THE CREATION OF AN EFFECTIVE ENVIRONMENTAL MANAGEMENT SYSTEM

by
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Abstract

A majority of research that is completed on ISO 14001 has focused on the development of the Environmental Management System for a company. Little research has been focused on whether the ISO 14001 certification ensures a company has better performance than a company without this certification. The customers request this certification and the company is to obligated to sell their products. If a company were to forgo having the ISO 14001 certification and create an environmental management system based on their company needs and not these guidelines, would consumers halt the purchasing of their products. In this context, this work aims to demonstrate the results that having an ISO 14001 certification don't ensure a company has higher performance than a company who is not certified. Several tire and chemical plants were monitored from 2013-2016 through various factors lead to this conclusion from a Fortune 200 company. Finally, this will conclude that financial revenue will be diminished due to the lack of consumers. The environmental management system implemented at this company is based of the latest version of ISO 14001: 2015 guidelines.

Acknowledgements

This review is my final Capstone Research project to obtain the degree of Master of Science in Environmental Science and Policy, with a concentration in Environmental Planning, from The Johns Hopkins University. First, I'd like to thank my mentor Jeffrey Malek for guiding me in my passion of sustainability and environmental science. ISO 14001 is a topic I had limited knowledge on, but I wanted to learn more. Taking a course on ISO 14001, working with skilled professionals, and having access to an abundant amount of resources helped me gain the understanding I wanted. IS0 14001 lacks in the research realm with many questions unanswered. A review of this regulation led to the hypotheses in this research that have yet to be answered by previous individuals. Through this research we were able to answer many of these questions as well as evolve new ones. I'm grateful to have this opportunity to work with such a skilled individual.

I'd also like to thank three employees within the environmental health and safety division within this fortune 200 company. During this research many questions would arise and not one question went unanswered. Data was needed to compare different plants and the commitment to gather this data was above and beyond. These professionals were well versed on the ISO 14001 guideline and not only an asset to this research, but the company itself.

Lastly, I'd like to thank Dr. Daniel Zachary for his commitment to our lessons and guiding us on the best practices within scientific research and writing.

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Introduction

ISO 14001 is intended to help an organization to achieve a more sustainable production practice. The objective of this paper is to examine if ISO 14001 certification is needed if there is already an effective Environmental Management System put in place by the company. Also, if there are financial impacts on a company if they're not ISO 14001 certified. The framework of this study will give future companies an understanding whether an effective Environmental Management System is comparable to the ISO 14001 certification. This specific framework has the capability to guide stakeholders from public and private sectors and process what application works best for their organization. ISO 14001 is initiated based off customer requests, and this research will challenge the current structures that help to shape global production.

This research has a couple of biased indicators that need to be addressed. The data utilized was part of one region. Within this region, all plants are ISO 14001 certified. There is only one plant in the North American region that is not ISO 14001 certified, but the data was not available for a comparative analysis. Therefore, a comparative analysis was unable to be performed due to the lack of information present. There were different types of literature used for this research that will be later explained in the sampling procedures. The data for determining whether there would be a negative impact on the financial sector of a company if it didn't utilize the ISO 14001 guidelines was established through literature. This literature shows both sides of utilizing the ISO 14001 regulation from a financial standpoint.

The main purpose of this paper is to address if an effective Environmental Management System can be created without the ISO 14001 certification. The second objective is to determine if there will be a decrease in financial stability from consumers if the company is not ISO 14001 certified. The last objective is to determine if a plant performs more efficiently than a plant that doesn't if they're certified.

Evolution of ISO 14001 and the Environmental Management System

In 1930, Walter Shewhart developed methods for statistical analysis and control of quality. [1] Later, in 1950, W. Edwards Deming taught the methods developed by Walter Shewhart to Japanese engineers and executives, and this is considered the origin of TQM (Total Quality Management). Today, TQM is the ideology for managing organizational quality. Quality standards like ISO 9000 series and 14001 establish principles and process that makeup TQM. [1] (ASQ)

ISO 9001 helps organizations to implement quality management programs. This standard specifies requirements when a company has demonstrated its ability to constantly provide products and services that meet the customer statutory and requirements. It also aims to enhance customer satisfaction through the application

[1] TQM Timeline and History

of the system. This includes the processes for improvement within the system and the assurance of conformity to the customer and requests. The requirements like ISO 14001 are generic and intended to be applicable towards any organization regardless of what kind of company it is. [2] (ISO 9001) ISO 14001 and ISO 9001 share a similar plan-to-act structure and have a lot of similarities but they don't align directly. The main difference between these two standards is that with ISO 14001 an organization can self declare their compliance. Self-declaration simply means that the organization issues a statement based on its own determination upon the review of its management system stating it has met all the specified requirements. [3] (ISO 14001 VS 9001)

The ISO 14001 standard is developed around W. Edwards Deming plan-do-act model that is a process applied regularly to ensure the benefits are being upheld and recognized. Below is a model of the primary operational component of an ISO 14001 Environmental Management System, grouped as follows:

[2] ISO 9001 Standard
[3] ISO 14001 VS ISO 9001

1. Create or Update and Environmental Policy

2. Plan:

i. Environmental aspects

ii. Legal and other requirements

iii. Objectives, targets, and programs

3. Do:

i. Resources, responsibilities, and authority

ii. Competence, training, and awareness

iii. Communication

iv. Documentation

v. Control of documents

vi. Operational control

vii. Emergency preparedness and response

4. Check:

i. Monitor and measure

ii. Evaluate compliance

iii. Nonconformity, corrective and preventive action

iv. Control of records

v. Internal audits

5. Act:

i. Management review

ii. ISO 14001 audit [4]

[4] Environmental Management Systems

Data Collection (Sampling Procedures)

This study utilizes a bibliometric and qualitative analysis method to analyze the usage of ISO 14001 within multiple facilities. To compile this literature, I used Science Direct that is the world's leading resource for scientific research. This source has an abundant amount of journals, books, and articles that were helpful in this study. The qualitative analysis that was used in this study was comparing notice of violations, number of permit exceedances, spills and releases, and our internal audits can help give an understanding of what area facilities can be lacking in. This was done over a course of seven plants located in the North American region. (NA region)

Keywords used in this syntax while researching documents on Science Direct were "ISO 14001" or "Environmental Management System" or "ISO 14000" or "ISO 9001". All publications that were published within recent years were utilized. The search result was then refined and articles that discovered both sides of using ISO 14001 were selected. The North American Region was used in the analysis of the comparing notice of violations, spills and releases, number of permit exceedances, and internal audits. One facility was used that was not ISO 14001 certified and this data helped to give insight whether having this certification is helpful.

Measurement Procedures

Measuring the effectiveness of ISO 14001 can be difficult, but through this project a couple of different factors were monitored. Auditing plays a large role to recognize what issues a plant is experiencing and what can be done to ensure the safety of every individual. ISO 14001 is intended to guide a company to ensure the measurement and improvement of environmental management, in addition, showcasing how an organization operates and increasing its operation efficiently. Utilizing notice of violations, number of permit exceedances, and internal audits, gives an insight on how effective ISO 14001 is within the plants.

Notices of violations are a one step within the investigation and enforcement of violations of EPA statutes and regulations. When a company receives this, they're also notified on how to come into compliance and fix the mistake that generally gave them the NOV in the first place. The number of permit exceedances represents the number of times that plant exceeded limits that are contained in permits and regulations and this includes: water, waste, and air. Trained individuals within this realm complete the internal audits. Audits are a great tool that assess regulatory compliance within the plants and ensures the safety of employees and the environment. Throughout this project these factors were compared by year from seven different plants within this fortune 200 company.

Variables

The dependent variable in this research is the effectiveness of ISO 14001 in creating an environmental management system. This was measured by comparing data from 2013-2016 and the data consists of: the notice of violations, number of releases, and audit findings. All of this information is made public and can be found on this fortune 200 company website. Multiple factors were considered within the environmental realm for this research. These factors include: energy consumption, carbon dioxide output, water, and the ISO 14001 regulation.

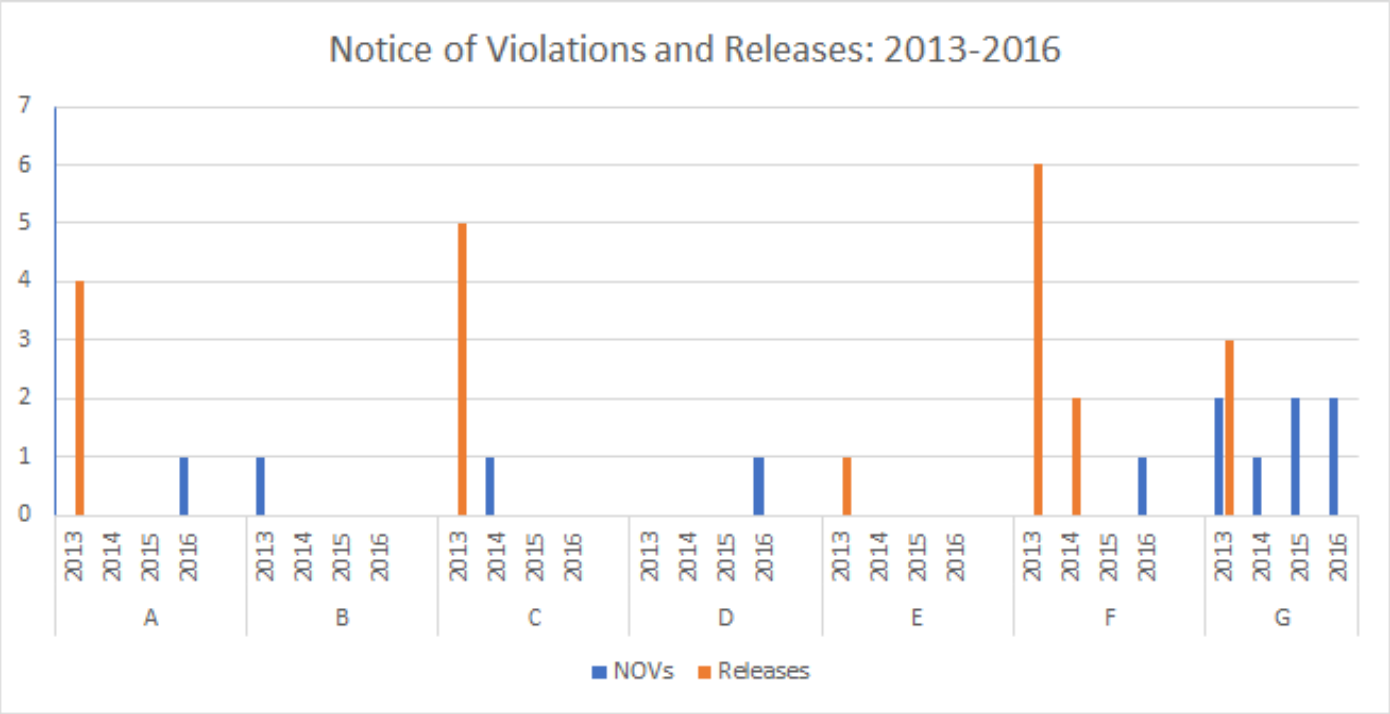
First, to measure the variable “notice of violations” I relied on the reportable incidents that were found in the database at the company. The excel spreadsheet consisted of: Incident report entered, incident report number, discovery date, quantity, location, division, type and the comments associated with that finding. The notice of violations present, were divided by media into air, waste, water, or chemical. For each notice of violation there would be a determination if the violation would count towards the goal for that given year. If the release were detrimental to the environment, it would then be marked accordingly within the reportable system and a separate spreadsheet to manage efficiently.

Second, the variables involving “releases” were measured using the same spreadsheet and recordable incident program as the “notice of violations”. The releases that were more serious were highlighted in red for easy reference for the future.

Environmental releases are classified as any substance that has the potential to cause harm to the environment. Although some may not be classified as serious, they're still recorded so may be investigated to prevent it from happening in the future. Environmental releases include: chemical, compromised water, waste, air, etc. The last variable for this study is the "audits". Audits are completed to ensure a facility is in compliance with EPA regulations and OSHA (Occupational Safety and Health Administration) standards. Individuals that have been trained on how to administer them complete audits. There is a checklist that the individual abides by while completing this task. The general requirement of this audit is if the scope has been documented to define the scope of what the EMS applies. This audit checklist touches base on environmental policies, roles and responsibilities, environmental management system requirements, training, awareness, communication, evaluation of compliance, etc. During the audit, the auditor will make observations in each category determine whether the plant is in compliance.

Analysis

As previously mentioned, ISO 14001 is a set of environmental guidelines that a company should follow for the implementation of their own environmental management system. Table 1 exemplifies the results of the notice of violations and releases into the environment from 2013-2016.



The plants that are utilized are all part of the North American region. Plants A-E are manufacturing plants, while plants F and G are chemical plants. The chemical plants are ISO 14001 certified as well as 9001 certified.

Audits are used within this study to draw the correlations between the releases and notice of violations. Comparing audits to these two variables allows for the CAR (Corrective Action Request) and understand if they match with what's in the database. CAR requests are found in audits to reveal the major and minor types within the plant and how many of these infractions were present. These requests give the statement of requirement, nonconformity, and the objective evidence to allow the training manager to render the issue. It also gives the location of the where the violation was located and what standard and clause is being violated.

For Plant A, in 2013 referencing the graph,, there was a notice of violation. The notice of violation was for a tank that had a crack in the tank. The drain was thought to enter into the sewer system, but instead it was tied to the storm water system releasing condensate to storm water. This was entered into the management system used to track notice of violations for future references and to render the problem as soon as possible. The notice of violations is not reported on the audits because they're a means of sampling. The sampling is performed before the audits are completed and then rendered. There were two corrective action requests that were both minor while assessing the audit for this plant. These requests conclude: programs are not clearly defined within the environmental management system and the hazardous waste and the used oil was not

labeled correctly.) Within the Environmental Management System, what the ISO 14001 sets guidelines for, two standard clauses were in violation. The first standard clause was for objectives, targets and programs and the second for operational control. In 2014, there were three corrective action requests: Control of Documents, Operational control, and Management Review. The document control procedure was found to not be effective; including the management review minutes were incomplete. In 2015, there was a water compliance issue where the permit was in exceedence. The oil and grease permit is set to control requirements to protect water quality while minimizing the resources that are required for compliance. These exceedances were not recorded on the graph listed above, but are still important to this study. During an audit there were two corrective action request submitted. The first was for not having a controlled document available at the point of use for the first case and for the second the monitoring reports were incomplete. The standard clauses to these request summaries are the control of documents and monitoring and measuring. In 2016, this plant had three corrective actions: sanitary overflowed with oil/carbon onto the grass and drainage ditch and the shamrock along with the city this plant is located pumped out sanitary sewer. The third corrective action was a late reporting of low pH levels of storm water readings to the Global team.

For plant B, in 2013, there was one notice of violation, for hazardous waste violations. This notice of violation was not recorded in the audit because there was sampling performed before the audit that was completed. The hazardous waste violation was mended and not recorded on the audit.

Plant C in 2013, there were multiple spills and releases. The first release was an air release due to a dust collector being inactive for an extended period of time. For a dust collector to be turned off can be detrimental to the air quality and the health of the employees. However, it also depends on the area the dust collector is it, it could be collecting actual dust or volatile compounds needed for the making of a tire. In this case, it was collecting fumes from the compound mixing area not filtering out volatile compounds that could cause an explosion within this area. The second violation was resulting in a water violation from the Department of Environmental Quality. There was a wastewater inspection. The third violation was found on land when a hydraulic line on the rail tamper burst. The fourth violation was again from the Department of Environmental Quality from air quality issues. The fifth violation was a land violation resulting in an acid spill. In 2013, there was no notice of violations. In 2014, there was one notice of violation. Throughout 2015 and 2016 there were no recordable or notice of violations for this plant.

Plant D in 2013, there was an exceedance of oil and grease, the meaning of this will be better explained in the discussion section. In 2016, there was a notice of violation in relation to air. However, they were found to be in violation of one permit, but not in violation of another permit.

In 2013, Plant E had a carbon black release to water and land resulting in a notice of violation. The result of the spill was due to a truck backing into two bags of carbon black resulting in the spill of 1645 lbs. of material onto the ground. This later washed

approximately 30 lbs. of carbon black into the storm water drain. However, when this was discovered the drains were immediately blocked off and a company that handles clean up professionally were called. Through the years 2014-2016 there were no NOV's nor spills/releases into the environment.

Plants F and G are chemical plants, not manufacturing plants like the plants stated above. However, they still operate under our ISO 14001 and 9001 as well as our Environmental management system. In 2013 for plant F, there were 6 environmental releases or spills. The first release was marked as red, indicating a severe release. This was due to flare emissions of excessive propane resulting in a decline of air quality. The second release was due to a cracked pipe because of corrosion. This resulted in the release of approximately 50 gallons of triisopropanolamine (TIPA). This substance is an amine used as an emulsifier, stabilizer, and chemical intermediate and used in most industrial applications. The third release was because the nipple of the phosphoric acid tote corroded resulting in the release of 220 gallons of 75% phosphoric acid. The fourth release was due to an open-ended line but there was a permit deviation. The fifth release was due to a truck fuel tank puncher and the sixth was due to a daybreak cap removed from trailer daybreak. In 2014, there were two environmental releases and spills, unfortunately, it's unknown what kind these were. In 2015, there was a water permit exceedance and this was noted as a reportable release to the environment. In 2016, there weren't any spills or releases recorded, but there was a NOV and a permit exceedance. The notice of violation was for air emission and the facts that title five was non-

compliant. There was one permit exceedance, however, after further review, it was not an exceedance. This was still recorded for future purposes.

In 2013, Plant G had three spills and releases as well as two notice of violations. The first release was due to flare emissions over 10lb for butadiene. There was a misalignment of the valve and a silenced alarm. The second release was a chemical release that happened during the transfer of a blend of fatty acids from a rail car and it leaked from a gasket onto the ground. This was reported as an environmental release. The third chemical release was due to a gasket failure line that resulted in the spill of approximately 50 gallons. This situation was rectified immediately to repair the line and cleanup activities. The two notice of violations were both due to chemical releases on land. The first one was because of a punctured tote with the fork of a forklift, also known as a power industrial vehicle. The second notice of violation was due to the fact that a chemical was overheated and spilled from the top of the railcar. Both of these violations were not reported as an environmental release. In 2015, there were two notice of violations. The first was a chemical notice of violation due to air compliance and the second was a water compliance violation. This was due to the failure to sample copper and lead over the course of 3 month sampling period. In 2016, there were two notice of violations. The first violation was due to a missed public water sampling. They were required to have a public notice for this missed sample and it was later posted in a public place for individuals to locate it. The second violation was an air emission discrepancy due to operating a diesel pump over 100 hours per rolling 12 months. There were also three permit exceedances within the year of 2016. First, there was an air permit

exceedance due to the failure to operate the diesel pump under 100 hour on rolling 12 month. The second permit exceedance was due to Cyanogen exceeding over 3 months. The third exceedance is where the pH was over the limit.

Discussions:

One of the main criticisms of ISO 14001 is that it's not entirely necessary to implement an environmental management system. An Environmental Management System can be written by individuals at a company without these acting guidelines. The research presented in this study exemplifies the relationship between audits and findings within the plant. This relates back to the accuracy of ISO 14001 guideline and how it's unnecessary in the field of creating an effective environmental management system.

There are 17 elements of ISO 14001 that are required to be met by the organizations for an effective management system, according to the regulation.

1. Environmental policy supported by senior management
2. Identify environmental aspects and impacts and the organization may cause
3. Environmental compliance requirements
4. Development of objectives and targets and their environmental management programs
5. Define resources, roles, responsibilities and authorities for the environmental management
6. Development of competence, training and awareness procedures
7. Communication process of the EMS to stakeholders and interested parties

8. EMS documentation required by standard

9. Development of document control procedures

10. Development of operational control procedures

11. Development of emergency preparedness and response procedures

12. Procedures to monitor and measure operations that may have an impact on the environment

13. Evaluation of compliance procedure

14. Procedures for management of non-conformance, corrective and preventative actions

15. Development of a records management procedure

16. Completing internal EMS audits and corrective actions

17. Procedures for management review by senior management [5]

Listed above are the steps to ensure a company has an effective environmental management system. After the environmental management system is implemented, it then by design goes through a continuous improvement cycle. This ensures that the environmental management system is efficient in providing a reduction of environmental impacts and to opportunity for companies to financially benefit.

Above, I've provided a list of multiple plants, both manufacturing and chemical that utilize this ISO 14001 regulation. Previously mentioned in the results section, Plant A in 2013 had an ISO re-assessment audit. During this audit, there were two corrective action requests noted. The guidelines for ISO 14001 specifically state that the policy

[5] Plan Do Check

must be supported by senior management and to developed objectives and targets within the program itself. The non-conformity that was listed for Plant A is that the program for solvents listing a responsible individual as well as time frames for projects were not established. The evidence that supports this finding is that the program was not clearly defined at top management level. The second corrective action was due to operational control violations. The statement requires that organization should identify and plan the operations that are associated with the identified significant environmental aspects that are consistent with the environmental policy, objectives and targets. Establishing, implementing and maintaining a documented procedure to control situations where the individual is not present could lead to a divergence from the environmental policy, objective and targets. The nonconformity in this case were drums of hazardous waste located in a 90 day storage area without the start date on the label. There were also two drums on the truck ramp without identification. Hazardous waste and used oil are not correctly labeled leading this to be the evidence in this non-conformity. In 2014, the auditor changed and there were three corrective action requests. The requests were similar with the same standard clause violation, except with the addition of another standard clause under management review. In 2015, the auditor was the same, and had a similar finding the previous year with control of documents and a different finding then previous audits introducing monitor and measurement. In 2016, there was a different auditor who found no corrective action request, but did have potential opportunities for improvement through observations. Although I didn't include 2017 in my data research, the audit is relevant to this research. In 2017, the auditor changed again another

corrective action request was found with operational control, the same as previous years of 2013 and 2014.

In the years 2013, 2014, 2015, and 2017 these audits were surveillance audits, while in 2016 this was a re-certification audit. There is a difference between these two audits. The surveillance audit is for the certification to determine if the management system is efficient in everyday operations. This visit will essentially identify issues that were missed during the certification trip. The certification audit will focus mainly on the environmental management system and if the main elements are in place. [6]

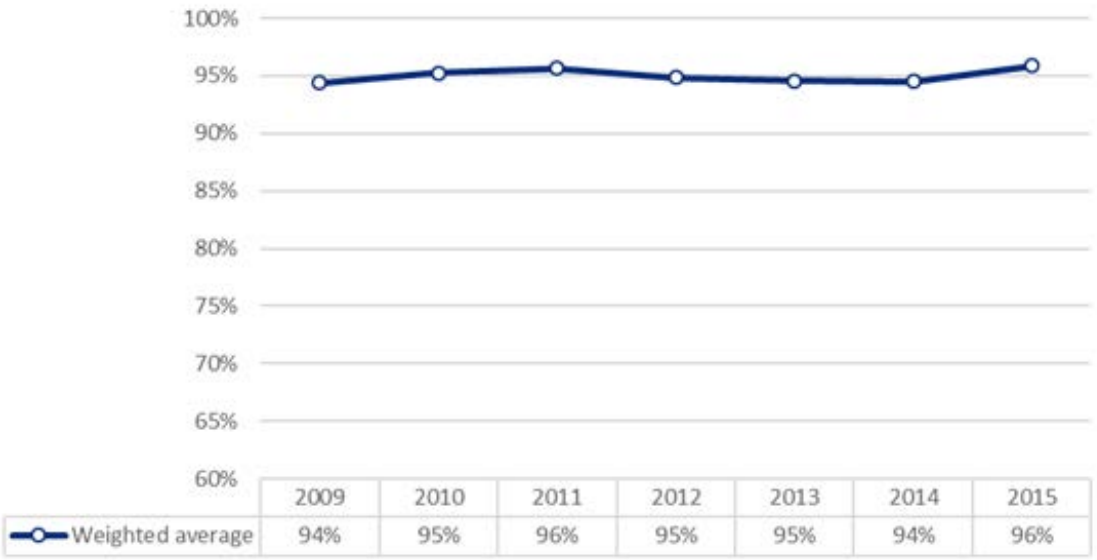
In 2016, the recertification audit was performed in within Plant A. Zero corrective action requests were listed in this audit, but rather potential opportunities through observation. A couple of these opportunities were: consider adding resources to support the scope for the EMS manager, continue enhancing the operational Excellence Model, and research solvents that generate less waste than the current solvent waste level. Over the course of the years, reports indicate that the top three violated non-compliant standard clauses are operational control, control of documents, and environmental aspects. If the recertification audits don't focus on the documentation that leads to a successful environmental management system, what exactly are they looking into? While these audits were conducted over the course of five years with changing auditors, their findings could be somewhat skewed. It seems that the surveillance audits tend to be stricter than the actual certification.

[6] Surveillance audits vs. Certification audits

Documentation plays a large part in an environmental management system. This documentation is kept to ensure the company is operating efficiently to reduce the environmental impact. For example, if there were two drums of hazardous waste sitting in the 90 day storage area without proper labeling, this needs to be documented and stored for future reference. The surveillance audit that was conducted one year later had zero nonconformities. The containers were located in the production areas that labels were utilized or they were illegible. In 2013 this was an issue for not labeling drums and now in 2017. In 2016, when the recertification was completed, was this a problem, or did the auditor "overlook" it or was this not an issue because they focus more on documentation?

ISO 14001 is a customer request that the company honors. Research has been completed to determine whether consumers would stop purchasing the product of the company if their ISO 14001 certification were to lapse. Essentially, the consumer wants to see the company is environmental friendly and by implementing the ISO 14001 certification it's a guaranteed that the company has a solid environmental management system. Adopting this practice ensures a commitment to the environment through protection and conservation. It reduces the risk of adverse environmental impacts and the business management drivers include public image and customer requirements. In 2013, a survey was issued in 11 languages through the National Standard Bodies. The survey asked about the benefit for using ISO 14001. 75% presumed they were meeting legal

requirements and improving the organizations environmental performance as a whole. 60% thought there was a moderate value or above for providing financial benefits. [7]



	2009	2010	2011	2012	2013	2014	2015
Weighted average	94%	95%	96%	95%	95%	94%	96%

[8]

The percentage of ISO 14001 certified sites among the total number of sites has remained stable between 94% and 96%. All sites under this fortune 200 company are ISO 14001 certified within the North American region, the region used for this study.

[7] Benefits of using ISO 14001

[8] Sustainability ISO 14001 Cert. Rate (Internal Chart)

Conclusion

The replication of this study has the potential to lead to the same results. Throughout this experiment, it's become evident that an Environmental Management System without the guidelines from ISO 14001 can be efficient. The individuals that are creating the Environmental Management systems within this company are professionals and have exemplified their knowledge within the environmental and sustainability realm. For the future replication of this research, there should be an increase in audits that are available to the researcher as well as a financial data. This would allow the individual to compare the years before the company was certified and the certification now, to understand if there was an increase or decrease in consumer purchases. Regardless of what system a company utilizes, it's how the company implements it. Essentially, a company can claim they're using a system, however, in reality they could be projecting this "reality" creating a false sense of how they conduct business.

The Environmental Management System would still be implemented within the company. Millennials' are the "new generation" ranging in age from 18-34. Millennials

have surpassed the “baby boomer” generation with a population of 75.4 million versus the “baby boomers” at 74.9 million. (See Appendix A) With the high population of the millennial generation, we can assume they are purchasing the most products. In recent years, it’s become evident they care more about the environment than any generation. Although they fight the hardest economic climates, a study produced by Neilsen exhibited they’re willing to pay extra for sustainable goods, finding 3 out of 4 respondents. This generation is looking for a company that has a strong sustainable product and program. “Brands that establish a reputation for environmental stewardship among today’s youngest consumers have an opportunity to not only grow market share but build loyalty among the power-spending Millennials of tomorrow, too,” says Grace Farraj, SVP, Public Development & Sustainability, Nielsen.” (See Appendix B) While ISO 14001 sets guidelines for these actions, a company that is trying to market to this high population generation, will want to implement a strong environmental and sustainable program. Without this, they could lose customers causing the collapse of their company.

The ISO 14001 certification is intended to better environmental performance on an international scale. However, this research exemplifies that a company is merely paying for convenience. If a customer wants to know if a company is environmentally friendly, they can see if they’re ISO 14001 certified. This will imply to the customer that they adhere to all the guidelines set forth by this certification. This research points out this can be misleading to the customer with relevant non-conformities and spills. A company can implement an effective

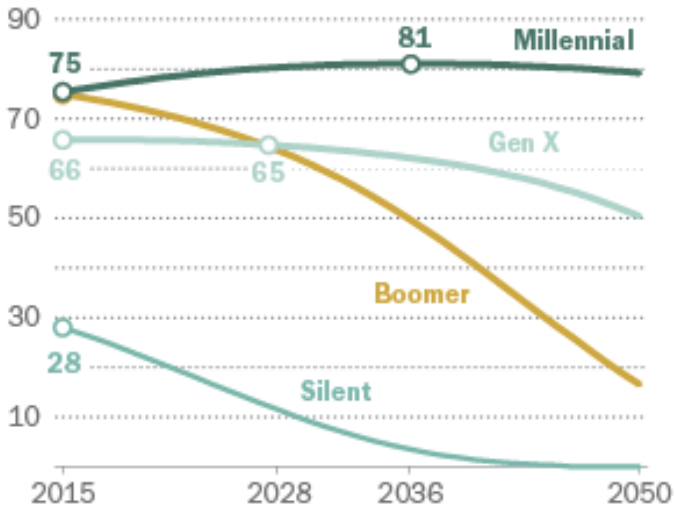
environmental management system to be in compliant with EPA and OSHA regulations to ensure they have a customer base.

Appendix

Appendix A- Projected Population by generation

Projected population by generation

In millions



Note: Millennials refers to the population ages 18 to 34 as of 2015.
Source: Pew Research Center tabulations of U.S. Census Bureau population projections released December 2014 and 2015 population estimates

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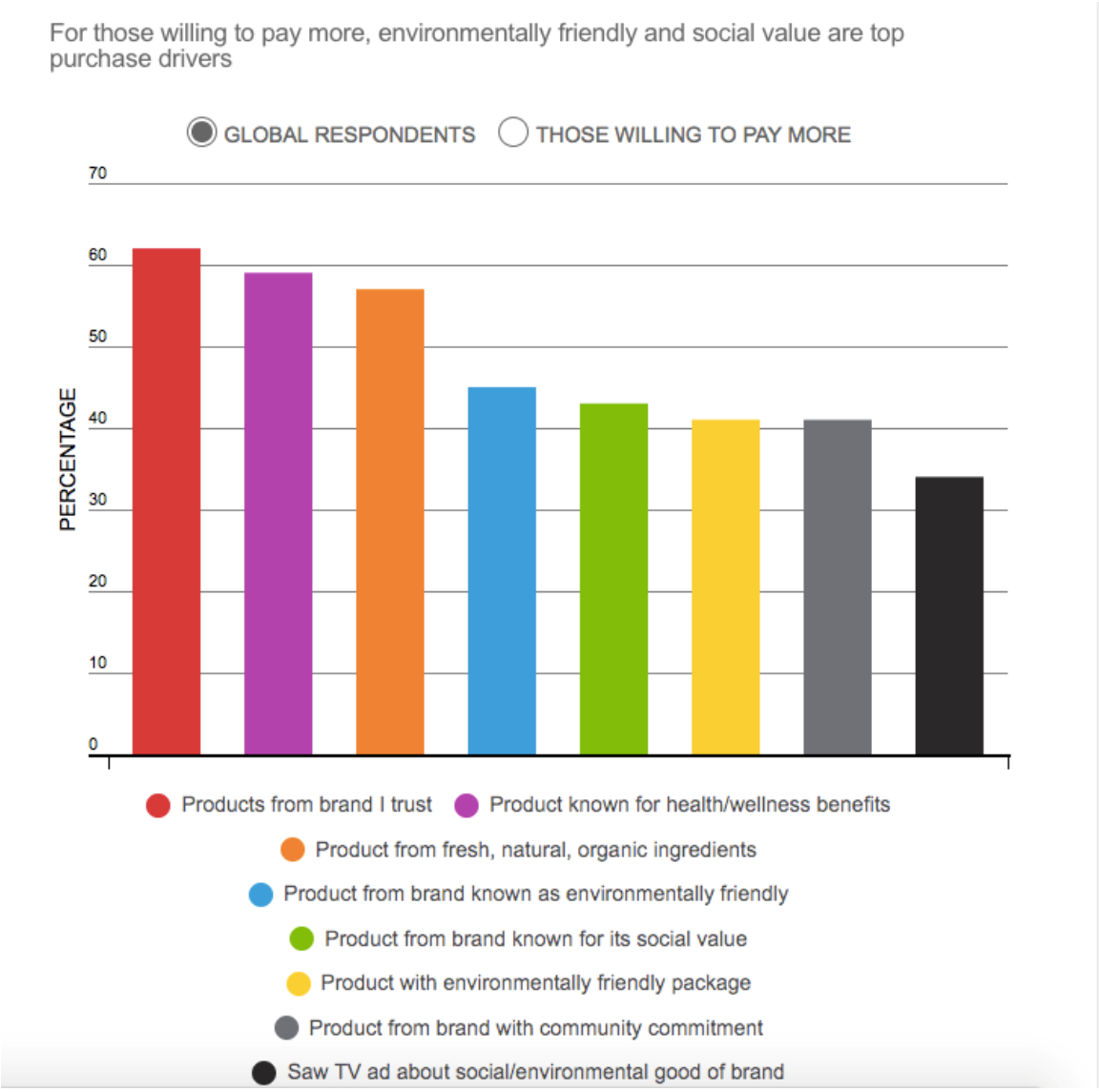
Appendix B: Top Sustainability Purchasing Drivers



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