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Choosing an Appropriate University or College Environmental Management System

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Abstract:
Universities considering integrating an environmental management system (EMS) have numerous decisions to consider. Should they pursue a formal certified model or an informal uncertified one? If informal is appropriate, which framework best meets their needs? Which environmental interactions are most important to manage? Are there any other sector specific considerations? This article discusses six different campus EMS frameworks, three different categories of drivers, and the six unique features of a campus EMS, and offers suggestions on when each framework is best applied. The frameworks considered are from: ISO 14001; Higher Education 21 (UK); the EMS Self-Assessment Checklist (USA); the Auditing Instrument for Sustainability in Higher Education (Netherlands); the Osnabrück University model (Germany) and the Sustainable University model (Mexico). This article also draws upon the empirical experiences of Dalhousie University in Halifax, Canada.

Keywords: University; Campus; Higher Education; Environmental Management Systems; EMS; Aspects; Drivers; Roles

1. Introduction

There has been a growing movement to implement environmental management systems (EMS) in order to systematically facilitate environmental and sustainability change [1-3]. An EMS is a part of an organization's overall management system. It includes the organization structure, planning activities, responsibilities, practices, processes, and resources for implementing and maintaining the EMS [4]. The implementation and details of this system vary depending on the sector [5]. Higher education institutions have started to implement EMS, and the approaches used vary considerably from formal certified models to informal uncertified ones. They also vary in which environmental interactions are managed, ranging from direct operations risks to indirect research and education benefits. This article considers three different categories of drivers, six different frameworks, and the unique features of a campus EMS. This synthesis of academic literature, selected practitioner tools, and one empirical case leads to suggestions for practitioners on which framework best meets their higher education institution’s needs. In essence, the article argues that universities and colleges require a sector-specific EMS framework that includes both direct and indirect environmental interactions, but the model and choice of environmental interactions (aspects) depends on the type drivers at their particular institution.

1.1 Campus Environmental Management System Literature

There is an ongoing debate in the campus environmental management system literature about the utility of the ISO 14001 certification and model for higher education systems. Some authors have argued that the ISO 14001 model for environmental management systems (EMS) is ideally suited for any organization, including higher education institutions [3, 6, 7]. Other authors have argued that a unique university EMS model is required [8, 9]. In practice, while there are universities that have found benefit in obtaining formal certification for their EMS [7, 10, 11], most are pursuing informal (no intention of seeking certification) EMS models [1, 3, 12] with varying levels of structure [2, 13-15]. Most of these informal EMS are based on ISO 14001, EMAS or BS7750 guidelines [16, 17], but others use a different model all together [18, 19].

In almost all cases, the formal EMS is only being used to manage direct impacts from operations. The exceptions to this are the examples from Sweden [10, 11, 15], which include indirect

environmental interactions, such as teaching and research, in their formal EMS certification[2]. These indirect interactions are some of the largest environmental impacts a university has [11] and are a result of the three missions of a higher education institution of teaching, research and service [20-23]. To ensure the coverage of these indirect interactions, some countries, such as the Netherlands, utilize a complementary tool like the Auditing Instrument for Sustainability in Higher Education (AISHE) [18]. In other countries, tools have been created for both direct and indirect aspects combined, such as the Campus Sustainability Assessment Framework [19] in Canada, yet these tools are not linked to a formal EMS. This article provides a synthesis of selected frameworks to enable a practitioner to consider their options.

1.2 Methodology

The majority of this article is based on further consideration and comparison of existing literature that discusses both formal and informal campus environmental management systems; the drivers, models, aspects, and roles and responsibilities. The six frameworks were selected based on: 1) available information; 2) demonstration of having been used by a higher education institution or designed for a campuses; 3) campus-wide (as opposed to one department or unit); 4) inclusion of content relevant to the complete EMS cycle (as opposed to only the assessment phase); and 5) an actual framework or model (as opposed to a case study with no framework presented).

The existing literature is supplemented with a case study from Dalhousie University; a medium size university of 15,500 students with undergraduate, graduate and professional programs which is located in Halifax, Nova Scotia, Canada. Dalhousie University adopted an environmental policy in 1990, which includes content on operations, education and research in the one policy. They also signed the Halifax Declaration in 1991, the Talliores Declaration in 1999, and the United Nations Declaration for Cleaner Production in 2000. The University's Senate Environment Committee has more recently drafted an updated environmental policy and a complementary implementation plan which also includes content related to operations, education, research and finance in one policy [24]. The university has implemented many initiatives related to the original 1990 policy over the years, especially in the areas of solid

[2] Note, Swedish institutions are mandated by the government to apply an EMS.

waste, hazardous waste, toxins, air quality, energy conservation, and environmental education [12]. The existing documentation of the informal EMS at Dalhousie University makes it an excellent case study for a campus environmental management system. Archival research was complemented with 13 interviews which were conducted with senior administrators, senators, and board members.

2. Drivers of a Campus EMS

The drivers of a campus environmental management system differ from those of most businesses [23]. ‘Drivers’ are what prompts the organization to undertake environmental action. Different drivers influence whether the organization undertakes the EMS, and the focus within the environmental management system. Unlike businesses, key drivers for a university are not due to external forces such as diligence or market influence; instead, drivers tend to be based around internally-driven responsibilities for the environment, health and safety [25, 26]. This section explains the results of four studies on drivers for a campus EMS, how those drivers influence the campus EMS, and how drivers can evolve through three different generations. These studies were chosen because they used quantitative survey methodologies to show the ranking of drivers of environmental management in higher education institutions, and thus had larger sample sizes, making them more generalizable than case-based studies.

The four studies were KPMG [27], Thompson and van Bakel [23], Davey et al. [25], and Bakker [28]. KPMG suggested driving factors for environmental management in the education sector were, in order of importance, compliance, directors' liability, employees, customer requirements and cost savings [27]. These drivers are particular to environmental management, not environmental management systems, though it can be assumed that they might be the same. Thompson and van Bakel identified campus EMS drivers, by rank, as strict legislation and enforcement, environmental codes and guidelines, financiers and insurers, financial donors and research grants, accounting practices, cost-effectiveness, employees and students, milieu of the academic institution, and community concerns [23]. Bakker found that the drivers for a campus EMS sequentially were: internal pressure to change, financial constraints, directors' liability, compliance, local community concerns, insurance availability and premiums, initiatives at other universities, university associations and agreements, and pressure from suppliers [28]. Davey et

al. determined drivers for campus environmental management based on stakeholder groups [25]. Table 1 shows the ranking of importance each group placed on various drivers and environmental problems.

<INSERT TABLE ONE HERE>

Also, sometimes the drivers could be different for a specific campus. Dr. Elizabeth Davey, Environmental Coordinator at Tulane University explained their driver for an EMS:

> The ISO 14000 series of standards is appealing here, in part, because in this region industry is a source of so many major environmental problems. ISO is an industry model, not necessarily a campus model, but people are interested in pursuing it because it creates a way to establish relationships with local industry and provides a way to test out the EMS here. When local industries adopt the standard, we would like to be able to relate to them in an authoritative way. [29: 4]

These four studies and the example of Tulane University indicate that there is a range of drivers depending on who within the campus community is asked. The study by Davey et al., as demonstrated in Table 1, indicates this range clearly. The top half of the table indicates the drivers for each of five different campus stakeholders, while the bottom half of the table indicates priority environmental issues for each of these stakeholders.

At Dalhousie University, from the perspective of the senior administrators, the Board members and the Senators interviewed, the most important driver was for the institution to play a leadership role and to be a role model in higher education. Following that, tied for second place, were the role of the university as a good citizen with its educational responsibilities and the potential for cost savings and long-term pay offs. Other ranked drivers were employee morale and health, less impact on the environment, community image, potential increase in market, need for self-education, the university's role in research, specific stakeholders, due diligence and reduced liability.

Table 2 provides a comparison of the drivers identified at Dalhousie University with the four other studies mentioned previously. The table includes the list of drivers from all five locations (Dalhousie University and the four studies) in order to present the variances. Davey et al. presented information for five different stakeholders so the employer role was chosen for this

comparison. Other drivers not mentioned in Table 2, but mentioned in the literature, are that an EMS: legitimates environmental efforts, both internally and externally; helps with internal and external communication of environmental efforts; improves management; improves internal cooperation; and allows for external certification [15, 30].

<INSERT TABLE TWO HERE>

As can be seen from Table 2, there are significant variances in the studies findings. This can be explained because the type of drivers can evolve for an institution over time. Bennett and James [5] explained that there are three generation of drivers. The first generation is cost and compliance, the second generation is stakeholder management, total quality management and pollution prevention, while the third generation is stakeholder partnerships, sustainable development and life-cycle management. Each generation builds on the last, so is inclusive of the previous drivers. These three generations of drivers explain why the responses in the four studies on campus EMS drivers differ. The KPMG results are mostly first generation drivers. The Thompson et al., which was based on a 1995 survey in Canada, are mostly second generation. Bakker and Davey et al. more aptly reflect third generation drivers. The drivers for a university environmental management system at Dalhousie University proved to be second and third generation drivers; Dalhousie University has demonstrated that it is interested in both environmental risks and benefits. This evolution over time of drivers was also found in Sweden between 1999 and 2003 when the evolution of driving forces changed from mostly internal stakeholder management (second generation) to more external partnerships (third generation) [15]. Table 3 outlines the three generation of drivers of Bennett and James as considered for a campus EMS.

<INSERT TABLE THREE HERE>

If the drivers are sufficient to inspire the university to create an EMS, then they will also influence the focus within the EMS. They influence the goal behind the EMS, if it is formal or informal, the environmental interactions chosen, the type of indicators that are monitored, the primary audience that is targeted, and the type of reporting that is done within the university's

management system. Some campuses strive for formal certification or accreditation because it will help them with marketing to: regulators (first generation), staff and students (second generation) or local industry (third generation) [29]; therefore formal certification is not linked with any particular category of driver. Other campuses informally use the EMS model as a management structure but do not see any advantage to certification. In general, first generation drivers lead a university to focus on the operations and the immediate environmental risks. Those universities with a second generation approach take into consideration the indirect environmental interactions (like finance and procurement practices) and the long-term benefits (like education, and research). Those with a third generation approach are also working to influence other organizations around them. If the drivers are from external (compliance) influences such as government regulations or funders, then the reporting will also be directed externally, whereas if the drivers are internal then reporting tends to have a different focus. Internal reporting is done against internal goals, for monitoring purposes, for bench-marking, and to show continual improvement [31]. There are different campus EMS frameworks available which are able to accommodate different generation of drivers with varying ease. The next section introduces the campus EMS and six frameworks.

3. Campus Environmental Management Systems

Generally an EMS is a cycle of plan-do-check-act, leading to continual improvement. Clarke [12] expressed the campus EMS in practice as the cycle shown in Figure 1. Compared to a generic EMS cycle, this figure also includes the emergent plans feeding into the implementation, the best practices feeding into the review and feedback loops of unrealized plans and improvements.

<INSERT FIGURE ONE HERE>

3.1 Campus Environmental Management Systems in Practice

In practice, some campuses, but not yet the majority, have integrated an environmental management system. Bakker [28] determined that among the 41 Canadian campuses that responded to her 1998 survey, 12.2% had developed an EMS, while 22.0% intended to and 12.1% were undecided or did not respond to the question. Although 53.7% had not considered an

environmental management system, no university president indicated an unwillingness to develop an EMS. Bakker's study indicated that in 1998 the majority of campuses had not been driven to even consider instituting an EMS. A more recent survey of 275 higher education institutions in the USA differentiated between formal and informal EMS frameworks [13] and found that 46% had knowledge of the steps involved in obtaining an ISO 14001 certification, with 7% indicating an intention to do so and 2% having done so already. More generally, 52% thought implementing an EMS would be beneficial, and 38% self-identified as having implemented a structured, comprehensive environmental management system; though only 10% said yes to all the necessary components listed in other questions, meaning their self-identification may not reflect a full understanding of what is involved in an EMS [13]. This study shows that while only 2% had adopted a formal EMS, 38% self-identified as having an EMS; likely indicated that 36% are informal. These findings are similar to a global survey done by Velazquez et al. [32] in which of the 40 universities studied, 35% have a campus EMS. In the USA, Canada, and most of the world, engaging in an EMS is voluntary, which is not the case in Sweden where it is mandatory for all higher education institutions to implement an EMS [11, 15].

3.2 Frameworks for Campus Environmental Management Systems

After a considerable review of the literature, and consideration of the tools and models available, this article considers six existing frameworks in order to best highlight the unique components of an EMS in a higher education institution. The chosen frameworks[3] for a campus EMS can be found in: 1) the ISO 14001 standards; 2) the EMS Self-Assessment Checklist; 3) the Higher

[3] The criteria for choosing these six frameworks are noted in the methodology section. There are other related articles and reports which did not pass the criteria for this study, but might be of interest to readers of this article. For example, the Canadian-based Sierra Youth Coalition has also recently developed a sustainable campus resource guide that provides a process to complement their Campus Sustainability Assessment Framework [33]. The International Institute for Environment and Development published an article by Bass and Dalal-Clayton [34] that outlines a continuous improvement approach to sustainable development strategies, though we are not aware of it having been used by higher education institutions. Lozano [35] offers a four level matrix of approaches and strategies to overcome barriers to change and thereby institutionalize sustainability into a university; while it is not an EMS as such, it offers a process. Ferriera, Lopes and Morais mention the existence of an EMAS@SCHOOL in Portugal which was developed under the European Commission's Life Environment Programme and stands for 'Environmental Management and Audit Scheme implementation at a complex school' project [36]. There are also numerous individual campus examples (see references for this article), and include for example, Shriberg's [37] outline of the EMS related initiatives undertaken by the University of Michigan's Housing Division and Koester, Eflin, and Vann's description of their 'whole systems approach' used at the Ball State University [38].

Education 21 program; 4) the Auditing Instrument for Sustainability in Higher Education (AISHE); 5) the Osnabrück University model; and 6) the Sustainable University model. Each are introduced briefly then compared to highlight the unique features of a campus EMS. The components of each are presented in Table 4 as part of the comparison.

ISO 4001

ISO 14001 is part of the ISO 14000 series of environmental management standards developed by the International Organization for Standardization [4, 39]. The ISO 14001 model uses the following titles: policy, planning, implementation and operation, checking and corrective action, and management review. It offers a formal certification and is not sector specific. In North America, the University of Missouri-Rolla is claiming the distinction of being one of the first academic institutions to undertake an ISO 14001 certification, as is The University of Texas M.D. Anderson Cancer Center [8]. Other ISO 14001 certifications around the world include, but are not limited to: Mälardalen University, Chalmers Institute of Technology and University of Gävle in Sweden [2, 11, 30]; University of Glamorgan, and University of Wales, School of Medicine (UWSM) in the UK[4] [7]; University of Paderborn - Process Engineering in Germany [6], and University of Queensland in Australia.

EMS Self-Assessment Checklist

The Environmental Management System Self-Assessment Checklist was developed in the USA by the Campus Consortium for Environmental Excellence (C2E2) in partnership with the Environmental Protection Agency - Region 1 and several universities from the New England States [40, 41]. It is a modification of the 1996 Global Environmental Management Initiative (GEMI) 14001 EMS Self-Assessment Checklist. Though the Checklist is a system audit tool designed to be used to determine gaps in a university's informal EMS, it can be analyzed for its unique campus EMS features. Its EMS is loosely modeled on ISO 14001, but differs in its focus, layout, and some of its components.

Higher Education 21

[4] UWSM has merged with Cardiff University and it no longer exists as such.

The Forum for the Future's Environmental Management System Guide was created in the UK in 1998. It was developed as part of the Higher Education 21 Project (HE-21). It is a systematic guide to establishing and implementing an informal or formal campus EMS. Contents include 15 essential steps for implementing an EMS. These steps include guidelines for planning, preparing and implementing a campus audit. This guide is closely aligned with ISO 14001 and European EMAS standards [21, 42]. The HE-21 also developed a set of sustainability indicators for the higher education sector. These indicators are process-focused for an EMS [21]. As part of the HE-21 there are also complementary resource sheets on curriculum elements for technical courses, business courses, teacher education courses and design courses [18].

Auditing Instrument for Sustainability in Higher Education

The Auditing Instrument for Sustainability in Higher Education (AISHE) was developed by the Dutch Commission for Sustainability for Higher Education - Working Group on Criteria. The tool is based on a model for quality management developed by the European Foundation for Quality Management [18]. AISHE is called an auditing instrument, but it is in fact an EMS development model, as well as an environmental education auditing tool. It indirectly outlines the components of a campus EMS. AISHE significantly differs from the content described in the ISO 14001 model. It has a completely different focus, different categories, different components, and a different layout. AISHE specifically highlights the academic environmental interactions of the university and presents comprehensive environmental programs for the environmental interactions of education, research, and external services and offers five stages for each. AISHE was tested at a number of universities in the Netherlands and in Sweden in 2001 [43]. For the purpose of Table 3, the 20 criteria categories from AISHE have been re-organized from plan-do-act into the policy-planning-implementation-checking-review framework.

Osnabrück University Model

Osnabrück University, in Germany, developed a professional environmental management system for universities entitled the Osnabrück Environmental Management Model for Universities. The model is outlined in a journal article [9] and then compared against the ISO 14001 model in

another article [8]. The model has ten building blocks and is in line with EMAS[5] Directive of the European Union. Results of this project were shared through the German Network for Environmentally Sound Development of Universities [9]. For the purpose of Table 3, the reorganization of the building blocks into the policy-planning-implementation-checking-review categories has been used [8].

Sustainable University Model

The Sustainable University model was developed by a team of researchers from Mexico, and is presented in a Journal of Cleaner Production article [32]. Valazquez et al. developed this informal EMS model by benchmarking best practices used by 80 different universities from around the world [32]. The model has four phases which are embedded in a plan-do-check-act cycle of continual improvement, supplemented by network interaction and conducting sustainability audits [32]. The model emerged from practice, and is sector specific, but follows a strategic management process of developing a vision, mission, campus-wide strategy, and then functional strategies. The model outlines that functional strategies are needed for education, research, outreach & partnership, and sustainability on campus (operations), and even outlines which direct and indirect environmental interactions are to be addressed in each. In 2006, at the time of publication of the article, the model was being validated by the University of Sonora in Mexico using the ISO 14001 framework as an operational instrument [32]. For the purpose of Table 3, the model has been reorganized into the policy-planning-implementation-checking-review categories.

<INSERT TABLE FOUR ABOUT HERE>

4. Unique Features of a Campus-Specific EMS

As can be seen in Table 4, the unique features of campus-specific environmental management systems are the: decision-making structure, declarations, environmental interactions, roles and responsibilities, lack of EMS documentation, and the environmental assessment. Each of these is discussed in the following section.

[5] EMAS is an acronym for Environmental Management Audit Scheme

4.1 Decision-Making Structures

A main difference between a university and most other enterprises is its decision making structures. Typically businesses have a hierarchical decision-making structure that simplifies management. Higher education institutions do not have a simple flow-chart of formal authority or hierarchical structure [26]. While the structures differ between higher education institutions, especially between different countries, the case study of Dalhousie University is useful in demonstrating the typical complexity of a university. The example of Dalhousie University has two separate decision-making structures within the university: the Senate and the Board of Governors. The Senate oversees the academic decisions while the Board of Governors oversees the financial and administrative decisions. Decisions affecting both academic and financial matters go to both bodies. The senior administration, made up of the President and Vice Presidents, works with both the Senate and the Board to ensure implementation of policy directions. Both the Board and the Senate have committees. At Dalhousie University the university-wide Environment Committee is under the Senate.

Various senior positions at Dalhousie University work under the Vice Presidents; for example, the heads of Facilities Management, the Environmental Health and Safety Office, and the Sustainability Coordinator all report to the VP Finance. The administrative side of the university is hierarchical, while the academic side is not. The academic side of the university is made up of revolving positions such as the Deans of faculties and heads of departments. While policy directives from the Board on operational issues like energy conservation initiatives can be implemented directly, this same top-down approach does not work on the academic side. Even though the Senate may pass an environmental policy that includes ecological literacy for all students, it would not mandate every department to implement the directive. Each faculty develops its own programs and curricula, which are then passed by the Senate. Each faculty member has ‘academic freedom’ over his / her class content, except in special cases like the professional engineering degree, where the mandatory curriculum may be determined nationally. This means that indirect approaches like optional professional development for faculty members must be used to encourage more environmental content in classes. Alternatively, new programs and money for new faculty hires can be adopted. The two separate and distinctly different

decision-making structures within the university complicate management and therefore the environmental management system.

To complicate the decision making structure even further, the Dalhousie Student Union owns and oversees its own building. This student decision-making body is elected annually. Much like the Student Union, many departments do their own purchasing for research projects and do not go through the centralized purchasing body. The decentralized decision-making structures within the university mean that one simple top-down environmental management system is not possible. This snapshot of Dalhousie University demonstrates the complex decision-making structure that characterizes many campuses [44]. To account for this, the EMS Self-Assessment Checklist is specifically designed for a decentralized decision-making structure [41]. AISHE also accommodates for the differences in university decision-making structure on the academic side [18]; even the language used to explain the tool emphasizes a different perspective. The AISHE model separates the planning for the management of physical operations from that of the 'management' of academic interactions, thus separating the top-down decision-making of physical operations from the bottom-up decision making of education and research. The Sustainable University model also accommodates for different decision-making structures by promoting the development of four different strategies for each of education, research, outreaching & partnership and operations (which they call 'sustainability on campus').

4.2 Declarations and Environmental Policy Scope

Another unique feature of an EMS at higher education institutions is the existence of declarations. The first sustainability declaration developed for higher education institutions was the Talloires Declaration [45], which was created in 1990 at a conference with 22 university Presidents in Talloires, France. As of 2007, more than 350 presidents and chancellors in over 40 countries and 5 continents have signed [46]. The Association of University Leaders for a Sustainable Future acts as the secretariat for this Declaration. Since 1990 numerous other declarations have been developed [47]. The declarations generally cover a broad range of topics from operations to research, education and community engagement. Universities may sign more than one declaration, as is the case at Dalhousie University. While the signing of these declarations may be only publicity events, they are also ways of committing a university (and

particularly a President or Chancellor) to environmental management. Also, some of the declarations are monitored for their implementation by the relevant association. For a detailed discussion on declarations for higher education institutions, see Wright [47]. For the most part, these declarations are not a substitute for having an environmental policy.

The university-wide environmental policy at Dalhousie University, like the declarations, captures a wide range of topics which transcend both the academic and administrative decision-making structures. In other words, it includes content on operations, research, and education. All of the EMS frameworks call for some type of 'policy' which should match the types of environmental interactions to be managed, although they have different approaches. The Osnabrück University model recommends 'environmental guidelines' as the equivalent of a policy for voluntary environmental protection, and recommends separate consideration of environmental regulations, which together, along with the result of an internal audit, lead to the development of 'environmental goals'. For this EMS model the goals are all operations based and are developed by a committee in consultation with internal stakeholders. The AISHE framework instead promotes the development of an explicit vision on sustainable development, promotes the incorporation of this vision into the institution's mission, and promotes one overarching policy. The AISHE framework emphasizes that this should be developed with both internal and external stakeholders. The Sustainable University model also calls for a vision which should then be incorporated into the institution's mission. But instead of one policy, this model suggests that multiple comprehensive campus-wide policies, objectives and targets be developed. The fundamental differences between these models are: the scope of the policy content, who is consulted, and how many policies are developed.

4.3 Environmental Interactions of a Higher Education Institution

The scope of the policy is directly related to the environmental interactions that the institution chooses to manage. An environmental interaction (environmental aspect) is an element of an organization's activities, products or services that influences or impacts the environment, either positively or negatively [30]. One of the first steps for an organization which is developing an environmental management system is to determine the significant environmental interactions that it will manage [39, 48] . Initially the organization lists all the potential environmental

interactions, which can then be prioritized and their significance determined. This can be done through a Delphi method, as was conducted at Dalhousie University and documented in a journal article [24], or by the multi-stakeholder committee (or working group) in consultation with other stakeholders, as is advocated by the Osnabrück University model [9]. Alternatively, the Sustainable University model provided the list of topics to be managed, so it is just a matter of prioritizing targets and implementation schedules [32]. This article discusses the potential environmental interactions for a higher education institution to choose from. Most enterprises tend to focus on their environmental risks, or negative impacts. Higher education institutions have many environmental interactions, which have either benefits or risks, through their operations, finances, community service, education and research [2, 3, 21, 48]. These activities can directly or indirectly have an interaction with the environment [15]. The choice for any particular university will be related to their generation of drivers.

Direct environmental interactions include waste and emissions into the air, water, and land from burning fossil fuels for energy and transport, scented products emissions, waste water, solid waste, and hazardous waste. These can be mitigated through eco-efficiency and cleaner production initiatives. Some indirect environmental interactions are caused through items the university imports. These items have direct environmental interactions at other points in their life-cycle. For example, the institution imports food, paper, fossil fuels, construction materials, landscaping materials and many other products which can have a negative environmental impact on the environment in their extraction and production phases. The university can mitigate these indirect environmental impacts through purchasing green products, or reducing the volume of their consumption. This is done through policies on consumption, purchasing, landscaping, transportation, design and construction. Green design of a new building can ensure lower volumes of inputs such as energy, water, materials for maintenance, and also lower volumes of outputs such as waste water, garbage, and air emissions. These operations-based environmental interactions are easily considered using any of the six EMS frameworks, though the AISHE is by far the weakest in this regard.

Another indirect environmental interaction of a university is through its investment practices. By purchasing shares in companies that have unsustainable practices and negative environmental

impacts, the university is supporting these companies to continue their negative environmental activities [48]. Alternatively, by investing in companies with more sustainable businesses, the university can have a positive effect. Investment impacts can be managed through university-developed investment screens, using socially responsible or ethical mutual funds, limiting investment to companies listed on the Dow Jones sustainability index, and/or by adding an ethical option to pension plans.

The other significant indirect environmental interactions of the university are through the educational, and research services of the university [30]. Higher education institutions can have environmental benefits through these potentially positive indirect environmental interactions. By teaching environmental education, modeling environmental operations, and researching environmental solutions, the university can play a role in the future directions of society. Both the education of the students in class and the role modeled by the university influence their personal and professional decisions and future environmental impacts. The research and publications of faculty members can influence future direction in society [18]. This can have a benefit to the environment by providing solutions, or have a negative environmental impact by promoting unsustainable practices [21, 48]. AISHE and the Sustainable University frameworks both have education and research embedded in their design. The HE-21 model also defines a broader scope for the EMS and requests a different level of detail in the selection of environmental interactions. The Osnabrück University model was not designed to accommodate this, as it was designed for operations only. The other frameworks can accommodate research and education, but are not designed with this in mind, so it will be more difficult to implement due to the bottom-up decision-making structures of the academic side of the university.

Roorda [18] compiled the 'Environmental Interactions for Internal Environmental Management' from TU Delft (1991); SME (1996); BS 7750, and EMAS. This is an extensive list of potential operations-related interactions and indicators within the categories of: organization, purchases, solid waste, problem materials, soil, water, air and noise, energy, country planning / building, nature conservancy, and traffic. In an article about environmental management in Swedish universities [15] they included both direct and indirect interactions, including research and education. They found prioritized environmental aspects to be: cooling media; restaurant; water

usage; building & rebuilding; goods/services/consumables; chemicals & hazard waste; purchase and procurement; paper usage; waste/waste management; energy usage; traveling & transportation; external projects; environmental education for staff; information activity; co-operation; research; and education. Table 5 presents a list of categories for potential environmental interactions as determined from the Dalhousie University experience.

<INSERT TABLE FIVE HERE>

In terms of uptake of different environmental interactions, Bakker studied the campus environmental interactions which are audited by Canadian universities [28]. These results indicate which direct and indirect aspects the universities prioritized for management and therefore for auditing. Bakker found that the percentage of the 28 surveyed campuses which included the following interactions in their university environmental audits in 1998 were: 92.8% - solid waste, 89.3% - energy, 82.1% - hazardous waste, 57.1% - water, 42.9% - printing and copying, 42.9% - landscaping, 39.3% - food services, 28.6% - purchasing, 25% - transportation, 21.4% - other, 14.3% - curriculum, and 14.3% - accounting, investment practices [28]. Many Canadian universities are now choosing to go beyond environment in their management system, and included some social and economic interactions and indicators in their audits. They are using the Campus Sustainability Assessment Framework as an audit tool [19]. Some of these universities have complemented or replaced their environmental management systems with sustainability management systems.

In summary, the environmental interactions of a higher education institution range from direct to indirect interactions and can fall within operations, financial, community, research and educational matters. The examples provided by other studies, organizations and universities indicate that many environmental interactions selected are operational in nature. The examples from the literature also mention education or curricula as a potential interaction, and most mention research too. Bakker's study [28] demonstrated that in 1998 fewer universities managed for environment interactions in education and research, but by 2007, at least in Sweden, it had become normal. Velazquez et al., [32] also found that of 40 universities surveyed from around the world in 2006, 90% were using education as a way to promote sustainability, 80% were

using research, 60% were engaged in sustainability outreach and partnership, and between 18% - 70% were managing operations (depending on the initiative, with energy efficiency as the highest with 70% and pest management the lowest at 18%). Some literature also included procurement and investment as potential interactions. It is interesting to note that a few of the examples also included decision making, organization or campus environmental assessment characteristics. These are ways of saying that the environmental management system itself is an environmental interaction to be included in management. The next sector-specific feature discussed is the roles and responsibilities.

4.4 Roles and Responsibilities

The difference between the decision-making structures of higher education institutions and other enterprises leads to a unique set of roles and responsibilities [49]. Based on the Dalhousie University case, leadership and authority was shared within four distinct stakeholder categories: staff, students, faculty and senior management (senior administration, Senate and Board of Governors). Environmental initiatives have been undertaken separately within each of these groups, or sometimes in a partnership between two or more groups. The senior management and staff roles were similar to those in other enterprises but the student and faculty roles differed significantly. Senior administration had a history of developing environmental declarations for universities, approving policies, approving budgets, and approving some staff initiatives. Faculty had a history of environmental education and research initiatives. Individuals on staff had taken on environmental projects within specific areas, monitored operations, and conducted audits. Students had a history of informal environmental education, campus audits and small-scale projects. All four groups together could develop, plan, implement, check and review a university environmental policy. According to the Dalhousie University experience, interviewees felt that a successful campus environmental system had to bring together the skills and expertise of all four stakeholder groups and bridge their varied decision-making and communication structures, ranging from horizontal, autonomous, and democratic to vertical and hierarchical.

In general, responsibilities vary within the university structure and connected roles often operate autonomously from one another [17]. In most enterprises, given the hierarchical structure, the expert on environmental management would be responsible for the EMS. At the university, there

may be a faculty member whose expertise is in environmental policy who has nothing to do with the university's environmental policy development. There may also be a faculty member whose expertise is in energy efficiency or some other aspect of environmental management who has no communication with the staff responsible. Also key in an EMS, but difficult on a campus, is the communication among staff, faculty, students and management [7, 11, 16]. Faculty members, and even specific management personnel tend to have excellent communication within their field outside their own institutions, but little communication across stakeholders within their institution. These differences in roles and responsibilities influence the environmental management system. Different structures are needed to involve the student, staff, faculty, and administration stakeholders. The AISHE model has dedicated one out of five sections just to connecting experts, which is about the interactions of staff and faculty members on environmental topics in: an expert team, their professional field, their research, their curricula, their external services and their professional development [18].

The AISHE model has also separated: 1) operations and finance, 2) curricula and behavior, and 3) research, networking and external services to emphasize these three distinctly different needs within the campus EMS [18]. This is not unlike the Sustainable University model which has four categories; the difference being that research and outreach are separated as this model's outreach section includes not just the education outreach, but also outreach to government agencies, private sector, NGOs and community. The structure and roles and responsibilities of environmental management within each of these three (or four) areas are different, and are perhaps better approached as separate management components. As implementation of each area is reported to a different Vice President within the university structure, and some are linked to the Board while others are linked to the Senate, by separating out the planning and implementation, it may lead to easier checking and reviewing.

Leadership is another important element of roles and responsibilities. The key leader of environmental management on campus must be an administrator or a faculty member who has access to power [50, 51]. If the leader is not an administrator, then the leader(s) require the support of senior administration to institute and improve a campus-wide EMS. The campus environmental management system structure must take a simultaneous top-down and bottom-up

approach, not just one or the other. The most senior people should be visibly interested in the cause. They must demonstrate commitment and a willingness to take risks, if the entire organization is to view environmental management as a serious exercise [52]. At the University of Surrey, a bottom-up approach to policy implementation was attempted in order to increase ownership [25]. This was done through policy development working groups which had an open membership. It took four years to adopt a final policy which had broad support and interest [25]. All members of the organization should be involved in the development, implementation, monitoring and enforcement of the initiatives [49]; it cannot just be left to one 'leader' as suggested by Allen [50]. In essence, initiatives on campus are conducted by various stakeholders. There are also a few roles which are specific to the EMS, though they might also overlap with the Health and Safety management system [17]. Further detail on the responsibilities of the unique positions of the environmental officer, the multi-stakeholder committee, the departmental contacts, and the auditors follows.

4.4.1 Environmental Officer

The environmental officer plays a pivotal role within an environmental management system. The authors of one study concluded that "reporting to the Board of Governors and/or having full-time staff responsible for an EMS sometimes does more to ensure dedicated resources (time, money, and expertise), than a simple declaration of principles" [14: 180]. In order for an EMS to exist, the university as a whole must have a centralized authority instead of separate functions in recycling departments, facility services, plant maintenance, health and safety, etc. The central body can ensure everyone is working for common goals and also streamline reporting [14]. Brown University created a 'Brown is Green' program office and hired an officer in 1990 who facilitated a wide range of conservation projects and managed students and volunteers [20]. SUNY Buffalo University's officer found that a successful sustainability officer had to balance technical skills with people skills. The technical work is a part of the role, but so is teaching and community organizing [20].Tufts University, Rochester University and at least 20 other American campuses have done the same [20]. In Canada, sustainability or environmental officers now exist at many universities, including, but not limited to: the University of Victoria, the University of British Columbia, the University of Saskatchewan, McGill University, Concordia University, Dalhousie University, and the University of Prince Edward Island [53].

The Osnabrück University model calls for this position to be created and integrated into the existing administration. Their model focuses on operations, so this recommendation implies placing the position in Facilities Management (or equivalent). The AISHE model, on the other hand, does not mention this position and instead references an 'internal assessment leader' and 'external AISHE consultant'. This internal assessment leader can be a member of the management team, a quality coordinator, a sustainability coordinator, etc., again implying that this is a staff (as opposed to academic) position. While the Sustainability University model calls for separate strategies for education, research, outreach and operations, the authors do not suggest a staff person for each, only the need for a campus wide committee. The inclusion of a full time staff responsible for the campus EMS is key to its success [14], and the placement of this position also has implications on how the environmental policy is implemented.

4.4.2 Multi-Stakeholder Committee and Process

The second EMS specific role on a campus is the multi-stakeholder committee. A university-wide environmental committee, or expert team, is generally made up of people from staff, students, faculty and senior management [7] and this team can spearhead the environmental management system [49]. This team may even include honorable members of the surrounding community [32]. This type of multi-disciplinary approach has been termed a multi-stakeholder process [53, 54], and can be used for both formal and informal EMS. Under this approach, faculty with expertise in the components of the EMS, key administrative leaders, relevant staff, and student leaders come together to set the priorities for the EMS and guide its implementation, often alongside an environmental officer [54]. Given its diverse participation, the multi-stakeholder group is generally able to trouble-shoot problems arising from the different management styles and operational structures that characterize the administration, faculty, and student population [54]. At Dalhousie University, some of the people involved were working within their job descriptions, some were taking on extra work responsibilities because of an interest in the environment, and some were volunteering. The HE-21 model, the Osnabrück University model, the AISHE model, and the Sustainable University model all call for this team to be created. The HE-21 model and the Osnabrück University model indicate that this committee should conduct an initial review before developing the policy and/or goals. The

Sustainable University model specifically indicates that “the committee does not take over the initiatives around campus, it helps people responsible for those initiatives by disseminating and receiving information, coordinating initiatives, avoiding overlapping efforts, obtaining funds, and ensuring that policies are effectively implemented” [32: 814].

4.4.3 Departmental Contacts

Another role on some campuses is the departmental contact [16]. For example, at the University of Buffalo (UB), there is a coordinator and student assistants who work with a team of 150 ‘building conservation contacts’ [55]. The contacts are volunteer monitors who disseminate information about university environmental policies, monitor participation levels and liaise with the task force. At UB each contact receives a checklist which covers energy, solid waste, hazardous waste, water, purchasing, and transportation topics. Contacts turn off unused lights, computers and equipment. They maintain heat and report overheated / undercooled areas, and identify other conservation opportunities [55].

4.4.4 Audit Team

Auditing can be carried out by consultants, students, or staff [49]. Herremans and Allwright's [14] study indicated that the majority of respondents do audits with internal staff (58%), while some use an external auditor (34%). They do not mention what the other 8% do. The responsibility of the auditor differs depending on the campus. Currently in Canada, most audits are carried out by students using the Campus Sustainability Assessment Framework (CSAF), which is promoted by the Sierra Youth Coalition [19]. These audits are conducted by the student groups, by students hired on work terms, as a thesis, as an independent research projects, or as assignments for class [53]. Assessments are published either electronically or in hard copy as an environmental report. This audit / report is used by middle and senior management, and by the environmental committee to determine needed corrective actions or conduct reviews. These Canadian campuses do not have a certified EMS. For certification purposes, an external audit is done on the EMS by a consultant [39]. To date, at least in North America, there is no external audit done for an informal EMS, though a peer-review external audit concept was discussed at the conference on ‘Cleaner Production and Pollution Prevention at Universities’ in 2002 in

Mexico. The countries that are using one main auditing tool, such as the CSAF in Canada or the AISHE in Holland, certainly help standardize the reporting.

In summary, Table 6 outlines a list of stakeholders, potential campus EMS components and potential roles and responsibilities for each. The compiled and condensed list of stakeholders was based on both the literature [20, 50, 51, 53], and the Dalhousie University case study. The list of EMS components was generated from the six tools outlined in Table 4. One addition to the compilation of a campus EMS that did not come directly from the six models is the financial plan. It is inspired by the emphasis put on financial planning by the Sierra Youth Coalition [48] and by Herremans and Allwright [14]. The lead (L) and support (S) roles and responsibilities were determined through the Dalhousie University interviews and the literature. As this structure is based on one mid-size Canadian university, it would need to be modified for other higher education institutions.

<INSERT TABLE SIX HERE>

Besides roles and responsibilities, another unique feature of a campus EMS is the documentation.

4.5 Lack of EMS Documentation

An area that has been identified as differing between ISO 14001 and other campus EMS models is the EMS documentation. An emphasis on less documented procedures can be seen in the Campus Consortium on Environmental Excellence's (C2E2) experience:

> It is our belief that the heavy emphasis in ISO 14001 with respect to formal procedures, excessive documentation and record keeping may be misplaced at U/Cs [Universities and Colleges]. An EMS for a U/C needs to focus on management support, planning, system flexibility, clearly defined roles and responsibilities, effective training and communication and reasonably frequent feedback loops [41: 10].

C2E2 found that most universities were not concerned with low scores in areas that are of priority to the ISO 14001 standard; excessive documentation and record keeping were not perceived as priorities. Instead priority is placed on environmental performance in terms of

compliance, minimization of impacts, environmental issues in decision-making, and integration of environmental values into education and research.

4.6 Environmental Assessment / Audit

The final unique feature identified is the environmental assessment itself. The unique decision-making structure of a higher education institution affects the checking and review processes. The multi-stakeholder committee can play a large role in the corrective action and review, though ultimately final revisions to policy or budgets must be appropriately approved by the Senate, Board, and/or senior administration. AISHE in particular has a category on result assessment which is based on the awareness, understanding and environmental stewardship of staff, administrators, faculty members and students, as well as on the perception of companies and other societal actors who work with the university in relation to their environmental record [18]. This is a type of "checking" of the results of the planning and implementation, though it is not based on targets or measurable indicators. Rather, it tries to measure the intangible outcomes of environmental education. Instead of measuring processes such as "how many graduates have taken an environmental course;" it tries to measure the actual outcome of changes in awareness. AISHE does call for measurement of pledges from graduates to pursue sustainable careers, and of certifications, publications, and awards for internal environmental management, sustainability research and sustainability education [18]. These types of measurements are definitely distinct to this sector.

Shriberg [56] considered 10 different campus sustainability assessment tools, including AISHE and the EMS Self-Assessment, which are studied in this article for their EMS frameworks. He concluded that in addition to sustainability measurement, "cross-institutional tools provide valuable insight into essential attributes of sustainability through their structure and content" [56: 38]. Specifically, Shriberg noted the importance of assessing: 1) throughput of aspects such as energy, water, and other materials; 2) sustainability education; 3) cross-functional integration of teaching, research, operations and service; 4) cross-institution implications such as campus investments; and 5) incremental & systemic progress both being evaluated [56]. Currently these tools are being concurrently developed and no one "universal assessment tool" exists [56]. In order to address this, Lozano [57] offered a modified version of the Global Reporting Initiative

(GRI) Sustainability Guidelines as one of the best tools for standardizing campus sustainability reporting. The modification for universities was worked on by researchers and educators from the University Leaders for Sustainable Future (ULSF) and adds educational performance indicators in the areas of curriculum and research [57]. Lozano [57] also offered a Graphical Assessment of Sustainability in University tool, to complement the modified GRI Sustainability Guidelines. Both the University of Hong Kong, China and the University of Florida, USA are GRI-reporting institutions [58]. While most of these assessment tools have not been specifically designed to be integrated into a campus EMS, in essence they provide sector-specific tools for the checking phase. They also inherently make the point that a campus EMS should include both direct and indirect environmental interactions.

5. Conclusion

The literature review provided in this article synthesizes campus EMS articles and practitioner documents, and succinctly presents three categories of drivers, six campus EMS models, and six unique features of a campus-specific EMS. The sector has specific drivers, decision-making structures, declarations, environmental interactions, roles and responsibilities, EMS documentation, and environmental audits. The debate on the best model for a campus EMS must take these unique features and needs into account.

This article contributes to the literature on drivers by integrating the three generation theoretical framework on drivers [5]. This framework explains the wide range of drivers found in the literature, demonstrating that they can develop through time from cost and compliance in the first generation, move to stakeholder management, total quality management and pollution prevention in the second generation, and ultimately transition into a third generation encompassing stakeholder partnerships, sustainable development and life-cycle management. Drivers for initiating a campus EMS often reflect the broader mandate of the institution to provide service, teaching and research. Indirect environmental impacts are a highly dynamic component of the environmental interactions at a university, particularly in the investment, procurement, teaching, learning, and research activities of the school. An EMS must be flexible enough to gauge the potential of these activities to achieve significant environmental change, not only in reducing risk and impact, but also in creating concrete environmental benefits.

The drivers behind why an institution adopts an EMS affect which campus EMS model is most appropriate. This article discusses six EMS frameworks; specifically ISO 14001; the Higher Education 21 (UK); the EMS Self-Assessment Checklist (USA); the Auditing Instrument for Sustainability in Higher Education (Netherlands); the Osnabrück University model (Germany) and the Sustainable University model (Mexico). Of these, ISO 14001 and the Osnabrück University model are best suited to first generation drivers and direct environmental impacts of operations, while AISHE and the Sustainable University model would not be appropriate for an EMS solely focused on risk reduction measures. The EMS Self-Assessment Checklist, and the Higher Education 21 are specifically designed for second generation drivers focused on internal direct and indirect environmental interactions. ISO 14001 can also accommodate second generation drivers, and AISHE and the Sustainable University model could be used for this purpose. For third generation drivers, only AISHE and the Sustainable University models have been designed to incorporate external stakeholder partnerships and regional sustainable development.

In general, certified EMS do not result in greater improvements in environmental performance as compared to uncertified ones, and the average cost (including direct, indirect, and labor costs) is $64,000 [8]. Only ISO 14001 was designed as a formal, certifiable EMS. Osnabrück University model was designed to be compatible with EMAS. Generally the certified EMS is compatible with first generation drivers, though the Swedish examples have proven that it can be extended to include indirect interactions such as education and research.

5.1 Key Features of a Campus EMS

- Involves a continual improvement cycle that includes emergent plans, unrealized plans, best practices feeding into the review, and interactions between planning and implementation; this was demonstrated in Figure 1 of this article.
- Can be used for all three generations of campus environmental management as was demonstrated by the diversity of drivers and shown in Tables 1-3 and the discussion on different EMS frameworks.

- Requires a structure that matches the decision-making structures. This raises questions on the best placement of the environmental office and officer; should it be aligned with the operations side of the university or the academic side?
- Requires policies that match the decision-making structures. This raises questions on the environmental interactions to be included in the environmental policy and if there should be one overarching policy or separate strategies for operations, education, research, and community. Declarations are also used as a complement to a university policy.
- Requires specific roles and responsibilities; in particular this article discussed the roles of the environmental officer, departmental contacts, audit team, and multi-stakeholder committee; and offered an example of Dalhousie's lead and support roles (in Table 5).
- Prefers less EMS documentation, and a sector-specific environmental assessment.

Herremans and Allwright [14] have also commented on what makes a successful campus EMS. Through their survey, they concluded that the necessary pieces include guiding principles, reporting to the Board, full-time staff, commitment, communication, defining authority, environmental audits, and capability in the form of people, information, finances and equipment [14].

In conclusion, there are a range of relevant EMS frameworks, many of which are specifically tailored to the university's needs. In a recent Journal of Cleaner Production article [8], the authors concluded that there are only two EMS models in the literature that have been proposed specifically for universities, although several guides are available; the ISO 14001 and the Osnabrück University model. This article expands the literature on campus EMS models by considering six different frameworks. and even then does not consider at least two more; the EMAS @ Schools (European) [36, 59] and the Sierra Youth Coalition guides (Canada) [19, 54, 60, 61]. The field is rich but there is work yet to be done, including a variety of new research areas identified in the following section.

5.2 Reflections on Future Research

As schools worldwide continue to reduce their environmental footprint and develop new tools, the study of environmental management systems within the university and college context is

similar to chasing a moving target, with much innovative work still to be pursued. Based on the literature review conducted for this paper, potential future research includes:

- Further cross-country comparisons are necessary as current articles on campus EMS are either regional [14], treat one country at a time, such as USA [13], Canada [28], Sweden [2, 15], Australia [17], or they focus on specific universities. The one international study [32], while very informative, had only 80 higher education institutions involved, as compared to the USA survey [13] which had 273 respondents.
- While recent literature has explored campus assessment tools [56, 62, 63], there is a lack of research exploring the links between campus auditing systems and EMS.
- More research is also needed on the empirically found implications of different structures and processes for a campus EMS, including the related roles and responsibilities. The number and timing of policies is a potential variable, alongside the number and variety of implementation plans. Are universities that use multiple policies and plans more successful in implementation than those that use one? Another potential research thread is the implication of the placement of the EMS office in the administrative structure; whether in facilities management, health and safety, an academic office, the student union, or located independently.
- More research is needed on the difference between a sustainability management system (SMS) and an environmental management system. At least in Canada, there is a recent trend towards SMS [53]. There are many potential questions in this area.

In conclusion, universities and colleges have unique features which require distinct approaches to integrating an EMS, and selecting the appropriate model depends on the campus-specific drivers.

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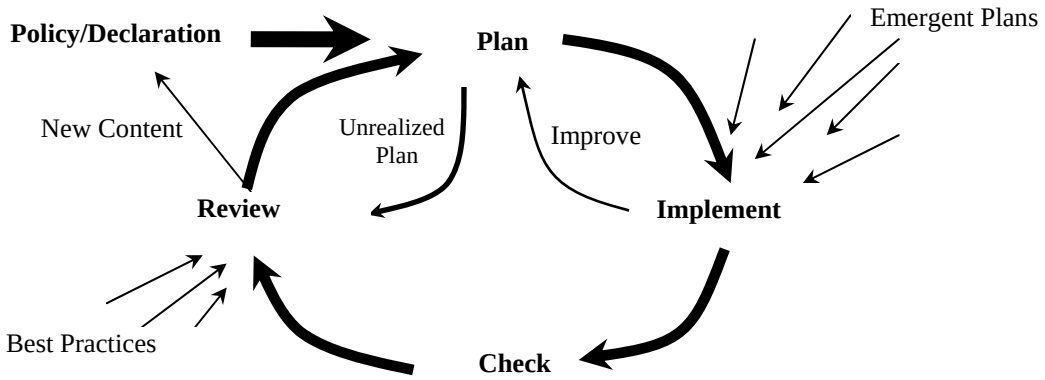
Figure 1: Environmental Management System Cycle with Emergent Content



[12: p. 386]

Table 1: Stakeholder Group Data on Drivers for Environmental Management (1 = highest and 8 = lowest)

Category	Community	Financial	Regulators	Employers	Students
Environmental performance	1	4	2	4	6
Financial performance	5	3	6	3	5
Ethical performance	3	6	4	5	4
Comparative performance	6	2	5	6	3
Heath and Safety performance	2	5	1	1	2
Quality of service	4	1	3	2	1
Resource depletion	3	5	2	2	2
Human health	2	1	1	1	1
Global warming	5	4	4	3	7
Ozone depletion	7	7	6	5	4
Acid rain	8	8	8	6	7
Eutrophication	6	6	6	8	6
Smog formation	1	3	5	6	3
Ecosystem degradation	3	2	2	3	5

Source: [26: p. 58]

Table 2: Comparison of Drivers for an Environmental Management System at Dalhousie University with Other Studies on Drivers for Campus Environmental Management.

Drivers	Dalhousi	KPMG	Thompson et al.	Bakker	Davey et al
Leader, role model, best practice	1			7	6
Good citizen, and education responsibility	2				5
Cost savings, long-term pay-off	2	5	5	2	3
Employee morale and health	3	3	6		1
Less use of resources and environment	3				4
Community image and concerns	3		8	5	
Increase market and promotion	3	4			
Educate ourselves and prepare for future	4				
Role in research, and practice what is preached, quality of service	5				2
Charismatic people and specific stakeholders	5		6	1	
Due diligence and compliance	5	1	1	4	
Reduced liability and insurance	5	2	3	3 and 6	
Declarations, associations, guidelines, and codes			2	8	
Financiers, grants and donors			3 and 4		
Location			7		
Suppliers				9	

Table 3: Categories of Drivers for Campus Environmental Management Systems

Category	Bennett and James Explanation	Campus EMS Drivers
First Generation	Cost and compliance	Cost savings, and long term pay-off; Due diligence and compliance; Reduce liability and insurance; Regulators; Financiers; Complying with suppliers; and Legitimate efforts to government.
Second Generation (Internal)	Stakeholder management; Total quality management; and Pollution prevention	Educational responsibility; Educate ourselves; Employee morale and health; Less use of resources and environment; Quality of service; Declarations; Role in research; Charismatic people and stakeholders; Legitimate efforts to internal audience; Increase market; Improve internal communication; Improve internal cooperation; and Improve management generally.
Third Generation (External)	Stakeholder partnerships; Sustainable development; and Life-cycle management	Good citizen; Leader, role model, best practice; Community image and concerns; Influence suppliers; Relationship with associations; Prepare the future; Legitimate efforts to community; and Improve external communication.

Table 4: ISO 14001, Higher Education 21 (HE21), EMS Self- Assessment Checklist, Auditing Instrument for Sustainability in Higher Education (AISHE), the Osnabrück Model and the Sustainable University Model - Compared for Unique Campus Features

	ISO 14001	HE21	Check-List	AISHE	Osnabrück	Sustainable University	Unique Features
Policy	• Environmental Policy	• Environmental Policy	• Environmental Policy	• Vision; Policy (and declarations) • Communication (including public position and support internally)	• Environmental guidelines (internal)	• Vision • Mission • Sustainability Committee (creating policies, targets, and objectives)	• Declarations
Planning	• Environmental Aspects • Objectives and Targets • Legal and Other Requirements • Environmental Management Programs	• Identify Team, Review and Scope • Environmental Aspects; • Objectives and Targets • Legal and Other Requirements	• Environmental Impacts Identified • Environmental Objectives • Consider Impacts • Objectives and Targets • Legal and Other Requirements	• Expert Group • Research and External Services • Network (in professional field with respect to sustainability) • Staff Development Plan • Internal Environmental Management (of operations) • Education Goals on: Profile of the Graduate, Educational Methodology, and Role of the Teacher	• Environmental Audit (life cycle assessment) • Environmental Goals; Environmental Program • External Environmental Regulations	• Sustainability Strategies for education, research, outreach & partnership, and campus	• Indirect Environmental Interactions
Implementation	• Structure and Responsibilities • Operational Control and Emergency Preparedness and Response • Training, Awareness, Competence • Communication; • Documentation • Documentation Control	• Structure, Responsibilities, and Training • Operational Control, Procedures, Accidents and Emergency Situations • Documentation • Documentation Control	• Structure and Responsibilities • Procedures for Human Health Hazards and Emergencies • Training and Competence; Communication • Documentation • Documentation Control	• Student Examination (on sustainability) • Curricula (on sustainability) • Integrated Problem Handling • Traineeships, Graduation and Education Content: Throughout and as a Specialization	• Organizational Structure • Staff Involvement/ Public Relations Work • Environmental Report • Environmental Training and Courses	• Implement strategies • Network and Organizations	• Decision-Making Structure • Roles and Responsibilities • Lack of EMS Documentation
Checking	• Monitoring and Measurement • Corrective and Preventive Action • EMS Audit	• Monitoring and Measurement and Records • Corrective and Preventive Action • Environmental Statement • EMS Certification Criteria and Assessment Program • EMS Audit	• Monitoring and Measurement • Corrective and Preventive Action	• Results Assessment: Staff, Student, Professional Field and Society (satisfaction). Includes declaration by graduates; certification and awards for internal management or sustainability education. • AISHE audit circle.	• Environmental audit (life cycle assessment) • Environmental Information System;	• Sustainability Audit	• Environmental Audit / Assessment
Review	• Management Review	• Management Review	• Management Review		• Environmental Report	• Continuous Improvement	

Table 5: Direct and Indirect Risks and Benefits of Campus Environmental Interactions (Aspects)

		Environmental Interaction		Impact Relationship	
Sector	**Environmental Aspect**	**Direct**	**Indirect**	**Risk**	**Benefit**
Operations	Solid Waste	*		*	
	Energy/Electricity	*	*	*	
	Food (use and waste)	*	*	*	*
	Grounds	*		*	*
	Paper and other supplies	*	*	*	
	Waster (use and waste)	*		*	
	Air	*		*	
	Built Environment	*		*	*
	Hazardous Substances	*		*	
	Transportation	*		*	*
Administrative	Purchasing		*	*	*
	Funding		*		*
	Investment		*		*
	Management		*		*
Academic	Research		*		*
	Education		*		*
Community	Services		*		*

Table 6: Sample Roles and Responsibilities in a Campus Environmental Management System

		President and VPs	Board	Senate	Enviro. Committee	EHS Committee	EHS Office	Facilities Manager	Enviro. Officer	Depart. Contact	Staff	Faculty	Students	Student Groups	Community	Outside Groups	Consultants	Utilities	Governments
Policy	Environmental Policy and Vision	L	L	L	S				S				S		S				
	Communication and Support Internally	L			S	S	S	S	S	S	S	S	S	S					
	Public Position and Declaration	L			S				S			S		S	S	S		S	S
Planning	Review and Scope	S			L		S	S	L										
	Expert Team / Responsible Unit	S			L	S	S	S	L						S	S	S	S	
	Environmental Aspects and Impacts				S			S	L							S			
	Objectives and Targets for Operations and Finance	S	S		S			L	S		S							S	
	Educational Goals for Curricula and Behaviors	S		S	S				S			L		S					
	Goals for Research, Networking and External Services	S		S	S				S			L		S					
	Plan for Legal and Other Requirements	S	S			S	L	L											
	Plan for Awareness and Staff Development	S	S		S			S	L			S		S					
	Financial Plan	S	S				S	S	L										
Implementation	Structure, Schedule and Responsibilities for Operations and Finance							L	S	S	S					S	S	S	
	Structure, Schedule and Responsibilities for Curricula and Behavior								S	S	S	L	S	S		S	S		
	Structure, Schedule and Resp. for Research, Networking and External Services								S	S	S	L	S	S		S	S		
	Procedures for Human Health Hazards and Emergencies					S	L		S	S	S								
	Training, Awareness,								L	S	S	S	S	S		S	S	S	
	Communication								L	S	S	S	S	S					
	Documentation								L										
Checking & Review	Monitoring and Measurement							S	L	S		S		S				S	
	Corrective and Preventive Action							S	L										
	Pledges by Graduates	L							S			S	S	L		S			
	Certifications, Publications, and Awards for Internal Env. Mgmt.. Env. Research and Ed.								S			L	S	S		S			L
	EMS Audit								L			S	S	L		L	L		
	Management Review	L	L	L	S	S	S	S	S										

L = lead person or group S = support person or group