Integrating environmental sustainability into universities

Meredith Ralph · Wendy Stubbs

Abstract   Universities play a fundamental role in addressing global environmental challenges as their education, research and community involvement can produce long-lasting environmental effects and societal change. By demonstrating best practice in their operations, research and teaching, universities have both multiple and multiplier effects on society. For universities to comprehensively address sustainability, a 'learning for sustainability' approach needs to be embedded across every aspect of institutional operations in a synergistic way. Using semistructured interviews, this research explored the factors that influence the integration of sustainability into the operations, teaching and research activities of universities in Australia and England. The research found that individuals, committed to the goal of a more sustainable world, play a vital role in the success of integrating environmental sustainability into universities. The factors critical to enabling universities to undertake the transformational changes necessary to embed environmental sustainability into all university areas included: a strong policy environment, resourcing of strategies, and encouragement of leaders and environmental sustainability advocates. Educating and building the awareness of university staff of the importance of environmental sustainability to future generations was key to a successful strategy.

Keywords   Universities · Environmental sustainability · Education for sustainability · Integration · Drivers · Barriers

Introduction

Addressing the current state of the global natural environment constitutes one of the most urgent and significant challenges in recent history. Mounting environmental pressures have

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arisen from population growth and from its associated economic activities and consumption patterns in a world that is increasingly industrialised and interconnected. The nature of the environmental crisis is wide-ranging as it includes increasing pollution, loss of habitat, loss of biodiversity and diminishing resources (Sharp 2002). Increased human development and its industrialisation has resulted in increasing levels of greenhouse gas emissions that are a major contributor to climate change, which has a range of serious consequences for life on earth (Intergovernmental Panel on Climate Change 2007).

The overwhelming view of scientists is that organizations, industries and governments must adopt sustainable practices and commence mitigation action to prevent further degradation, to decrease current greenhouse gas emissions and to prevent further increases in emissions in order to minimise these impacts (Stern 2006). Universities play a distinctive role in addressing environmental pressures and in creating a sustainable society as their education, research and community involvement can produce long-lasting environmental effects and societal change (von Oelreich 2004). Through demonstrating best practice, researching solutions to problems, educating future communities and leaders and promoting sustainability, universities have both multiple and multiplier effects on the sustainability of today's and future society (Ferrer-Balas et al. 2008; Fisher and Bonn 2011; Tilbury et al. 2005).

In universities, the strategic implications of sustainability reach beyond individual curriculum changes, isolated environmental practices and environmental policies, with adjustments also required to academic priorities, organisational structures and financial systems (Ryan et al. 2010). For universities to comprehensively address sustainability, 'there is a need to link campus management to research, curriculum and administrative practice, such that a learning for sustainability approach is embedded across every aspect of institutional operations in a synergistic way' (Tilbury and Cooke 2005: 62). Previous studies have identified drivers and/or barriers to integrating environmental sustainability into universities but have not explored how the factors may differ across the three facets of operations, teaching and research activities. This paper seeks to address this gap in knowledge.

The paper first reviews the literature on sustainability in the university sector, including the drivers and barriers to integrating sustainability into universities. The research methods are then described, followed by a discussion of the factors influencing integration of environmental sustainability into operations, research and education. Finally, the implications of these findings are considered.

Addressing environmental sustainability in universities

Sustainability is a paradigm for thinking about the future in which the economic, environmental and social dimensions are intertwined, not separate, and are balanced in the pursuit of an improved quality of life (United Nations Educational Scientific and Cultural Organization 2011). In order to achieve this, the economic and ecological considerations of institutions must be fully integrated (Brundtland 1987).

Generally, the higher education sector has lagged behind government and business sectors in rising to the environmental challenge, but over the last decade universities have demonstrated increasing initiative in applying sustainability principles (Merkel and Litten 2007). Significant numbers of senior university leaders have signed one or more international declarations that promote sustainability in higher education. The translation of signing these non-binding commitments into effective action, however, rarely results in lasting institutional transformation (Bekessy et al. 2007).

Recognising their large environmental impact in energy used and waste generated, increasing numbers of universities have improved the environmental management of their campuses to reduce their ecological footprint (Corcoran and Wals 2004; Tilbury et al. 2005; Wals and Blewitt 2010). Urgent environmental issues led to the inclusion of environmental topics in the curriculum of higher education institutions in the 1970s (Wals and Blewitt 2010). However, the extent of curriculum 'greening' appears to be limited by internal, interdisciplinary barriers, requiring governmental assistance and student pressure to effect greater change (Haigh 2005). Full integration of sustainability into the overall curriculum is progressing more slowly than 'greening' of campuses, with the emergence of a 'third wave of sustainability' in higher education now focusing on teaching and learning (Wals and Blewitt 2010). The numbers of higher education institutions undertaking sustainability reporting, and the level of that reporting, is still in its early stages compared to corporations (Lozano 2011).

Large-scale changes to institutional culture are necessary to embed sustainability into universities so that it influences decisions, management procedures, curricula and research (Tilbury et al. 2005). A university that has comprehensively integrated sustainability can been described as displaying the following characteristics (Clugston and Calder 1999; Tilbury et al. 2005; Ferrer-Balas et al. 2008):

- Leadership and vision that expresses commitment to, and promotes, sustainability;
- Incorporation of the concepts and practices of sustainability into the teaching and research of all academic disciplines;
- An emphasis on fostering the inter- and trans-disciplinary teaching and research needed to provide solutions to sustainability challenges;
- Recognition of the ecological footprint of the institution, together with sustainable policies and practices in operations, support and services that minimise this footprint; and,
- Engagement in community outreach that enhances environmental sustainability.

Drivers for integrating sustainability into universities

The requirements of international and national policy directives and statements are external drivers for universities to adopt sustainability (Wright 2002). A number of sustainability declarations relevant to higher education have been developed since the Stockholm Declaration in 1972, which recognised the need for environmental education (Wright 2002). Over 400 university presidents and chancellors in over 50 countries have signed the Talloires Declaration (TD). The TD is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities (University Leaders for a Sustainable Future 2008).

The United Nations (UN) Earth Summit in Rio de Janeiro in 1992 placed education for sustainable development on the global agenda and as one of the top priorities in national policy documents (Anderberg et al. 2009). The Kyoto Declaration of 1993, adopted by 90 universities across the globe, also challenged higher education to take on sustainability in the education of students and in public outreach activities to the broader community (Anderberg et al. 2009). UN-sponsored initiatives have continued to strengthen and focus global efforts in this area, culminating in the current Decade of Education for Sustainable Development (2005–2014). These international declarations have been implemented, both at a national and at an organisational level, through legislation (Sammalisto and Lindhqvist 2008; Niu et al. 2010), government policy (Nomura and Abe 2010), government funding

initiatives (Scott and Gough 2006) and through partnerships with non-governmental organizations (Wright 2002; Nomura and Abe 2010).

One of the most compelling internal drivers for integrating sustainability into universities is the ethical obligation to address this significant global challenge. Given their collective knowledge and research capacity, there is a moral responsibility for universities to educate future leaders and to advance knowledge that can lead to the creation of a sustainable environment (Moore 2005; Nicolaides 2006). In addition, universities, as large greenhouse gas emitters with significant financial influence, should also provide leadership for the broader society (Sharp 2002) by setting an example in their own operations (Kirwan 2010).

Increasingly, universities are being pressured by their staff and students to address sustainability by providing solutions to the global crisis and by using their knowledge to add a voice to national and international policy development (Helferty and Clarke 2009; Sharp 2002). The enhanced public image resulting from environmental leadership within the sector can also provide universities with improved financial viability through increased student recruitment and through the financial savings achieved from environmental efficiencies (Nicolaides 2006; Nomura and Abe 2010).

Barriers to integrating environmental sustainability into universities

The barriers to integrating sustainability into universities identified in the literature are predominantly internal. Financial constraints can limit the implementation of sustainability initiatives at universities due to competing priorities for limited resources and because the long term savings of these projects are not accounted for in budget modelling (Wright 2010). Within university communities, there is often a lack of understanding and awareness of sustainability issues, resulting in confusion and a lack of staff commitment to implementing sustainability programs (Evangelinos and Jones 2009; Wright 2010). As in all large organizations, there can be resistance to change, particularly when imposed from another area or discipline of the university—all levels of stakeholders must be engaged in the decision-making process and initiatives in order to ensure their long-term success (Sharp 2002; Nicolaides 2006). The most significant challenge to integrating sustainability into universities is to achieve a coherent institutional approach, where operations, teaching, research, and outreach are synergised (Tilbury et al. 2005; Nomura and Abe 2010).

Research methods

The case study method was used to guide this research study. Case study research 'investigates a contemporary phenomenon in depth and within its real-life context', using multiple sources of evidence such as archives, interviews and observations as well as numerous levels of analysis, often combining qualitative and quantitative data (Yin 2009, p. 18). This study utilised interviews and universities' websites, combining qualitative and quantitative data, to investigate how universities were integrating environmental sustainability into operations, teaching and research. Whilst acknowledging the three dimensions of sustainability (economic, environmental and social), this research focused on the environmental dimension, in particular, actions taken by universities to address the challenge of climate change, because it is considered to be a 'super wicked' problem (Levin et al. 2009).

The study examined four English and four Australian universities. The dissimilarity in the policy, regulatory and climate change actions of these countries provides contrasting contexts to analyse the factors influencing environmental sustainability integration. England is world leading in its approach to climate change with advanced climate change legislation setting challenging, legally binding emissions targets (Fankhauser et al. 2009). Higher education institutions in England have specific governmental requirements to address these targets, which include measurement and reporting processes, together with linking of capital funding to reductions in carbon emissions (Hopkinson 2011; Tilbury 2011).

Australia's higher education policy for environmental sustainability has focused on systemic change rather than direct governmental regulation, with the national action plan emphasising the role of education in addressing sustainability throughout society (Chambers 2010). National research funding is available to address environmental sustainability issues and to inform policy and practice (The Australian Research Institute for Environment and Sustainability 2012). In contrast to English universities, Australian universities have indirect incentives to reduce operational carbon emissions in order to avoid paying a carbon tax introduced in 2012.

Four Australian universities were selected using the Sustainable Campus Group Report (Sustainable Campus Group 2011) and from an assessment of the presence and depth of environmental sustainability information on the university's website. Four English universities were selected using the People and Planet (2010) Green League tables, the results of which are increasingly important in the planning and strategies of universities (Breakwell and Tytherleigh 2010). The universities selected were:

- publicly funded;
- generalist, not specialist, universities. From their public websites, it was ascertained that each university had at least three faculties/schools covering at least three disciplines, e.g. humanities, science and business;
- of comparable size, as determined from student numbers; and,
- had general university statistics and environmental sustainability information available on their website.

Semi-structured interviews were supplemented by secondary data from universities' websites. Eighteen interviews were conducted from the eight participating universities, either face-to-face (thirteen), or by phone (five). Each 1–2 h interview was audio taped. Transcripts were sent to all interviewees for confirmation, enhancing the validity of the data (Yin 2009). While an interviewee was sought from operations, teaching and research areas at each university, some universities were unable to provide all three representatives (see Table 1).

Each staff member interviewed was an authority in implementing environmental sustainability programs in their area of expertise of operations, teaching or research, as well as being in a position of sufficient seniority to provide an overview of the university's programs in that area of expertise. Interviewees were asked about: their university's environmental sustainability activities; the drivers and barriers to integrating environmental sustainability into their area of responsibility; how they ranked the importance of the drivers and barriers; their view on how successful their university had been in integrating environmental sustainability into their area of expertise; and, the key success factors. To maintain anonymity of the research participants, the names of the universities and interviewees are not identified in this paper.

Table 1 Summary of interview participants

University	Role at university	Type of position
Australian universities		
1	Operations	Professional
1	Research	Professional
2	Operations	Professional
2	Teaching	Academic
2	Research	Academic
3	Operations	Professional
3	Teaching and research	Professional
4	Operations	Professional
4	Teaching	Academic
4	Research	Professional
English universities		
1	Teaching	Academic
2	Operations	Professional
2	Operations	Professional
2	Teaching and research	Academic
3	Operations	Professional
3	Teaching	Academic
3	Research	Academic
4	Operations	Professional

The activities were scored against a comprehensive list compiled from the literature, as a measure of environmental sustainability activity (see Table 2). Each response was given a score, with the presence of the activity given a score of 1, the absence of an activity given zero, and partial development of an activity given 0.5.

The interview transcripts were coded (Gagnon 2010) to draw out the drivers, barriers and key success factors. As patterns emerged within the data the codes were grouped together under sub-themes, which were combined into themes of like categories (see Tables 2 and 3).

Findings

Figure 1 summarises the environmental sustainability activities across operations, teaching and research areas. The scores achieved by each university are summarised in Fig. 2, expressed as a percentage of the maximum possible score from Table 2 (Operations = 32, Teaching = 6, Research = 7). The data showed similar levels of integration in Australia and in England, particularly in the operational areas of the university, where five of the eight universities achieved scores of greater than 60 %. The results confirm previous findings that universities are concentrating on, or finding it easier to, 'green' the operational areas of their campuses, rather than undertaking transformational change across all university activities (van Weenen 2000; Dahle and Neumayer 2001; Noonan and Thomas 2004; Tilbury 2010).

Although integrating environmental sustainability into teaching in Australia lagged English universities, environmentally sustainable research activities at Australian

Table 2 Key to the environmental sustainability activities at universities, graphed in Fig. 1

Area of university	Number of activity	Environmental sustainability (ES) activity
Operations	1	Publicly available ES policy published in the last 5 years
	2	Externally audited environmental management system
	3	Publicly reports on ES annually
	The university engages with the university community through:	
	4	ES awards to staff and/or students
	5	ES awareness-raising campaigns
	6	Staff training in ES
	7	A staff engagement scheme (green representatives, eco-champions)
	8	Staff inductions include ES policy and issues
	9	ES newsletter
	10	Student representation on ES committees
	11	Student involvement (course work, volunteering) in ES projects
	12	Student inter-halls competitions
	13	Availability of funds for student or staff-led ES projects
	14	Provision of land for student/staff food-growing projects
	The university sets targets to reduce environmental impact in the following areas:	
	15	Waste management
	16	Transport
	17	Water
	18	Construction and refurbishment
	19	Emissions and discharges
	20	Biodiversity
	21	Sustainable procurement
	22	Publicly available carbon management plan published in the last 5 years:
	23	With a specific carbon reduction target within a specified time frame
	The carbon management plan includes:	
	24	Energy
	25	Procurement
	26	Staff and student business or study trips, for example, flights to conferences and field trips
	27	Staff and students commuting to university on a daily basis
	28	Carbon emissions associated with the travel between students' homes and the university (including international students' travel to and from their home country)
	The university invests in renewable energy, including:	
	29	Green energy or GreenPower
	30	On-site renewable energy
	31	Publicly-available Sustainable Food Policy published in last 5 years
	32	Accredited Fairtrade University with the Fairtrade Foundation

Table 2 continued

Area of university	Number of activity	Environmental sustainability (ES) activity
Teaching	1	Policy for integrating ES into the curriculum
	2	Co-ordination body (for example, a committee) for integrating ES into the curriculum
	3	Plan for integrating ES into the curriculum
	4	Target for integrating ES into the curriculum
	5	Economic incentives for faculties/schools to integrate ES into the curriculum
	6	Professional development to assist staff to integrate ES into the curriculum
Research	1	Group(s), centre(s) or institute(s) dedicated to sustainability/environmental research
	2	Policy for integrating ES into research
	3	Coordination body (for example, a committee) for integrating ES into research
	4	Plan for integrating ES into research
	5	Target for integrating ES into research
	6	Economic incentives for faculties/schools to integrate ES into research
	7	Professional development to assist staff to integrate ES into research

universities were more advanced. This finding suggests that, in the absence of direct governmental regulation, programs or funding, Australian universities have been driven by other factors to adopt environmental sustainability as a guiding principle, particularly in operational and research areas.

The marked variability in the extent of integration of environmental sustainability between operations, teaching and research suggests that transforming different areas of the university occurs at different rates and/or that different factors contribute to the success of the integration in each of these areas. The factors were found to differ between countries as well as between the operational, teaching and research areas of universities.

Drivers, barriers, key success factors: Australia and England

Table 3 summarises the three most frequently cited drivers, barriers and key success factors for integrating environmental sustainability into Australian and English universities.

Drivers

Previous studies have focused primarily on the barriers to integrating environmental sustainability into the curriculum or campus operations, rather than the drivers (Lang et al. 2006; Sharp 2002; Sterling and Scott 2008). This study found that in Australian universities, *policy/programs* and *leadership and support,* particularly of *senior management* and *individuals*, were the most cited drivers for integrating environmental sustainability. It was predominantly *policy/programs* at a *university* level, rather than at *state, national* or *international* level that were driving integration. *Pressure* applied by both *internal* and *external* stakeholders was the second highest driver, supporting previous studies (Lang

Table 3 The three most frequently cited factors for integrating environmental sustainability (ES) into Australian and English universities

Australian universities				English universities		
	Theme	Sub-theme	Citations		Theme	Sub-theme	Citations
Drivers	1. Policy/programs	University	4		1. Financial incentives	Financial savings	2
		State/County	1			Provision of funding	6
		National	1		2. Policy/programs	University	3
		International	1			National	3
	1. Leadership and support (equal 1st)	Individuals	2		3. Pressure Internal	Staff	2
		Senior management	4			Students	3
		University	1				
	3. Pressure -External	Community	2				
		Employers	1				
		Government	1				
		Potential students	1				
	3. Pressure -Internal (equal 3rd)	Staff	2				
		Students	3				
Barriers	1. Academic silos	Threat to academic freedom	2		1. Resource constraints	Insufficient funding	2
		Relevance to discipline	2			Insufficient people	2
		Working across disciplines	2			Insufficient time	2
		Separation of academic and operational areas	2		2. Academic silos	Threat to academic freedom	1
	1. Lack of knowledge and/or understanding of ES (equal 1st)	Lack of understanding	5			Relevance to discipline	2
		Lack of expertise	2			Working across disciplines	2
		Lack of understanding of significance	1		2. Lack of leadership and support (equal 2nd)	Senior management	2
		Curriculum	1			University	3
	3. Competing priorities	Resources	1				
		Time	2				
		Not high priority	1				

Table 3 continued

Australian universities				English universities		
	Theme	Sub-theme	Citations		Theme	Sub-theme	Citations
Key success factors	1. People	Committed individuals	3		1. People	Committed individuals	3
		Dedicated resources	1			International standing	1
		Desire to see work used effectively	1				
		International standing	2				
		Key people	1				
		Quality of staff	2				
	2. Policy/programs	Strategic direction	2		2. Policy/programs	Implementation strategy	1
		University	2			National	1
						Strategic direction	1
	3. Leadership and support	Senior management	2		2. Demonstrable achievements (equal 2nd)		3
		University	1				

Fig. 1 Environmental
sustainability activities in
operations, teaching and research
at Australian and English
universities. The number of
universities undertaking the
activity is shown on the radial
axis, with the activity number on
the periphery of the chart (see
Table 2)

■ Australian universities
□ English universities

Operations

Teaching

Research
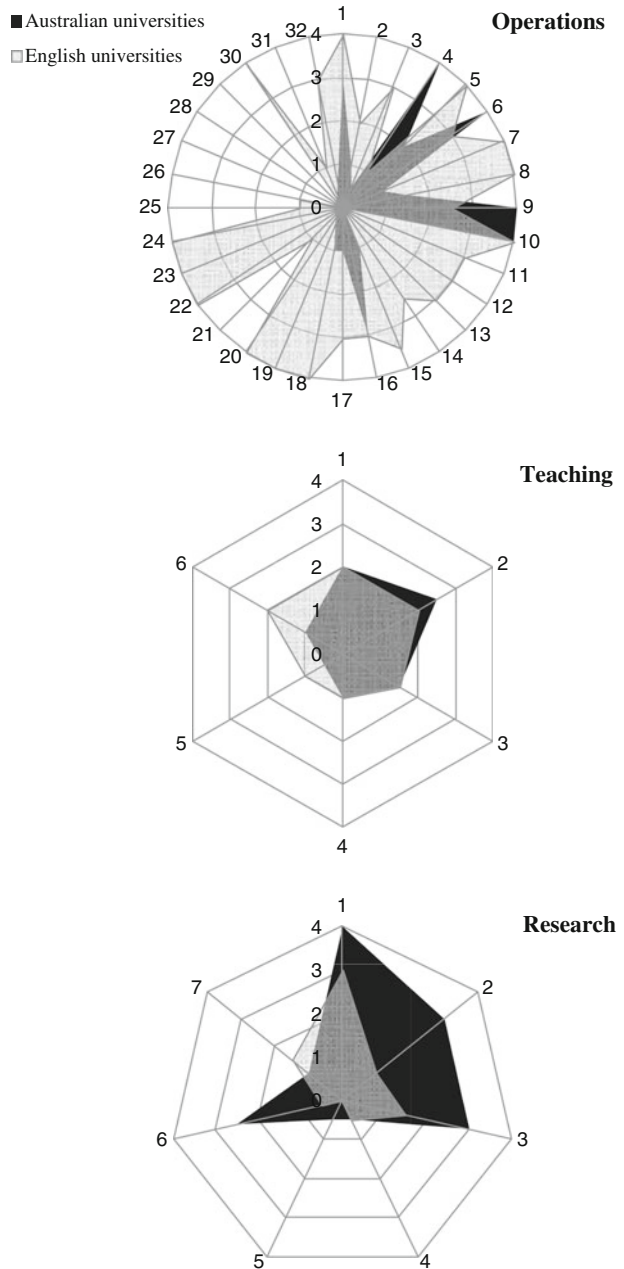
et al. 2006; Sharp 2002; Sterling and Scott 2008). Although *university* and *national policy/
programs* were also important drivers for English universities, the *financial incentives*
arising from national *funding* schemes [e.g. Higher Education Funding Council for Eng-
land (HEFCE)] to support environmental sustainability initiatives and the *financial savings*
arising from environmental efficiencies were found to be the most important drivers.
English universities were also subject to pressure from their staff and students.
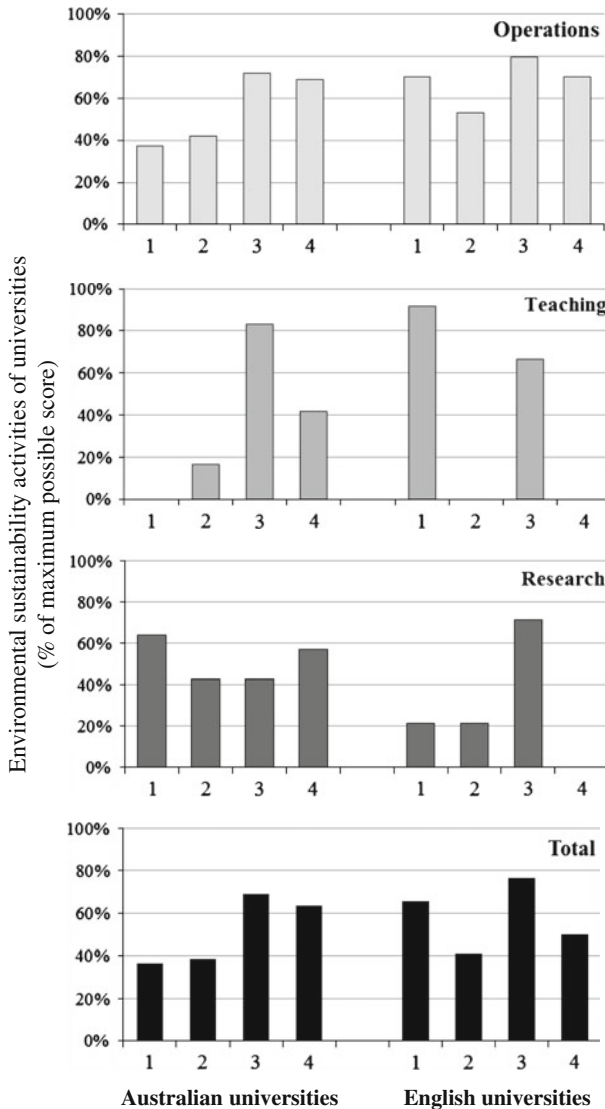
Fig. 2 Environmental sustainability activities at participating universities

Barriers

With increased specialisation in universities, academics no longer talk, share ideas or work together, particularly across different disciplines (Thomas 2004; Krizek et al. 2012). Teaching and research in the area of environmental sustainability is inherently problem-based, engaging a multidisciplinary approach that is quite alien to university structures, staff, funding and incentive mechanisms (Sherren 2006; Tilbury 2011; Krizek et al. 2012). The presence of academic silos can prevent the systems-level integration required to embed sustainability (Krizek et al. 2012). Reinforcing this perspective, the presence of

Table 4 The three most frequently cited factors for integrating environmental sustainability (ES) into the operational, teaching and research areas of universities

	Theme	Sub-theme	Citations
Drivers			
Operations	1. Financial incentives	Financial savings	5
		Provision of funding	1
	1. Pressure Internal	Staff	3
	(equal 1st)	Students	3
	3. Legislative compliance		4
Teaching	1. Policy/programs	University	3
		National	1
		International	1
	2. Leadership and support	Individuals	1
		Senior management	2
		University	1
	2. Moral/ethical obligation	Provide leadership to society	2
	(equal 2rd)	Educate future leaders	2
	2. Pressure Internal	Staff	1
	(equal 2rd)	Students	3
Research	1. Policy/programs	University	3
		State/County	1
		National	1
	2. Financial incentives	Provision of funding	3
	2. Inherent research capacity		3
	(equal 2rd)		
Barriers			
Operations	1. Lack of leadership and support	Senior management	3
		University	1
		Government	1
	1. Resource constraints (equal 1st)	Insufficient funding	1
		Insufficient people	3
		Insufficient time	1
	3. Academic silos	Threat to academic freedom	1
		Separation of academic and operational areas	2
	3. Lack of knowledge and/or understanding of ES	Lack of understanding	1
	(equal 3rd)	Lack of expertise	2
Teaching	1. Academic silos	Threat to academic freedom	1
		Relevance to discipline	3
		Working across disciplines	1
	2. Competing priorities	Curriculum	2
		Time	2
	2. Lack of knowledge and/or understanding of ES (equal 2nd)	Lack of understanding	2
		Lack of expertise	1
		Lack of understanding of significance	1

Table 4 continued

	Theme	Sub-theme	Citations
Research	1. Academic silos	Threat to academic freedom	1
		Relevance to discipline	1
		Working across disciplines	3
	2. Difficulties of interdisciplinary research	Funding	2
		Recognition	2
	3. Lack of knowledge and/or understanding of ES	Lack of understanding	2
	3. Resource constraints	Insufficient funding	1
	(equal 3rd)	Priority of funding	1
Key success factors			
Operations	1. People	Committed individuals	4
		Dedicated resources	1
	2. Demonstrable achievements		3
	2. Funding	Government	1
	(equal 2nd)	University	2
Teaching	1. People	Committed individuals	2
		International standing	1
		Key people	1
		Quality of staff	2
	2. Policy/programs	Implementation strategy	1
		University	2
	3. Demonstrable achievements		2
	3. Leadership and support (equal 3rd)	Senior management	2
Research	1. People	Desire to see work used effectively	1
		International standing	2
	1. Sustainability Centre/Institute (equal 1st)		3
	3. Policy/programs	Strategic direction	2

academic silos and *working across disciplines* were major barriers in Australian and English universities. Academic staff saw having to integrate environmental sustainability as a *threat to their academic freedom,* and as not *relevant to their discipline*, supporting previous studies (Noonan and Thomas 2004; Nicolaides 2006; Hopkinson et al. 2008; Justice et al. 2009).

Despite the presence of formal commitments and action to embed sustainability into education institutions in Australia, the *lack of knowledge or understanding of environmental sustainability* was also found to be a major barrier to integrating environmental sustainability. Further, a general *lack of understanding* of environmental sustainability issues, which often results in a perceived *lack of expertise*, is consistent with previous findings (Nicolaides 2006; Reid and Petocz 2006; Wright 2010). This may be explained by the lack of clear public policy and direction in the area of climate change in Australia (Daley et al. 2011).

Perversely, in England where there is directed funding and programs, the *resource constraints* of *insufficient funding*, *people* and *time* were the most commonly cited barriers.

English universities also talked about the *lack of leadership and support*, particularly at *senior management* and *university* level, despite the leadership being shown by HEFCE at the national level. In Australian universities, *competing priorities,* either within the *curriculum* or for the *resources* or *time* required, limited the integration of environmental sustainability (Dahle and Neumayer 2001; Wright 2010).

Key success factors

There was considerable consensus between Australian and English universities in the key success factors for integrating environmental sustainability into universities. The contribution of *people* and the presence of *policies and programs* were most frequently cited. In both countries, policies at a strategic, university level were important. *Committed individuals* at any level of the university, together with the involvement of academic staff of *international standing*, were important integrating factors. *Leadership and support* was also important in Australian universities, with *demonstrable achievements* important in English universities.

Drivers, barriers, key success factors: operations, teaching and research

Previous studies have not addressed how the drivers, barriers and key success factors differ between the operational, teaching and research activities in universities. The three most frequently cited drivers, barriers and key success factors for each area are summarised in Table 4.

Drivers

Although common drivers existed across operations, teaching and research at universities, each of these areas also had a unique set of drivers explained by the clear differences in their roles. Operational areas were found to be driven by the *financial incentives* to manage the resources of the university prudently, and by their role in maintaining *legislative* environmental *compliance* for the university (Sterling and Scott 2008). Where *students* and *staff* were able to see the results of environmental efforts, such as in the operational areas of waste management and energy efficiencies, they applied *pressure* for environmental improvements (Sharp 2002; Lang et al. 2006; Sterling and Scott 2008).

Changing the curriculum is a complex, resource-intensive task for teaching staff, requiring *university policies/programs* and *senior management leadership* to drive the integration of environmental sustainability. Integration into teaching was also driven by *student* interest in environmental matters and by *staff*, who saw a *moral/ethical obligation* to provide an appropriate education for future generations (Moore 2005).

Integrating environmental sustainability into research activities required a strategic *policy* direction from the *university*, together with *funding* support and an *inherent research capacity*.

Barriers

Except for the research-specific theme of the *difficulties of interdisciplinary research*, the interviewees from the teaching and research areas of the university identified similar

barriers. The presence of *academic silos* was the most significant barrier to integrating environmental sustainability for the interviewees from the teaching and research areas, but was also ranked third in operational areas. Teaching and research in environmental sustainability needs a holistic approach, rather than a narrow disciplinary approach, requiring staff to work across the boundaries of their academic disciplines to integrate a range of issues outside their normal subject areas (Tilbury 2011). Research staff further discussed the difficulty of *working across disciplines*, with teaching staff not seeing the *relevance to* (their) *discipline*.

The key barriers for operational areas were lack *of leadership and support* from *senior management* within the university and *resource constraints,* particularly *people. Insufficient funding* was not a barrier for operations, as operations can realise *financial savings* from environmental efficiencies. The difficulties of finding sufficient *resources*, particularly with *competing priorities*, together with the *lack of knowledge/understanding of environmental* sustainability, were barriers in all areas of universities.

Key success factors

People, in particular *committed individuals,* was a key success factor for operational and teaching areas. People provided *dedicated resources* and *quality* work above the requirements of their substantive role to further the aims of environmental sustainability. Interviewees described the contribution from staff as 'fabulous staff', 'local leadership' and, 'key people in the right place at the right time'. In research areas, critical success factors were found to be researchers of *international standing* in the field, committed to seeing their *research used effectively*, with their work supported by a *sustainability research centre* working under a *strategic university direction*.

While individual commitment is identified as a key success factor, commitment at a university level wasn't explicitly identified as a success factor by the interviewees. However, university commitment is an important driver as demonstrated by the high number of citations (see Table 3) for sustainability *policies and programs* and *senior management leadership and support*.

In operational areas *funding* is a key success factor, although not a driver to integrating environmental sustainability. To enable teaching areas to embed sustainability across a range of disciplines, *university policy/programs* and *leadership and support* of *senior management* were key success factors, which is consistent with the key drivers. *Demonstrable achievements* in operations and teaching were also important.

Conclusion

Although universities have recognised the importance of their role in leading societal change for a more sustainable world for more than twenty years, they have not achieved whole-of-institution change themselves. Drawing on case studies of universities in England and Australia, this study identified the drivers, barriers and key success factors that facilitate, and inhibit, the organisational changes required to integrate environmental sustainability into operations, teaching and research.

Whilst there were many similar factors influencing the integration of environmental sustainability into universities, this study highlighted factors that differed between the English and Australian universities. Although national funding and policies, where they exist, were important drivers, university policies, leadership and engagement of the

university community could replace these. The study also suggests that overcoming the barriers will need clear leadership in a number of areas: prioritising interdisciplinary collaboration; providing resources to undertake the work required; and providing the university community with the necessary information, skills and knowledge. The importance of engaging, informing and resourcing university staff of the university is critical to the success of integrating environmental sustainability into all areas.

Previous studies have identified drivers and/or barriers to a single aspect of integrating sustainability at universities. In contrast, this study compared the relative importance of these factors across the three major university activities of operations, teaching and research, finding that the factors varied according to the nature of the tasks required for the particular activity. Operational areas were driven by the practical fiscal and legislative requirements of the university, requiring senior management support to provide the resources to implement programs. University leadership via an over-arching university strategic direction or policy that prioritised integrating environmental sustainability was a significant driver for the multi-disciplinary collaboration and resourcing required in teaching and research activities. The commitment and expertise of individuals of international standing, often working together in a dedicated institute, was also of key importance in integrating environmental sustainability into teaching and research. These differing priorities may help explain the inability of universities to drive comprehensive institutional change.

The findings draw attention to the need for universities to implement a multi-faceted approach to integrating environmental sustainability, supported by their respective governments. Extrapolating these findings, a multi-faceted approach would include:

- Development of national policies and/or programs by governments to enhance and support the strategic directions of universities to integrate environmental sustainability;
- Targeting funding to provide the resources necessary to embed sustainability into university curricula and to develop interdisciplinary research programs;
- Engaging with both leaders and environmental sustainability advocates within the university sector to support universities in providing leadership and support to their communities (Ferrer-Balas et al. 2008; Justice et al. 2009; Lozano 2006); and
- Providing information, training and skills to leaders, environmental sustainability advocates and staff to improve their understanding of current environmental sustainability principles, direction and policy.

The university that displayed the highest degree of integration of environmental sustainability (English university 3; Fig. 1) confirms that the existence of multiple factors has been important to this success. A coordinated approach to integrating environmental sustainability into all university activities has been part of this university's tradition and vision since inception. Sustainability research is coordinated through a sustainability institute and is strongly related to the local environment. The university has had strong strategic policy direction articulated at the highest level and has received significant government investment to advance education for sustainable development nationally. Internationally recognised teaching and research staff committed to advancing the sustainability of the world have provided inspiration at all levels of the organisation. Together, these initiatives can help transform universities into leaders that demonstrate environmental best practice across all aspects of their activities, "… because its about changing the way we do things in the world, changing where we are in the world and changing with the way we see the world" (English university 3 interviewee).

The authors acknowledge that there are limitations to this research study. Organisational factors such as size, location and orientation (generalist or specialist) of the universities could influence the level of integration of environmental sustainability into universities. The influence of these attributes was not considered in this study as universities were chosen that were of similar size and orientation. Future research studies could explore how size, location and orientation influence the key success factors identified in this study.

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