Cloud Computing and Sustainability: An Australian Public Sector Perspective.

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Abstract: Businesses are compelled to shift their organizations' strategies to focus on sustainable growth. The recent summits in Copenhagen and Cancun have alerted businesses of their corporate social and environmental responsibilities. This require a shift in mindset that it is no longer the economic and financial stability that will drive an organization's success but the longevity and sustainability of any organizations are also heavily dependent on their social and environmental outlook. An organization may no longer be sustainable if their social and environmental approach is de-coupled from the organization's strategies. A way forward might be through the application of ethical management integrated with a full understanding of the agile and innovative technological solutions. This paper provides findings from a survey of the Australian public sector organizations of the awareness of cloud computing technology and the attitudes toward this innovative business solution. Two hundred and forty responses were received from the public sector organizations in Australia. The findings reveal that cloud computing technology is an important trend, and it can be concluded that it is extremely important for business leaders in their entirety, not just the IT managers, to understand the great potential that cloud computing technology has to offer.

Keywords: Organizational Sustainability; Corporate Social and Environmental Responsibilities; Carbon Footprint, Cloud Computing Technology.

1 Introduction

Businesses today are faced with the challenge of balancing demands of globalization and its growth with sustainable development. It does not seem that there is a choice for these businesses, as they are faced with additional pressure from government, media, and environmental groups to safeguard our environment, sustain our society and support our economy. Globalization, technological innovation, regulatory restructuring, demographic

shifts, and environmental pressures have all conspired to continually redraw the competitive landscape. Businesses are compelled to shift their strategies to focus and to become more concerned with their environmental responsibilities. Initial initiatives have taken place coupled with on-going discussions. The 2009 summit in Copenhagen is one example that aimed to engage the world attempting to establish a more serious consideration of climate change. Another example, which is somehow more successful than Copenhagen, late 2010 a deal was reached in the Cancun climate change summit, which seems to have succeeded in provoking countries, governments, businesses, communities, and individuals to participate in taking into account more social responsibilities towards the environment, especially with its set of recommendations. In this agreement, that took four years to negotiate, deforestation prevention, and promotion of the transfer of low-carbon technologies to developing countries were high on the agenda.

Given this and other recent publicity of Greenhouse Effect Climate Change, businesses are in desperate need to be acutely aware of their corporate social and environmental responsibilities. A way forward might be through the application of ethical management coupled with a full understanding of the triple bottom line and looking at technological concerns in businesses. This paper provides an evaluation of the Australian preparedness to move towards a more sustainable way of doing business in the use and application of information communications and technology (ICT), in particular, the use of cloud computing technology in the workplace.

2   Sustainability, Corporate Social and Environmental Responsibilities, Cloud Computing

This is a very well known fact, in 1983, the Sustainability concept was founded and addressed by Gro Harlem Brundtland, from the World Commission on Environment and Development meetings. As it is evident in any literature on sustainability, in 1987, the Brundtland's report was released to alert the global world to the urgency of marking progress towards economic development, since people have become required to use our world in a way that will not detract from the future. Scott et al. (2010, p.2) defines sustainability as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. While Weybrecht (2010, p.14) indicates that sustainability define as 'adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting sustaining and enhancing the human and natural resources that will be needed in the future'. Therefore, businesses and higher education, should consider sustainability innovation in their strategies and curriculum to protect the environment not only for the current generation but also for the seventh generation as we are always reminded by Newton (2003). Rainey (2006) posits that applying sustainability in business strategies enhances business performance thus contributing to cost reduction and efficiency improvement, which enhances reputation, recruiting and retaining excellent people, gaining better access to investors' capital reducing liabilities. Recently, Dao, Langella and Carbo (2011, p.64) indicate that sustainability has become an important concept to businesses around the world over the past decades as a 'result of rapid depletion of natural resources and concerns over wealth disparity and corporate social responsibility'.

Sustainability and 'Green IT' are concepts that are gaining momentum in businesses locally and globally. This might not have been a voluntary act on behalf of these businesses, but rather the majority of them have been under growing pressure to implement and address these concepts in their companies either by their stakeholders or through legislations. According to Newton (2003) incorporating sustainable strategy with emerging technologies has become the norm in contemporary businesses, an idea that has its support from Erek et al. (2009, p.2) who contend that 'sustainability has been extensively discussed within corporate management under the synonyms of corporate social responsibility (CSR), greening the business eco-efficiency or eco-advantage'.

Some scholars argue that although corporate social responsibility is increasingly on most major corporations' agendas, corporate executives are still largely supportive of the view that corporations should maximize the financial return to their owners and shareholders. Other scholars assert that commitment to corporate social responsibility is a source of power, as well as an ethical practice for corporate endeavours, concluding that the re-establishment of strong relationships with employees that could be developed by revisiting businesses' corporate social responsibility. This simply suggests that businesses have a role to play in managing employees' ethical perceptions and work attitudes. Orlitzky, Siegel and Waldman (2011, p.8) define CSR as 'actions that appear to further some social good, beyond the interests of the firm and that which is required by law'. Hopkins (2011) and Stewart (2011) both argue that CSR has emerged as an effective way for businesses to create favourable attitudes among employees and consumers. There are new demands upon businesses to advance their aspirations within a context of demonstrable, even measurable adherence to public interest values. Indeed, 'A greater consciousness for new ways of comprehending and acting on both individual and collective notions of responsibility has corporations sustaining shareholder value by focusing on delivering stakeholder value. This new responsibility paradigm goes beyond the buzz in social responsibility theory of the triple-bottom line (people-planet-profit) to encompass a macro-transformation' (Stewart 2011, p.59).

Murugesan and Laplante (2011, p.16) indicate that Information Technology and Systems have a new role to play helping to 'create a greener, more sustainable environment while offering economic benefits'. In addition, the green IT agenda represents a major shift in priorities for the 'IT industry, IT professional, educators, researchers, and users must be prepared to adjust their 'level of thinking to realize IT's Potential' (Murugesan & Laplante 2011, p.18). By the same token Prasad et al. (2010, p.106) posit that Information Technology and Information Systems should start from the very beginning, i.e., from the minute decision is taken to produce a product to the design to the choice of material, to the usage and decommissioning of that same product. 'The reduction of Green House Gas in existing systems can be done by reducing CPU speed, putting to sleep or shutting-down of systems when load on these systems is low. New systems or evolution of existing systems with 'green' in mind will be far more effective'.

One of the methods that are gaining momentum in ICT is 'cloud computing'. The concept of cloud computing first emerged in 2009. Cloud computing is defined as a 'model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction' (Basciani 2011, p.9). Cloud computing is the idea that instead of your organisation running its own applications, organisations can rent access to

applications from a provider via the Internet. Most businesses have traditionally host their own applications and data but the use of the 'cloud' enables businesses to access applications and store data on servers, which are housed at locations other than the businesses' premises. Cubitt, Hassan & Volkmer (2011, p.149) posit that cloud computing usage in businesses will prevent end users to use complex and expensive computer with ecologically damaging 'hard drivers and CD-DVD players, or memory- and power-hungry local software. In place of full-blown computers, for all but highly professional or necessarily secure uses, a 'thin client' will be sufficient'.

Zissis & Lekkas (2011) indicate that cloud computing is empowered by virtualization technology, which allows to create one or more virtual machines in one machine and can run any software, from operating systems to end-user applications. Furthermore, cloud computing is often segmented into three areas: '1) Software as a service (SaaS): Applications services delivered over the network. 2) Platform as a service (PaaS): A software development framework and components all delivered on the network. Offered as on-demand, pay for usage model. 3) Infrastructure as a service (IaaS): An integrated environment of computing resources, storage, and network fabric delivered over the network. Offered as an on-demand, pay for usage model' (Zhang & Chen 2010, p.680). There are five characteristics of cloud computing: 1) on-demand self-service, 2) rapid elasticity, 3) measured service, 4) broad network access and 5) resource pooling. Cloud computing services are ideal, since activating or shutting down hardware happens without human administration and in a quick manner, to provide this capability, 'the cloud must be able to track and control its resources. This metering also can be visible for the consumer, which then can be charged for its individual use of a cloud' (Basciani 2011, p.10)

Cloud computing has ''green' credentials as long as the location of the storage and hardware premise uses renewable sources of energy' (Bateman & Wood 2009, p.1475). Provided that the premise is eco-friendly, users using the cloud computing technology can reduce hardware usage, as this technology "indirectly helps to reduce the environment destruction" (Bajgoric 2010, p.227; Berl et al. 2010). Vykoukal, Wolf & Beck (2009) argued that the cloud technology plays an important role for organization in reducing the accumulation of greenhouse gases by reducing the CO_2 emissions. This is vital considering the various negative impacts from rising costs of waste disposal, corporate image and public perception (Vykoukal, Wolf & Beck 2009). In addition, there are further concerns in relation to security and physical location of data. There are also issues pertaining to unavailability of service due to crashes or bugs in the providers' storage and privacy and control issues of data residing at third party's network. It is also clear that educating the communities and businesses require time and effort; and the shift will not happen overnight (Preston 2008). Although the up-take is slow, there are those businesses who are leading the way in using cloud computing services and technologies.

Besides considering the previously mentioned ICT strategic issues, businesses today will now need to decide which applications to host in the cloud and which should remain in their data centers. Apart from a financially sound strategy and cost savings issue of implementing a cloud computing system, entrepreneurs, Chief Executive Officers (CEO) and Chief Information Officers (CIO) have to ensure proper management of information technology resources within the organization.

3 Research Methodology

This research employs a mainly quantitative technique using paper-survey composed of two sections. The first section contains demographic survey of the respondents. This section concludes with an open question for respondents to provide their opinion concerning the issue of 'cloud computing'. The second section contains fourteen statements seeking respondents' opinion using a seven-point Likert scale, from 'Strongly Agree' to 'Strongly Disagree' with an additional 'Do Not Know' option. The 'Do Not Know' option was deemed necessary given the new concept of cloud computing. These statements aimed at investigating and examining the attitudes of Australian organizations and their personnel towards the new development in the ICT industry.

The population of interest was managers in the Information Technology organizations in Australia. This purpose of this survey is to determine attitudes in Australian organizations towards this relatively new development in the ICT industry. Westerman and Yanchar (2011, p.146) define quantitative research as a research that 'employs measurement procedures and other techniques (e.g., methods of statistical inference) to study truly quantitative attributes'. Westerman (2011, p.157) echoes that quantitative methods have something special to offer not 'because they can help us find mathematical principles that lie behind meaningful activity, but because methods concerning quantity are a useful part of our practical engagement with things, including our attempts to understand psychological phenomena'.

With the innovation of ICT and cloud computing, organizations are faced with having to re-focus and re-strategize on their ICT business plan and vision. In addition to pressures from governments and with many businesses' stance on corporate social and environmental responsibilities, organizations are shifting the attention towards sustainable growth. CEOs and CIOs are also seeking to embrace energy-sustainable operations. Organizations are increasingly looking at operating smarter and wiser businesses by investigating technologies such as cloud computing to find ways to reduce costs, increase efficiencies and productivity. The findings from this research will benefit and inform those in strategic and management position within the organizations.

4 Research Findings and Analysis

This research was conducted in Australia and 5828 surveys were disseminated to the public and private sector organizations in Australia. The questionnaire was addressed to the CIO, IT Manager or similar role or title. The survey is voluntary and anonymous. The survey takes about 10 minutes to complete. A total of 1100 responses were received and this equates to a response rate of about 18.9%. Table 1 provides a summary detail of the respondents' information. One hundred seventy three responses have not heard of cloud computing and hence the respondents were not required to complete the questionnaire. This accounted to about 15.7% of the total respondents. Of the 1100 responses received, 240 were public sector organizations, 674 were from the private sector, and 13 respondents did not indicate whether they were from the public or private sectors. There were 819 male and 96 female respondents, and 12 respondents did not indicate their gender. The remainder of the paper will contain a report on the analysis and findings from the Australian public sector organizations.

Number and Percentage of Questionnaires	
Questionnaire Distributed	5828
Questionnaire Returned	1100
Response Rate	18.9%
Have not heard of Cloud Computing:	173
Have heard of Cloud Computing:	927
Gender	
Male Respondent	819
Female Respondent	96
Did not indicate gender	12
Sector Type	
Public Sector Organization	240
Private Sector Organization	674
Neither / Left as Blank	13

Table 1 Summary detail of survey

Public Sector Organizations Responses

Table 2 shows the number of employees within the public sector organizations. There were 203 male respondents, 36 female respondents and 1 did not provide his/her gender. The number of employees range from 10 to over 25000. No correlation of the number of employees and the utilization of cloud computing can be drawn from the figures provided. Education with 90 responses, government administration with 70 responses, and health and community service with 21 responses are the top three industry within the public sector organizations that are utilizing cloud computing.

Number of Employees in Public Sector Organization	
50 and less	54
51 to 100	41
101 to 500	86
501 to 1000	20
1001 to 2000	17
2001 to 10000	12
10000 to 25000	3
More than 25000	6
Did not indicate	1
Total	240

Table 2 Number of employees in public sector organizations

Of the 240 respondents from the public sector organizations, 157 respondents indicated that their organizations have not adopted cloud computing, 78 respondents indicated that

their organizations are utilizing services on the cloud, while 5 respondents are unsure of whether their organizations will use cloud computing technology.

Public Sector Organization (240 responses)		
Not utilizing cloud computing	**157**	**65.4%**
Utilizing cloud computing	78	32.5%
Don't know	5	2.1%

Table 3 Utilization of cloud computing

Of the respondents who had indicated that their organizations are utilising cloud computing technology include the use of the following cloud services: email and archiving system; educational applications such as e-portfolio, mathletics software, plagiarism software, learning management system; travel portal; finance system, real estate application; HR system, property and asset management system; disaster recovery services; customer relationship management; accounting system, and infringement system. Some have indicated that their organizations have implemented small non-core application on the cloud.

Based on some of the types of application systems on the cloud that these organizations are utilizing, management must evaluate the benefits of deploying some of the organizations' ICT operations on the cloud.

Some of the respondents who had indicated that they are not presently utilizing cloud computing technology had also mentioned that their organizations are looking at deploying the use of the cloud into their organization. Some had indicated that their organisations are waiting for stability in the security plan on the cloud and some had indicated that the Internet access and bandwidth are not adequate for the organization to move to the cloud. The above findings highlight the need for organizations and management to have a proper business plan when deciding to utilize the services and applications on the cloud. In particular, security, risks, privacy, intellectual property, bandwidth reliability, and service management are some of the issues and challenges that management must consider.

Innovative Utilization of Cloud Computing

As the respondents were asked to select from 7 Likert scales, it was decided during the analysis of the findings that the scales will be grouped into 5 scales. The following Figure 1 shows the suggested grouping of the 5 scales where the two outer-most items are denoted as Strongly Agree and Strongly Disagree.
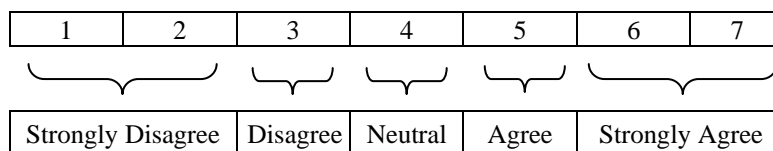
1	2	3	4	5	6	7

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Figure 1 Grouping of the Likert scales.

The analysis for the findings from the survey will follow the grouping of the Likert scales as indicated in Figure 1. When asked if cloud computing helps organizations to become 'greener', the following responses as shown in Table 4 were recorded.

Public Sector Organization (240 responses)			
Cloud computing helps organizations become 'greener'.			
Strongly agree	46	105	43.7%
Agree	59		
Neutral	41		17.1%
Disagree	25	47	19.6%
Strongly disagree	22		
Did not indicate	15	47	19.6%
Don't know	32		

Table 4 Cloud computing helps organizations become 'greener'.

One hundred and five out of 240 or about 43.7% respondents agree and strongly agree that utilizing cloud computing will have a positive impact on the environment. On the other hand, about 19.5% indicated that cloud computing will not help the organization to become 'greener'. Exactly the same number of respondents (47) did not indicate or indicated that they are unsure (ie. 'don't know') whether cloud computing will have a positive impact. In addition, 41 respondents recorded a 'neutral' response. This finding indicates a positive response that utilizing cloud services helps the organization becomes 'greener'.

When asked if cloud computing reduces organisations' carbon footprint, the following responses as shown in Table 5 were recorded. Ninety nine out of 240 or about 41.2% respondents agree and strongly agree that utilizing cloud computing reduces carbon footprint. On the other hand, about 15% indicated that cloud computing will not reduce carbon footprint. Sixty four respondents or about 26.7% did not indicate or indicated that they are unsure (i.e. 'don't know') whether cloud computing will reduce carbon footprint. Forty one respondents recorded a 'neutral' response and this neutral figure is the same as the previous question. When compared to the previous question on 'organizations become greener', the respondents were less clear if accessing and utilizing services on the cloud will reduce the organizations' carbon footprint. There is also an increased of those respondents who were unsure (i.e. 'don't know') of the 'reduction in carbon footprint' when compared to the previous question on 'organizations becoming greener'.

Public Sector Organization (240 responses)			
Cloud computing reduces organizations' carbon footprint.			
Strongly agree	42	99	41.2%
Agree	57		
Neutral	41		17.1%
Disagree	20	36	15.0%
Strongly disagree	16		
Did not indicate	16	64	26.7%
Don't know	48		

Table 5 Cloud computing reduces organizations' carbon footprint.

When asked if cloud computing contributes to organizations' sustainable strategy, the following responses as shown in Table 6 were recorded. Eighty two out of 240 or about 34.2% respondents agree and strongly agree that utilizing cloud computing contributes to organizations' sustainable strategy. About 13.8% indicated that cloud computing does not contribute to organizations' sustainable strategy. Seventy one respondents or about 29.5% did not indicate or indicated that they are unsure (ie. 'don't know') whether cloud computing will contribute to organizations' sustainable strategy. Fifty four respondents recorded a 'neutral' response. When compared to the previous two questions on 'organizations become greener' and 'organizations reduction in carbon footprint', the respondents for this question were less clear if cloud computing services will contribute to organizations' sustainable strategy. There is also an increased of those respondents who were unsure (ie 'don't know') of the contribution to organizations' sustainable strategy when compared to the previous questions on 'organizations becoming greener' and 'organizations reduction in carbon footprint'.

Public Sector Organization (240 responses)			
Cloud computing contributes to organizations' sustainable strategy.			
Strongly agree	29	82	34.2%
Agree	53		
Neutral	54		22.5%
Disagree	19	33	13.8%
Strongly disagree	14		
Did not indicate	17	71	29.5%
Don't know	54		

Table 6 Cloud computing contributes to organizations' sustainable strategy.

Security and Risk Issues of Cloud Computing

When asked if cloud computing introduces security problems, the following responses as shown in Table 7 were recorded. One hundred and thirty nine out of 240 or about 57.9% respondents agree and strongly agree that cloud computing contributes introduces data and information security problems. About 13.8% indicated that cloud computing will not create security issues. Forty two respondents or about 17.5% did not indicate or indicated that they are unsure (ie. 'don't know') whether cloud computing will create security problems. Twenty six respondents recorded a 'neutral' response. The issue on data and information security is a challenge for all organizations. Given that cloud computing technology is a relatively new innovative solution to businesses, it will take a bit of time for stability and security concerns to be alleviated.

Public Sector Organization (240 responses)			
Cloud computing introduces security problems.			
Strongly agree	82	139	57.9%
Agree	57		
Neutral	26		10.8%
Disagree	17	33	13.8%
Strongly disagree	16		
Did not indicate	16	42	17.5%
Don't know	26		

Table 7 Cloud computing introduces security problems.

When asked if cloud computing is more risky than traditional computing, the following responses as shown in Table 8 were recorded.

Public Sector Organization (240 responses)			
Cloud computing is more risky than traditional computing.			
Strongly agree	61	115	47.9%
Agree	54		
Neutral	43		17.9%
Disagree	24	41	17.1%
Strongly disagree	17		
Did not indicate	15	41	17.1%
Don't know	26		

Table 8 Cloud computing is more risky than traditional computing.

One hundred and fifteen out of 240 or about 47.9% respondents agree and strongly agree that cloud computing is more risky than traditional computing. About 17.1% indicated that cloud computing is not riskier than traditional computing. The same number of respondents (41) or about 17.9% did not indicate or indicated that they are unsure (ie.

'don't know') if cloud computing is more risky than traditional computing. Forty three respondents recorded a 'neutral' response. Similar to the issue on data and information security, risk is another challenge for all organizations.

Cloud Computing and Capital Expenditure

When asked if cloud computing reduces capital costs, the following responses as shown in Table 9 were recorded. One hundred and forty one out of 240 or about 58.8% respondents agree and strongly agree that cloud computing contributes reduces capital costs. About 12.9% (or 31 responses) indicated that cloud computing will not reduce capital costs. Forty four respondents or about 18.3% did not indicate or indicated that they are unsure (ie. 'don't know') whether cloud computing will reduce capital costs. Twenty four respondents recorded a 'neutral' response. Cost savings is an advantage that organizations may consider using the cloud as a service.

Public Sector Organization (240 responses)		
Cloud computing reduces capital costs.		
Strongly agree	83	141	58.8%
Agree	58		
Neutral	24		10.0%
Disagree	17	31	12.9%
Strongly disagree	14		
Did not indicate	16	44	18.3%
Don't know	28		

Table 9 Cloud computing reduces capital costs.

Summary of Analysis and Findings

The findings are important that there are great potential surrounding the use of cloud technology and services. If proper care and management are applied, this innovative solution may eventually provide business values to organizations. In today's modern day environment, organizations are compelled to exercise its social morale in ensuring that their organizations are economically and environmentally sustainable.

On-going issues and challenges such as security and risk as reported in the findings will require organizational training and education awareness of the agile and innovative use of cloud computing. Reduced costs are a compelling proposition for organizations and the cloud is also able to provide on-demand resources and organizations will be able to keep pace with the rapidly changing needs of the organizations.

The findings also reveal that the cloud technology is a relatively new strategic option for organizational sustainable growth. There are key capabilities and potential of this agile, innovative and disruptive solution. While due diligence is required to manage change, in the longer term, organizations will be more sustainable when climate change, economic,

financial, social, and environmental factors are considered in the strategic direction. There are also operational issues such as risk control and security guards and guidelines that need to be considered. Relevant IT and data governance and regulations must be taken into account. It is essential that careful consideration of these issues must be discussed with all stakeholders involved – business owners, employees, users, and service providers.

5 Conclusions

As today's businesses are faced with the demands of globalization and sustainable development, organizations are turning to put into effect their corporate social and environmental responsibilities. Governments from various countries are strategizing for ways to implement reduction in carbon footprint by asking its business leaders, the community and society at large to safeguard the environment, support the economy and at the same time sustain the world. Technological innovation is one way to help shift the business owner, employees, and users' mind-set.

Given the recent Copenhagen and Cancun summits, businesses are acutely aware of their corporate social and environmental responsibilities. Management may wish to apply ethical management by looking at technological innovation in businesses. This paper has provided an evaluation of the Australian public sector organizations preparedness to move towards a more sustainable way of dealing with business with the utilization and application cloud computing technology in the workplace.

From the findings, it can be concluded that cloud computing is an important trend. If managed properly, cloud technology will have a considerable effect on how business is conducted over the next decade and beyond. It is for this reason alone that it is extremely important for business leaders, not just the IT managers understand the great potential that cloud computing technology has to offer. The business opportunities and values of this agile and innovative solution will not only satisfy the organizations financial and economic situation but it will also tackle the social and environmental factors. Organizations must now contemplate a cloud approach in the business' sustainable and growth strategies.

This study practically contributes to the understanding of the Australian Public Sector and the level of their developing thoughts in respect to sustainability and Cloud Computing. Indeed, this is not only applicable to the public sector, but rather the higher education worldwide must play a major role through the development and delivery of special units that deal with the issues of sustainability and cloud computing. Surely co-operation amongst academics and practitioners is the key for a better generation of leaders who are keen to develop and implement sustainable strategies including the introduction of cloud computing. Despite its limitation, being conducted in one country 'Australia', this study has provided insights of the way of thinking of those in the Australian Public Sector, which can be replicated in the future to study other sectors, in other contexts and other countries, however, prior to doing so, another examination of the methodology to move beyond the sole technique might be advisable, while another avenue might to be go to multi-method approach (Crump and Logan, 2008, Duque and Weeks, 2010).

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