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Understanding printing behaviours and paper consumption at the University of Wollongong

Alison Louise Scobie
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UNIVERSITY OF
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Understanding printing behaviours and paper consumption at the University of
Wollongong

This thesis is presented as part of the requirements for the
award of the Degree of Master of Environmental Science
from the University of Wollongong

by

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August 2015

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CANDIDATE'S STATEMENT

I, Alison Scobie, declare that this thesis, submitted in fulfilment of the requirements for the award of Master of Environmental Science, in the Department of Geography and Sustainable Communities, Faculty of Social Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Alison Scobie

30th August 2015

ABSTRACT

Universities and other organisations have a role to play in reducing the environmental impacts of their operations. Government, through policy, are encouraging organisations to reduce these impacts by minimising consumption, purchasing products with reduced environmental impacts and through improvements to technology. Understanding how much paper is consumed, how it is consumed and the reasons for paper consumption are important for understanding ways to reduce the environmental impacts of the organisation's operations in relation to paper use.

This study examines the office paper purchased, used and disposed and the reasons for office paper consumption at the University of Wollongong (UOW). This study has been undertaken in order to inform initiatives to reduce office paper use at UOW and provide insights for other organisations wishing to undertake similar initiatives.

This study obtained and reviewed data on the amount of paper purchased and used as well as the amount of paper disposed during 2010 and 2011. To investigate and obtain an understanding of the reasons and context for paper use at UOW interviews were conducted with staff who purchase paper for their work areas. The reasons for paper use identified in the literature can be explained by the affordances of paper or the technological alternatives, the relationship between technology and society, individual behaviours and social practices, and this study draws on all these perspectives.

This study found that UOW's reporting mechanisms currently do not allow for a full understanding of the amount of paper purchased, used and disposed by UOW as many data limitations were identified. This lack of awareness and knowledge of paper use and habitual practices that might contribute to paper consumption highlights the "invisibility" of paper consumption at UOW.

The literature identified that paper reduction initiatives are based on the behaviour theory perspective. This behaviour theory perspective individualises responsibility. The interactions between processes, social factors, technologies and broader contexts

that result in everyday activities having more or less sustainable outcomes is also not fully acknowledged with a behaviour theory perspective. An alternative approach to paper reduction interventions is considered necessary.

Reasons for paper use identified in this study were due to processes that required paper to be used or were due to a lack of trust in some processes. Other reasons found relate to the affordances of paper that make it highly suited to particular tasks. The use of technological alternatives for those tasks may not actually reduce paper use but instead shift who is printing and where it is occurring in the process.

Rather than develop initiatives to change individual behaviours, instead UOW should seek to:

- Reduce impacts of the use of paper and Information Communication Technology (ICT) products by setting and monitoring minimum environmental performance targets;
- Involve staff in the review of the work processes that require paper to be consumed. Caution should be applied to tasks that are considered to be more suitable for paper as any change to the process may actually just shift where in the process the paper is used; and
- Improve awareness of tasks that are best suited for use with ICT options and increase access to these technological options for those tasks that are also likely to reduce paper use.

These initiatives account for the interactions between processes, social factors, technologies and the broader contexts and are focused on gaining traction towards achieving more sustainable outcomes.

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1 INTRODUCTION

Paper is embedded in many activities in our day to day lives, its convenience and ease of use, means that it is often used without much thought or consideration. Within organisations such as the University of Wollongong (UOW) paper is an intrinsic part of work activities and continues to be used despite the availability of electronic alternatives. There are a number of environmental impacts associated with the manufacture, use and disposal of paper products and their electronic alternatives. Government agencies are encouraging organisations through policy, to reduce these environmental impacts by minimising consumption, purchasing products that have reduced environmental impacts and via improvements to technology.

Universities have a role to play in developing and implementing environmentally sustainable work practices and to incorporate sustainability within their teaching and research. At UOW, paper purchase and use is not part of the reporting process and therefore little is known about the type and amount of office paper used within the organisation. Knowledge of the amount and type of paper consumed and the reasons and context of this consumption within an organisation are important steps towards understanding ways to reduce the environmental impacts of the organisation's operations in relation to paper use.

The overall aim of this study is to understand how office paper is being used by staff at UOW within their work activities. The specific objectives are to;

- Identify the office paper purchased, used and disposed by staff at UOW during 2010 and 2011 calendar years;
- Identify the reasons and context of office paper consumption by staff at UOW; and
- Inform the development of initiatives aimed at reducing the amount of office paper consumed by staff at UOW, and provide insights for other organisations wanting to develop similar initiatives.

These aims and objectives are to be achieved through review and analysis of paper purchase, print usage and waste disposal data and via face to face interviews with

the staff who purchase paper for their work areas. The staff who purchase paper for their areas can provide insights on the paper consumed in their areas and clarify reasons for paper use.

This chapter outlines the importance and role of universities in implementing sustainability and the organisational context of UOW, the focus of this study. A number of issues are then reviewed in order to better understand the impacts associated with paper consumption and the reasons for continued paper use. Why is paper consumption an issue and do the electronic alternatives offer a more sustainable option? How can organisations minimise the impacts of the use of paper and the electronic alternatives? In this chapter these questions are explored and Australia's paper consumption trends and the use of Information Communication Technology (ICT) are reviewed. The environmental impacts of paper manufacture, use and disposal, as well as the environmental impacts of ICT manufacture, use and disposal are examined. The environmental accounting tools that have been used to assist in understanding the impacts of paper, compare different paper products or compare against the electronic alternatives are then outlined. Relevant policy guidelines are examined in order to inform decisions aimed at reducing the environmental impact associated with the procurement decisions and use of paper and ICT.

This chapter then explores a number of reasons that have been, or could be used to explain paper use. Areas in the literature that have been used to explain paper use include the concept of affordances, the relationship between technology and society and the influence of individual behaviours. Social practice theories also offer explanation. These four areas frame the issue of paper use from different perspectives, provide insights on the reasons for paper use and provide options for intervention methods to reduce paper use.

1.1 Sustainability in universities

Sustainability is defined and interpreted in many different ways but generally it involves working to achieve sustainable development. The United Nations (1987 p41) defines sustainable development as *“development that meets the needs of the present without compromising the ability of future generations to meet their own*

needs”. Australia’s National Strategy of Ecologically Sustainable Development 1992 provides an overarching strategy for implementing sustainability within Australia and defines Ecological Sustainable Development (ESD) as “using, conserving and enhancing the community’s resources so that ecological processes, on which life depends are maintained and the total quality of life now and in the future can be increased” (Australian Government, Department of Environment, 1992, para 1). The need to manage the environmental, social and economic aspects and impacts of activities and the responsible consumption of natural resources are highlighted by these definitions.

University activities and operations, like those of other large organisations, can potentially generate significant environmental, social and economic impacts. Universities due to their size, staff and student population, nature of the activities and operations conducted, and their longevity are somewhat unique to other organisations. Universities are educational and research institutions and in this capacity, universities have a role to play in addressing the global environmental challenges and supporting the transition of our communities towards sustainability (Mio 2013). These roles include educating their students on sustainability concepts, undertaking research in areas of sustainability and communicating and implementing these findings within the community (Mio 2013). As highlighted by Association of University Leaders for a Sustainable Future ULSF (2008a) implementing sustainability within a University not only involves improving the sustainability of operations but also emphasising sustainability concepts in teaching and research and supporting sustainable development within their local and regional community.

A number of universities have united to sign declarations such as the Talloires declaration 2008 (Association of University Leaders for a Sustainable Future ULSF 2008b), the Halifax declaration signed by 16 Universities in Canada in 1991 (Wright, 2003), and the Lucerne Declaration of 2007 which encourages geography educators to integrate sustainable development into geographical teaching (Haubrich et al, 2008). These declarations focus on areas of action for Universities to not only become sustainable in their operations but also embed sustainability

principles into their teaching and research and be role models for other organisations. The Talloires Declaration for example, is a commitment made by universities to environmental sustainability in higher education. It provides ten areas for action in order to incorporate sustainability into teaching, research and university operations (Association of University Leaders for a Sustainable Future ULSF 2008b). Universities, unlike other organisations, are expected to lead the way towards a sustainable future.

Many universities across the world are working towards incorporating sustainability into their teaching, research and operations. A number of networks such as Australasian Campuses Towards Sustainability (ACTS), and the International Sustainable Campus Network (ISCN) have been established to support and encourage universities and other higher education institutions to apply sustainability within their operations, teaching and research (Australasian Campuses Towards Sustainability (ACTS) 2013, International Sustainable Campus Network (ISCN) 2007). The importance of educating for sustainability via not only formal curriculum but also through student involvement in and reflecting on the sustainable practices and operations of the university (via informal and hidden curriculum) has also been identified as a potential opportunity for improving the sustainability literacy of students (Winter and Cotton, 2012).

However, achieving a sustainable university in teaching, research and operations is not without its challenges. According to Viebahn (2002) environmental and sustainability action within universities has been impeded due to the relative absence of legislative requirements as well as organisational structures and financial systems that do not motivate and encourage staff to use resources wisely. As suggested by Moore (2005) universities need to rethink their approach and move towards collaborative transdisciplinary and innovative approaches to research and teaching, promote a socially sustainable workplace where workloads are reduced, job security is improved, involvement of community in teaching is encouraged and where sustainability is embedded in decision-making. Changed management approaches (new managerialism) and reduced government funding in the university sector has created a need for universities to be more competitive and performance

focused and has increased pressure to perform well in university rankings (Lynch, 2015). These changes in management approaches can have adverse effects on employee job satisfaction, workloads and workplace culture (Pick et al, 2012) and these potentially have an impact on the level of involvement and commitment to sustainability actions by staff. It is important to acknowledge this context in the implementation of sustainability initiatives within universities.

A review of a number of Australian universities websites, environmental management plans and annual reports revealed that several are reporting and monitoring their paper consumption and some have advice and tips for students and staff to reduce paper use (Bean 2008, Monash University 2009, Monash University 2010, Monash University 2011, Monash University 2012 and Monash University 2014; University of Western Australia 2011a and University of Western Australia 2011b; Charles Sturt University 2012, Griffith University 2014a and Griffith University 2014b, Macquarie University 2014a and Macquarie University 2014b).

1.2 The University of Wollongong (UOW)

UOW is a regional university on the south coast of NSW, Australia. UOW has numerous smaller regional campuses located on the South Coast and Southern Highlands of NSW and students studying overseas in Dubai, and via off shore course delivery in Hong Kong, Singapore, Indonesia and Malaysia. During 2013, a total of 30,620 students were enrolled at UOW and 2,532 full-time (and fraction full-time) staff were employed (UOW 2013a). UOW also has a number of controlled entities (such as Unicentre Ltd, University Recreation and Aquatic Centre URAC Ltd and UOW Enterprises) that are owned by UOW and operated from Wollongong Campus and other campus locations (UOW 2013b).

During the period of this study, UOW reviewed its organisational structure, with a number of Faculties being combined and Divisions and work areas reorganised (UOW 2013c and UOW 2014a). It should be noted that the organisational structure in place at the time of data capture for this study was the previous organisational structure.

In 2009, UOW established an Environment Unit within the Facilities Management Division to support the shift of the organisation towards environmental sustainability. In December 2010, UOW became a signatory to the Talloires Declaration (Maina 2010), and is therefore committed to incorporate sustainability into teaching, research and university operations. Since 2010 UOW has established an Environmental Management Plan which outlines the mechanisms for delivering on the UOW Environmental Policy (UOW 2014b) and the environmental goals within the University's Strategic Plan 2013-2018 (UOW 2012). UOW has committed to implement the Environmental Management Plan 2014-2016 and will "support the development and implementation of office paper waste reduction initiatives" as it works towards achieving its waste reduction and recycling objectives (UOW 2014c p9).

This study has practical application in reducing the environmental impacts of the UOW's operations. The author of this study is a staff member within the Environment Unit and based on knowledge of the organisation, UOW does not currently monitor or report on its paper use. There are no coordinated initiatives being conducted to reduce office paper waste at the present time. This study intends to address this gap. To understand the motivations for the focus on paper consumption in this study the following explores some of the problems associated with the use of paper, the use of electronic alternatives and the reasons identified for paper use.

1.3 Why is paper consumption an issue?

1.3.1 Paper consumption and technological trends in Australia

As discussed in Brown and Duguid (2002), new technologies have been widely predicted to bring about the end of a number of practices including the use of paper. However, paper use has continued (as shown in Figure 1), and over the last ten years the apparent annual consumption of printing and writing paper in Australia increased to a peak in 2007/08 when Australians consumed 1,822 kilotonnes of printing and writing paper (ABARES 2013a, ABARES 2013b). Since then this consumption has been much lower, dropping to 1,356 kilotonnes in 2009-10, increasing again in 2010-11 to 1,495 kilotonnes, then reducing slightly in 2011-12

to 1,400 kilotonnes and staying around this value in 2012-13 and 2013-14 (Australian Bureau of Agricultural and Resource Economics and Sciences ABARES 2013a, ABARES 2013b, ABARES 2014a, ABARES 2014b). These trends are also reflected in Figure 2 with Australia's per capita apparent annual consumption of printing and writing paper peaking in 2007/08 at 0.09 tonnes per capita, reducing down to 2001 levels at 0.06 tonnes per capita in 2009/10 and increasing again in 2010/11 to 0.07 tonnes per capita (ABARES 2013a, ABARES 2013b, Australian Bureau of Statistics ABS 2014). Since 2010/11 Australia's per capita apparent annual consumption of print and writing paper has reduced and then remaining steady in 2012/13 and 2013/14 at 0.06 tonnes per capita (ABARES 2013a, ABARES 2013b, ABARES 2014a, ABARES 2014b, ABS 2012a, ABS 2012b, ABS 2013, ABS 2014, ABS 2015).

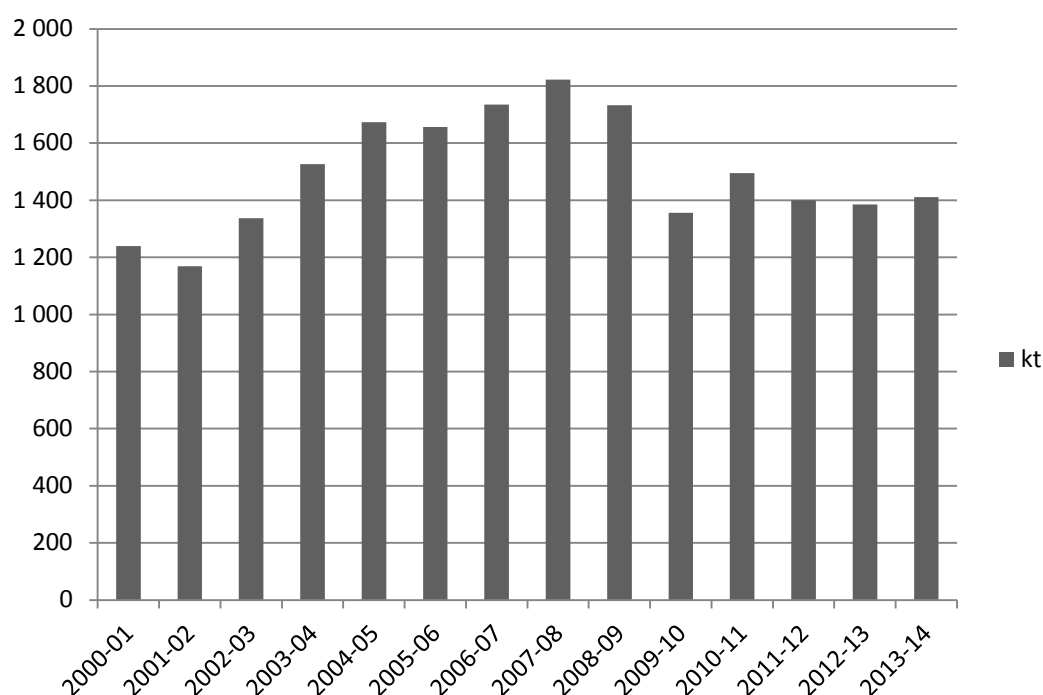


Figure 1: Australia's apparent annual consumption of printing and writing paper
Source: ABARES (2013a, 2013b, 2014a and 2014b)

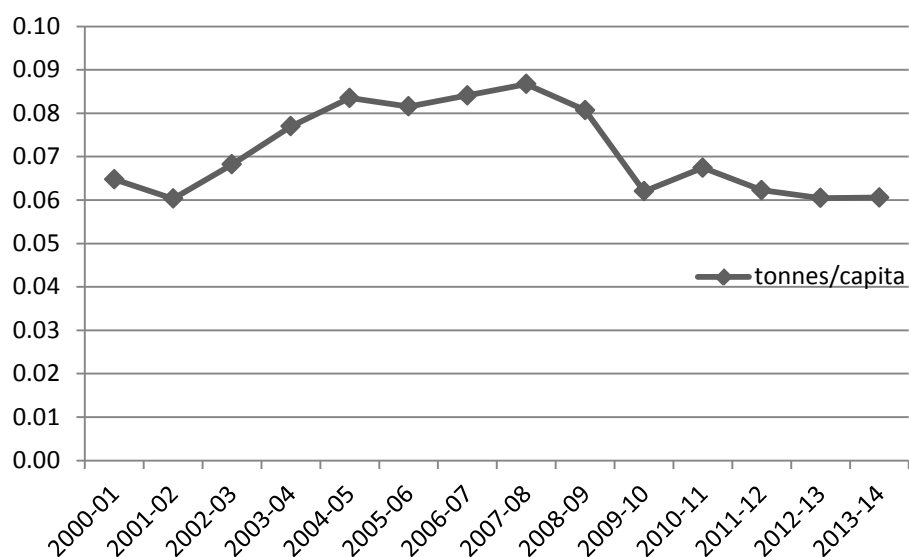


Figure 2: Australia's per capita apparent annual consumption of printing and writing paper

Source: ABARES (2013a, 2013b, 2014a and 2014b) and ABS (2012a, 2012b, 2013, 2014 and 2015)

NSW government agencies and NSW state-owned corporations were required under the NSW Environment Protection Authority (EPA) (1997) *Waste Reduction and Purchasing Policy* (WRAPP) to report on their progress to reduce waste and to increase the use of materials with recycled-content. Under the WRAPP, NSW government agencies with fewer than two hundred staff were required to report on progress in their annual report every three years. Larger NSW government agencies with more than two hundred staff were required to report waste in their annual reports every year and to prepare a report against the WRAPP every two years. Data on the purchase of copy paper and data on printing and publication paper was a reporting criterion and the reams of copy paper and printing and publication paper purchased by these agencies over a number of reporting periods are shown in Table 1.

The WRAPP reports show an increase from 2,346,097 reams in 2001 to 2,577,893 reams in 2007. They also show an increase in use of recycled-content copy paper from nineteen percent (19%) in 2001 to forty-five percent (45%) in 2007. More recent information was not available as the WRAPP was replaced by the NSW

Government and Office of Environment and Heritage (2014) *Resource Efficiency Policy* in 2014 and reports under this new policy have not been released.

Table 1: Summary of the WRAPP progress report results

Year	Total A4/A3 white copy paper purchased (reams)	% copy paper with recycled-content	Total printing and publication paper purchased (reams)	% printing and publication paper with recycled-content
2001	2,346,097	19	1,602,293	39
2003	2,367,799	36	1,434,959	23
2005	2,043,827	44	1,649,205	21
2007	2,577,893	45	1,501,572	19

Source: NSW DEC (2006), NSW DECC (2008)

As defined in the WRAPP progress reports, NSW DEC (2005), NSW DEC (2006), NSW DECC (2008), print and publication paper is that paper used in printing publications including reports, forms, educational or advertising material, brochures, pamphlets, posters (that are printed internally or by an external printer) and copy paper is white A4 and A3 paper including letterhead but not coloured or tinted paper.

Access to and use of ICT has also increased in recent years. As demonstrated in studies conducted by the ABS (2009), in 2008-09, nearly four out of every five households (or seventy-eight percent of households) in Australia had access to a home computer, compared with just over two out of every five households (or forty-four percent of households) in 1998. By 2010-2011, eighty-three percent (83%) of households in Australia had access to a home computer (ABS 2012a). Additionally, Australian Communications and Media Authority ACMA (2013) indicate that there were an estimated 8.67 million smartphone and 4.37 million tablet users in Australia as of May 2012. Despite ICT being used more widely, paper is still an intrinsic part of work activities and paper consumption has continued.

1.3.2 Environmental and sustainability related impacts of paper use

Paper has a number of environmental, social and economic impacts throughout its production, consumption, transportation and disposal. It is a global issue with imports of print and writing paper into Australia totalling 1173.9 kilotonnes and

exports from Australia totalling 132.1 kilotonnes in 2011-12 (ABARES 2013a). The production of paper typically involves producing and acquiring fibre, chemically or mechanically processing the fibre into pulp, and running the pulp through a paper machine to create large rolls of paper which are then converted into products (Kinsella et al. 2007).

Fibre is most commonly sourced from wood harvested from plantation or natural forests and recycled paper and board (Spencer, Lamont and Keogh 2009). Fibre sourced from plantation or natural forests can be from sustainably managed forests, unsustainably managed forests or from illegal forestry. Some of the impacts associated with fibre sourcing from natural forests include deforestation, forest degradation and biodiversity loss as well as those impacts related to global warming and greenhouse gases. The preferred source of wood fibre in Australia is plantations (Spencer, Lamont and Keogh 2009). Nonetheless, there are impacts associated with fibre sourcing from plantation forests and these are related to monoculture tree plantations and associated biodiversity impacts, chemical use, a result of shifting land use from agriculture to plantation and those related to global warming, carbon absorption and greenhouse gases (Spencer, Lamont and Keogh 2009). Recycled fibre is sourced from pre-consumer sources (from the paper making process) and post-consumer sources (from recycling waste collections) (NSW DECC 2009a).

Processing the fibre into pulp also has numerous environmental impacts. These impacts vary depending on locality and production methods used but involve water and energy consumption, and the generation of air and water emissions including greenhouse gases, sulphur dioxide, nitrogen oxides, volatile organic compounds, particulates, reduced sulphur (rotten egg gas odours), dioxins and solid waste disposal (Kinsella et al. 2007). As described in NSW DECC (2009b), bleaching agents are used in virgin and recycled paper pulping processes. Elemental chlorine and small amounts of chlorine dioxide was used in the past as a bleaching agent. This has since been found to be a source of dioxins. Most office papers are now made without using elemental chlorine and alternative bleaching processes are used.

Large quantities of waste water production and energy consumption are associated with the paper industry. According to Kinsella et al. (2007) the paper industry in the US is the largest user per ton of product of industrial process water, and is one of the biggest industrial consumers of energy.

Alternatives to using wood fibres for paper manufacture do exist and include paper produced from agricultural residues (e.g. sugarcane bagasse), fibre crops (e.g. hemp, flax, bamboo) and textile wastes (Sridach, 2010). The use of non-wood fibres for paper production has many benefits (e.g. use of agricultural waste and addressing wood shortages) however the production of pulp using non-wood fibres is problematic and has caused environmental problems (Rousu et al, 2002). These problems are being overcome through research and implementation of alternative pulping processes and improvements to technologies used (Moral et al 2016, Kim et al 2016, Beltramin et al 2015, Requejo et al 2012, Sridach 2010, Gonzales-Garcia et al 2010a and Gonzales-Garcia et al 2010b).

The environmental impact associated with paper use also includes the use of printers and copiers (such as electricity use, production use and disposal of print and toner cartridges) as well as the disposal of printers and copier machines. The environmental impacts of disposal of paper include landfill space and the greenhouse gas emissions resulting from paper decomposing and producing methane. In 2010/11 about five million tonnes of paper and cardboard was disposed in Australia with sixty-five percent (65%) of it being recovered (Randell, Pickin and Grant 2014). Transportation is another environmental impact of paper use, consuming energy and generating greenhouse gas emissions (Kinsella et al. 2007).

The environmental impacts associated with paper production, use and disposal are many, varied and happen at a local and global scale.

1.3.3 Environmental and sustainability related impacts of Information Communication Technology (ICT)

The electronic alternatives to paper also have environmental and sustainability related impacts; some are positive and some are negative. ICT has immense opportunity to mitigate environmental impacts through educating people on environmental issues, improving infrastructure systems, monitoring energy use and improving energy management. ICT also has environmental impacts as a result of its manufacture, use and disposal (Labelle 2008).

There are direct and indirect impacts associated the production, use and disposal of ICT. Examples of direct impacts of ICT include those created during the extraction and refining of scarce materials and heavy metals, chemicals and energy used, the waste products created during manufacture, the energy consumed during use and transport fuel emissions. Increased exposure to toxic metals in a formal e-waste recycling facility employees in Sweden also highlights that the impacts of ICT are more than just those involved in the ICT's manufacture and use but also occur in the disposal and recycling of the ICT items and has an impact on workers and the environment (Julander, Lundgren et al. 2014). With computers now having less than a two year lifespan, lack of longevity and a built-in obsolescence of ICT items compounds this waste issue (Gibson, Farbotko et al. 2013).

Indirect impacts are those created by the ongoing use and application of the ICT (Yi and Thomas 2007). As discussed in Labelle (2008), such impacts are much harder to predict and although ICT may generate an environmental benefit on the one hand ITC might also generate unintended consequences. For example, teleworking may generate environmental savings as a result of not having to commute to and from work however the behaviour of the teleworkers may create other environmental impacts. The free time generated by not having to commute to work may result in a leisure drive, so that the teleworkers may not have used their car for commuting but for other activities that have been enabled because they haven't had to spend time commuting (Yi and Thomas 2007).

ICT has the opportunity to be of huge environmental benefit but can also have significant environmental impacts. Many impacts are indirect and difficult to predict and identify. This suggests that any activities that are aimed at reducing paper use and that encourage the use of electronic alternatives must also consider the impacts of these electronic alternatives.

1.3.4 Relative environmental impacts of paper and Information Communication Technology (ICT) items and government policy

In order to make informed choices to reduce the environmental impacts of an organisation's operations in relation to paper use, it is important to understand the relative environmental impacts of paper and ICT items and be informed by current government policy.

There are a number of different environmental accounting tools (such as carbon foot printing, ecological foot printing and lifecycle assessments) that have been used to assist in understanding the impacts of paper, compare different paper products or compare electronic alternatives and assist in communicating these impacts to stakeholders.

The carbon footprint is applied to communicate the carbon footprint to customers, to facilitate development and implementation of greenhouse gas management across the products lifecycle and to identify opportunities for mitigation measures (Dias and Arroja 2012). There are a number of different methods available to estimate the carbon footprint of products (Dias and Arroja 2012). An international standard for carbon footprinting, ISO/TS 14067:2013 has been published that provides guidelines on the quantification and communication of the carbon footprint of products (ISO 2013). Many paper products in Australia are now able to offset their carbon emissions under the National Carbon Neutral Offset Standard (NCOS) and advertise that they are Carbon Neutral under this accreditation scheme (Department of Climate Change and Energy Efficiency 2012).

The ecological footprint is another environmental accounting tool that has been applied to paper. Hogan (2009) calculated the ecological footprint of the University

of Limerick's annual A4 paper use over a number of years. Chambers, Simmons et al. (2000) also calculated the ecological footprint of a newspaper. However, the ecological footprints calculated by Hogan (2009) and Chambers, Simmons et al. (2000) are based on northern hemisphere scenarios and figures several years old. Due to the global nature of the paper product supply chain it is difficult to calculate the ecological footprint without making significant assumptions about the origin of the paper and the figures used in the calculations (Hogan 2009).

Lifecycle assessments (LCAs) have also been applied to paper and have been used to compare the relative impacts of paper-based options with electronic alternatives. Moberg, Jogansson et al. (2007) and Borggren, Moberg et al. (2011) found that the paper-based options had the greater environmental impact compared to the electronic based options with the main impact associated with the paper-based options in the paper production. Moberg, Jogansson et al. (2007) compared the environmental impact of paper-based newspaper reading with web-based and tablet e-book options and revealed that the tablet and web-based newspaper reading options had a lower environmental impact than the paper version. Forestry pulp and paper production was considered the main environmental impact associated with the printed newspaper. The energy use was considered the main impact of reading the web-based newspaper. The production of the tablet e-paper device was the main environmental impact of using this device (Moberg, Jogansson et al. 2007). Borggren, Moberg et al. (2011) compared the use of e-books with the traditional printed book and also identified that paper books had a greater environmental impact. The main environmental impact of the printed book was in the production of the paper and also in the transport and distribution of the book.

However, LCAs have limitations as discussed in PricewaterhouseCoopers Advisory France (2010). These limitations include that LCA are relevant only for the geographic location where the data was collected unless the data is adjusted accordingly. LCA identify potential impacts and are not a calculation of actual impacts. They are a snapshot at a point in time and results of two LCA on the same subject may provide different results depending on factors such as the quality of data, assumptions, methods used and objectives.

As highlighted in Bull and Kozak (2014), undertaking LCA of ICT items is challenging due to the complexity and global nature of the sector and its supply chains and the multiple uses that these items can be used. LCA's of ICT items often need to rely on outdated or estimated data and significant impacts can also be unaccounted for (Bull and Kozak 2014). Additionally, due to the speed of technological change (e.g. new product models and production methods) the assessment of the environmental impacts of technologies such as laptops, tablets, iPads and e-Readers is not only complicated and costly but are likely to be out of date in the time taken to undertake an assessment (Gibson, Farbotko et al. 2013). Indirect impacts are also not accounted for in these assessments. Based on this information it is therefore very difficult to speculate on whether paper or the ICT items are preferable and have the least environmental impact.

Australian government policy that provides guidance in the purchase use and disposal of paper products and ICT is available. At a Commonwealth level, the Commonwealth of Australia (2013a) *Sustainable Procurement Guide* and Commonwealth of Australia (2012) *Public Sector Environmental Management: reducing the environmental impacts of public sector operations, Better Practice Guide* offer useful tools. Environmental performance targets to be achieved by 2015 as identified in Commonwealth of Australia (2012) based on the Commonwealth of Australia (2010a) *Australian Government ICT Sustainability Plan 2010-2015* and the Commonwealth of Australia (2010b) *Australian Government Data Centre Strategy 2010-2015* in relation to paper consumption and the energy use of ICT include:

- 250 kWh per person target for desktop energy consumption;
- 20:1 desktop computer to printer ratio;
- 1.2:1 desktop computer per end user ratio;
- 90% compliance for computers to be shutdown overnight;
- 100% post-consumer recycled paper use;
- 9 reams of paper per person per year; and

- 1.9 Power Usage Effectiveness (PUE) target in data centres and server rooms.

In addition, the use of recognised eco-labels and standards is suggested as a good method of ascertaining the green credentials of goods or services and to avoid greenwash (Commonwealth of Australia 2013a). The Electronic Product Environmental Assessment Tool (EPEAT) silver or equivalent eco-label has been set as the minimum requirement by the Australian government for ICT equipment procurement standards (Commonwealth of Australia 2013b). EPEAT eco-labelled items registered for Australia include desktop computers, notebooks, displays, thin clients, slate/tablet devices, work stations and integrated desktop computers and printers, multifunction devices and scanners (Green Electronics Council 2014).

At a NSW level, the *NSW Government Resource Efficiency Policy* (NSW Government and Office of Environment and Heritage 2014) requires all NSW government agencies to report on their top three waste streams by total volume and by total cost. NSW government agencies that are required to report under this policy are listed as general government sector agencies in Appendix B of *NSW Government Budget Statement 2014-2015* (NSW Government 2014). Reporting is not mandatory for other organisations such as local government, state-owned corporations, public trading enterprises and public financial enterprises but they are also encouraged to adopt this policy (NSW Government and Office of Environment and Heritage 2014).

Under this policy NSW government agencies are encouraged to improve their resource efficiency and continually improve their waste efficiency and introduce paper reduction targets and electronic file management systems. Agencies are also encouraged to purchase copy, stationery and print publication paper that is:

- post-consumer recycled-content, as defined under AS1402;
- certified as lifecycle carbon reduced under the National Carbon Offset standard; and
- non-recycled but from sustainable sources that are accredited under the Program for the Endorsement of Forest Certification (PEFC), Forestry

Stewardship Council (FSC) or equivalent (NSW Government and Office of Environment and Heritage 2014).

Under this policy all NSW government agencies are required to purchase computers, printers, fax machines and photocopiers that are endorsed as being high efficiency rating under ENERGY STAR® in Australia (NSW Government and Office of Environment and Heritage 2014).

In summary, paper use has continued despite the increased use of other electronic based technologies with both paper and electronic alternatives having many and varied environmental impacts. Research comparing the relative impacts of paper and electronic alternatives has been conducted but these are based on overseas scenarios that may not be applicable in an Australian context. Additionally, data limitations exist due to the complexity and global nature of the ICT supply chain, and due to the speed of technological change, assessments conducted on ICT items are likely to be quickly out of date. It is therefore difficult to speculate on which option is preferable and has the least environmental impact overall. Reliance on policy documents is then necessary to provide guidance on how best to reduce environmental impacts of activities conducted.

Australian government policies and guidelines that provide best practice guidance for government entities in the purchase, use and disposal of paper products and ICT are available. The NSW Policy is based on improving resource efficiency. Adopting equivalent or similar targets and applying these guidelines may be helpful for universities and other large organisations in order to minimise the environmental impacts associated with paper and ICT use. However, this has the potential to cause organisations and staff confusion if research is found to be in conflict with the policy stance and potentially undermines the implementation of policy based actions.

1.4 Exploring the reasons why paper is being consumed

In this section a number of areas in the literature that have been or could be used to explain paper use are explored in order to understand why paper continues to be used.

1.4.1 The features of an object and the nature of the task

Sellen and Harper (2002) look at paper use with the concept of affordances, which refers to the properties of an object and how that determines what people can do with that object. They suggest that to understand why paper is being used within organisations we need to understand why paper supports certain activities better than the electronic alternatives.

Sellen and Harper (2002) highlight that paper and electronic alternatives tend to be used to undertake the tasks they best support and are often used in combination. For example, they identified that during knowledge work, paper supported information based activities (such as understanding, creating and reviewing information) and in social processes (such as face to face discussion and collaborative work). Electronic alternatives, in contrast, tended to occur in the support of these paper-based activities (e.g. accessing, organising storing, finalising information, managing workflow and distribution) (Sellen and Harper 2002). This highlights that paper and electronic alternatives are being used for the tasks that they best support, and that the paper and electronic alternatives are often being used in combination to form the overall work process (Sellen and Harper 2002).

Availability and use of electronic mobile devices has expanded since 2002. More recent studies by Taipale (2014), Fortunati and Vincent (2014) and Franze, Marriott et al. (2014) have identified that reading on paper is still the preference over electronic based reading despite the availability of electronic reading devices, mobile internet accessibility and the improved selection of electronic reading materials. Taipale (2014) and Fortunati and Vincent (2014) and Franze, Marriott et al. (2014) found that many of the affordances of paper that support reading tasks, as identified by Sellen and Harper (2002), were still relevant despite these technological changes. The use of paper was found to be preferred by students in Universities in Finland and Italy, particularly for longer documents and sustained reading, as paper supported the ease of annotating and highlighting text, allowed greater mobility in posture and reading location and did not depend on electricity, battery power or internet connections (Taipale 2014, Fortunati and Vincent 2014). Academics surveyed in an Australian and a German University also found that

paper-based reading was more tangible and allowed for better comprehension of text (Franze, Marriott et al. 2014). Screen-based reading was found to have negative affordances (such as screen size, posture needed to read from screen and eye tiredness) but it also had the positive affordance of being able to search for words and phrases within the text better than paper-based reading (Taipale 2014, Fortunati and Vincent 2014).

Although paper continues to be preferred over electronic options for reading, this is not necessarily the case for writing preferences. As highlighted by Baron (2008) electronic based writing has increased with accessibility and use of electronic devices, internet access and online tools. Taipale (2014) and Fortunati and Vincent (2014) found that writing electronically allows for greater speed, results in less tiredness, was supported by automatic editing tools and also avoided embarrassment due to poor hand writing. Electronic writing also enables instantaneous communication and publishing using online tools and mobile devices (Baron 2008). However, the preference for writing on paper compared to writing with electronic means was found to be different between two student groups from Finland and Italy (Taipale 2014). This difference in preference was considered to be due to the cultural or social frame of reference and the duration of use of the electronic alternatives (Taipale 2014). Those exposed to the electronic alternatives for a longer period of time preferred electronic writing whereas those exposed to electronic alternatives for a shorter period preferred either electronic writing or paper-based writing (Taipale 2014).

This research highlights that the cultural influences, and how long users have been using the electronic alternatives, are important and relevant factors on user preferences and perceived affordances (Taipale 2014). Sellen and Harper (2002) also identified that many of the affordances of the electronic alternatives are not obvious or are unknown to some users and as a result the use of electronic alternatives are found to be dependent on the skills, knowledge and familiarity by an individual on how to use all aspects of the technology. Weymann and Sackman (1993) cited in Lim (2010) identified that the skills, knowledge, experience and familiarity of the technology used by an individual during their formative years

(between 10-25 years old) is considered to have an influence on an individual's attitude and behaviour towards newer technologies. Individuals from different technological eras may find the affordances of current technologies difficult, not intuitive and therefore this influences their preference to use paper over the newer technologies (Weymann and Sackman 1993 cited in Lim 2010).

Another key aspect to paper use is that the features or properties of paper have been found to enable social meanings to be conveyed (Sellen and Harper 2002). As highlighted in Taipale (2014) and Fortunati and Vincent (2014), writing on paper is more personal and conveys more emotion than electronic options. This social aspect of paper use is discussed in Section 1.4.2 in more detail.

It is also important to consider that communications technologies, such as paper and ICT, due to their affordances, support or enable communications and information to be preserved over time or enable communications to be delivered across distance. Innis (1991) termed these characteristics time-binding or space-binding. The latest shifts in modern technology focus attention on the space-binding characteristic of the technology, the speed and ability to move information and communicate quickly around the world (Brown and Duguid 2002). Electronic writing in combination with mobile and internet accessibility has these characteristics. However, newer technologies tend to lack the time-binding characteristics (Brown and Duguid 2002). For example, content on the internet is not permanent and is constantly changing as links are broken and access is lost. In addition, as highlighted in Gibson, Farbotko et al. (2013) the platforms used to provide the information are also rapidly changing. For example, music platforms have changed considerably over the last 50 years from vinyl records, to cassette to compact disc to electronic files (Gibson, Farbotko et al. 2013). This brings into question the durability and longevity of the newer platforms to preserve information over time in an uncertain, rapidly changing technological environment. The constantly changing electronic storage formats and software compatibilities mean that electronic documents may be unable to be accessed after a period of time. For example electronic documents stored on 3 inch floppy disk saved in the 1990s can now not be accessed very easily. Other more recent electronic storage

platforms and files saved in particular software formats may suffer the same fate twenty years from now. Paper in contrast has the proven ability to preserve information over a considerable period of time with relative certainty.

The concept of affordances frames paper use in terms of how the nature of the object (paper or the electronic alternatives) influences how it is used, and also what it enables. The affordances of paper or the electronic alternatives support not just the task but also where the task is performed, enable social meanings and social interactions associated with the task and enable communication or storage of information. Cultural or social framings which give preference to the affordances of paper or electronic options are relevant influences in user preferences. User preferences are also influenced by skill, familiarity, knowledge and perceptions of the affordances of paper or the electronic alternatives. The concept of affordances suggests that some paper use is necessary for certain tasks when the electronic alternatives do not support what the user is trying to do.

1.4.2 The relationship between technology and society

The relationship between technology and society is also relevant in explaining paper use. Although very different viewpoints, theories such as technological determinism and the social shaping of technology help us to understand the relationship between technology and society and how this is relevant to paper use. Technological determinism is the view that technology shape or determines society (Matthewman 2011) whereas the social shaping of technology suggests that society and technology shape and influence each other (Wajcman and MacKenzie 1999).

Paper is itself a technology, and paper use, writing and the printed word has a history that goes back thousands of years. This history is important in explaining the reasons for continued paper use today. The printing press is seen as having had a significant role in history and in social development (Eisenstein 1979). Cope and Kalantzis (2006) attribute writing, paper and the printing press to the significance of literacy and education, and standardisation of language and culture within today's society. Paper as a technology is very much embedded in our way of life. As highlighted by Mackay (1997), technologies also limit or constrain what is

possible. New technologies are designed and based on existing technologies (Wajcman and MacKenzie 1999, Davisson 1972 and MacKay 1997) and the designs are also constrained by the materials available (Mackay 1997).

Additionally, the introduction of a new technology does not necessarily mean that it completely replaces the old technologies and instead the use of both old and new technologies can become integrated (Richter 1982). The coevolution of technology and work practices is reflected in how paper use as well the electronic technologies have been found to be interwoven with work practices (Sellen and Harper 2002). How documents have been created in the past highlights how the use of paper and other technologies in the workplace have evolved together over time. Documents that were created by typewriter were labour intensive and could only produce one copy of the document at a time (Sellen and Harper 2002). The introduction of computers and word processing software connected to printers improved the ease of producing and replicating the paper document (Sellen and Harper 2002). As the computers were not connected to each other paper documents were still required to communicate the information (Sellen and Harper 2002). The evolution of computers that could be connected to other computers and to more advanced printers improved the ability to distribute the documents electronically between computers and gave the ability to produce high quality print documents (Sellen and Harper 2002). These technological changes did not shift the creation of documents away from the use of paper. Instead these changes shifted at what point the paper documents were created, they improved the ease and ability of creating the paper documents and communicating the information across distances (Sellen and Harper 2002). The affordances of each technology are used in combination as they complement each other and enable the work tasks to be conducted.

The influence of society on technology is demonstrated in the design of technologies that have been influenced by existing work roles and by the social expectations about who would be undertaking the tasks involved (Hoffman 1999, Webster 1993). The influence of gender bias in the design of the printing press and subsequent evolution of printing, computers and word processing technologies (Cockburn 1999 and Hoffman 1999) has influenced the type of work roles that

were made available to men and women in the past and the associated work practices conducted by them. This has in turn influenced the work roles and genders associated with the use of paper throughout history (Webster 1993, Cockburn 1999). This gendered division of the work roles associated with paper and ICT use has changed somewhat in recent times. The use of typewriters and word processors were primarily considered to be a women's role (Webster 1993, Cockburn 1999) whereas the all-purpose office computers used today are now generally accepted as being a task suitable to be conducted by both men and women.

Technologies also have social meanings and enable social meanings to be conveyed. The proper or appropriate use of a particular technology such as paper is also relevant in explaining its use or non-use (Mackay 1997). Hand delivery of paper documents has been found to be conducted in order to convey the importance of specific documents and to show deference to managers (Sellen and Harper 2002). The use of paper to convey expertise and power within an organisation was also identified in Komito (2009). This use of paper becomes the social norm and is considered the proper way to do those tasks.

These examples demonstrate that the influence of society on technology is not only relevant in the design of new technologies but also when and why a technology (new or old) is used and also by whom. The use of paper for particular tasks becomes the social norm, the expected way of doing the task, and even if an alternative technology is available with the appropriate affordances it may not be used as a result of the social expectations. An example of paper use due to social expectation in the context of a university is the presentation of a testamur at a graduation ceremony as a formal acknowledgement of the qualification gained by students at the institution.

In summary, paper use can also be explained by the relationship between technology and society. The coevolution of paper, technologies associated with paper use, and the associated work practices are relevant in explaining paper use within an organisation. Social meanings, proper use or social norms associated with

paper use are relevant. Beyond affordances and the social technological relationships, behaviour theory has also been used to explain paper use and this is explored further in the following section.

1.4.3 The influence of individual behaviours

Paper use can also be explained using behaviour theory. Behaviour change interventions are commonly used approaches to address environmental issues and have been used to both examine and reduce paper use within university settings (Bedard 2008, Isaev, Clark and Davidson 2010, Cole and Fieselman 2013).

Based on summaries by Commonwealth of Australia (2007) and Darnton (2008), models of behaviour (research on what influences people's behaviour) and theories of change (research on how to change these behaviours) can be divided into three areas of focus:

1. an individual level focus that seeks to understand why individuals undertake a particular behaviour;
2. an interpersonal level focus, including the influence of others on an individual's behaviour; and
3. a social or community level focus that examines how behaviours are adopted by parts of our community.

The individual models are focused on the attitudes (beliefs and values) of the individual to the behaviour, the influence of social pressures (norms), the presence of barriers (including habits and contextual factors) and the perceived ease to overcome those barriers (agency) (Darnton 2008 and Commonwealth of Australia 2007). Bias and heuristics also influence an individual's decision making (Kahneman 2012).

Examples of individual based models include the Rational Choice Model, Theory of Planned Behaviour (Ajzen 1991, as cited in Ajzen 2002) and Cognitive Consistency Theory. Most individual level models of behaviour are based on standard economic theory and use the assumption that individuals behave rationally and aim to maximise benefit to themselves (Darnton 2008). However, for pro-

environmental behaviours, when the benefits are not to the individual but to society, the convenience of the action will have more influence on whether or not a pro-environmental behaviour will be undertaken by an individual (Collins et al. 2003). Cognitive Consistency Theory suggests that people are motivated to seek consistency between their beliefs, values, attitudes and behaviours (Halpern et al. 2004).

With social marketing the focus is on knowledge, barriers and convenience (McKenzie-Mohr and Smith 1999), and by improving or reducing these we can influence an individual to act. Michie, van Stralen and West (2011) use the terms motivation, opportunity and capacity and have developed a behaviour change wheel as a tool to assist practitioners and policy makers to determine the behaviour change interventions that are most applicable to a given situation and assist with more effective (best practice) behaviour interventions.

At an interpersonal level, authority figures and reciprocity influence individual's behaviour (Commonwealth of Australia 2007). Social influences are also highlighted by theories that explain how behaviours spread across a community and how places with increased social capital are better able to act on pro-environmental behaviours (Commonwealth of Australia 2007). The process of influencing is more about managing, cultivating and spreading change, and the key to spreading change is to identify the intermediaries or those who are best placed to influence others (Collins et al. 2003, Godin 2002).

To understand an individual's behaviour associated with paper use from a behaviour theory perspective it is important to identify the attitudes of the individual, the social pressures that exist and barriers that apply to existing paper use.

Research applying behaviour theory to examine paper use within university settings (Bedard 2008, Isaev, Clark and Davidson 2010, Cole and Fieselman 2013) provides useful insights into the attitudes and barriers identified in relation to paper use in organisations. The influence of belief and perceptions of individuals about paper

use is highlighted by Isaev, Clark and Davidson (2010), who found that there was a perception by individuals that their ability to affect change to reduce paper use was limited at an individual level and higher level organisational changes were needed. Barriers to reducing paper use by individuals included habits, difficulty in reviewing electronic documents, concern about security of electronic storage and requirements by others for hard copy documents (Isaev, Clark and Davidson 2010). Barriers to implementation of double-sided printing were related to lack of technology available to double-sided print and the cost involved in purchasing new printers (Bedard 2008), as well as lack of knowledge on how to change printer settings to default to double-sided printing (Isaev, Clark and Davidson 2010). Convenience of the behaviour was also found to be important in relation to paper use (Isaev, Clark and Davidson 2010). As a result, the interventions used or proposed to reduce paper use were about improving knowledge, improving available technologies and improving personal responsibility (Isaev, Clark and Davidson 2010, Bedard 2008). Interventions suggested were focused on areas with high paper consumption to achieve the best returns (Bedard 2008).

These examples highlight that paper use occurs as a result of the attitudes and beliefs of individuals, social norms and requirements of others, habits, convenience, work process requirements, lack of skill or knowledge in the electronic alternatives and lack of access to the electronic alternatives. If we consider these reasons for paper use in relation to affordances and the social technological relationships (discussed in the previous sections) we can see that these reasons may be a result of one or more of the following:

- the influences of our society (e.g. attitudes, beliefs, social norms and work process requirements);
- the affordances of paper or the electronic alternatives (e.g. the security of electronic storage and also the difficulty in reviewing electronic documents); and
- skill and knowledge of the affordances of paper or the electronic technologies (e.g. individuals being unable to change the printer settings).

Habit and convenience can be viewed as a result of the influences of all three; society, affordances and also skills and knowledge. Habits and routines are conducted without thought and deliberation and many are unable to exist without the affordances of the technologies available (Warde 2014).

In addition (as outlined in the previous sections) society, affordances, skills and knowledge are inherently linked and have an influence on each other. So rather than viewing these reasons to paper use as being an externality to be manipulated, as is the case with the approach with behaviour theory, the reasons instead should be viewed as being intrinsically linked with the activities being conducted.

Behaviour theory has limitations in that it does not adequately explain the value-action gap where an individual's values do not necessarily correspond with the actions that they undertake (Blake 1999). Behaviour theory also views habits as driving behaviour and not a behaviour itself (Shove 2010). As highlighted in Maniates (2001), responsibility for environmental issues has increasingly been placed on the individual. However, individualisation of responsibility does not challenge current views of economic development, consumption and production. Models and theories of change are therefore limited in that they do not challenge the status quo (Shove 2010). To successfully address environmental issues, individuals, organisations and governments should all take responsibility (Maniates 2001, Shove, Pantzar et al. 2012).

Changing the behaviours of individuals is viewed as an important intervention and policy tool to address environmental problems, particularly at the scale of the household. However, policy approaches typically applied to householders are based on assumptions about everyday practices and the motivations of individuals for their behaviour and decisions (Lane and Gorman-Murray 2012). Similar assumptions about everyday practices and motivations are also embedded in policy aimed at the level of a workplace. As highlighted in Head et al. (2013) these approaches often fail to achieve their intended outcomes. Typical policy approaches and interventions do not fully acknowledge the complexity and interactions between social factors and meanings, technologies, skills and

knowledge and material systems that are involved in everyday actions at a local and a broader scale (Head et al. 2013). Conflicts and resistance (areas of friction) occur as a result, and sustainable outcomes become more difficult to achieve (Head et al. 2013). Instead the focus should be on creating areas of traction towards more sustainable practices (Head et al. 2013).

Social practice theories, discussed in the next section, offer an alternative approach in reframing the reasons associated with paper use. Practice theories shift the focus away from an individual and instead the focus is placed on the action or practice itself.

1.4.4 Influence of social practices

Theories of social practice have evolved from a variety of theories such as those developed by Giddens and Bourdieu (Reckwitz 2002, Warde 2005). Theories of social practice are a type of cultural theory (Reckwitz 2002) that place practices as the focus for understanding social systems. A practice is defined in Reckwitz (2002 p249) as a “routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, “things” and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge”.

The elements that are considered to make up a practice differ between theories (Shove, Pantzar and Watson 2012). The components of practices, as described by (Shove and Pantzar 2005), have three elements of practice: material, meaning and competence. Material includes all physical aspects, the individual and material artefacts used in the performance of the practice. Meaning relates to the emotions, understandings and beliefs associated with and relevant to that material. Competence refers to the skills and knowledge that are required to undertake the practice (Shove and Pantzar 2005). The behaviour of an individual (practice as performance) is the observable expression of the combination of those practice elements (practice as entity) (Spurling et al. 2013). Practice elements are interlinked and evolve and change over time (Shove, Pantzar and Watson 2012).

Coherence between these elements is also considered important for a practice to persist and spread. Holtz (2012) as cited in (Holtz 2014) suggests that a practice will become routine when an individual does not experience significant inconvenience when undertaking the practice and that the practice also needs to be consistent with what an individual thinks and believes (cognitive dissonance is not present). In other words, the elements of material and meaning need to be consistent and the elements of competence (skills and knowledge) and material must also be consistent. An individual who undertakes a practice with a high level of coherence between the elements does not experience any urge to change the practice and the practice is likely to become habitual (Holtz 2012 as cited in Holtz 2014).

Practices are interconnected and form bundles and complexes of practices (Shove, Pantzar and Watson 2012). Practices are enacted in similar places and infrastructure and institutions influence where and when activities take place and thereby play an important role in how practices interlock and become bundles of practices (Shove, Pantzar and Watson 2012, Spurling et al. 2013). Complexes of practices occur when practices become dependent on each other (Shove, Pantzar and Watson 2012).

To understand the practices that result in paper use within a workplace it is important to identify the material, the meaning and the competencies that apply and how these elements are consistent with each other. It is important to understand and acknowledge how practices are interconnected and influenced by broader scale factors such as policies, systems, processes and procedures.

The reasons for paper use, from a practice theory perspective are a result of the interaction and combination of the practice elements. The practice elements in relation to paper use are the:

- Materials (e.g. the paper and electronic alternatives as well their affordances);
- Meanings (e.g. attitudes, values, social meanings and expectations, perceptions associated with paper use); and

- Competences (e.g. skill and knowledge of the use of paper or the electronic alternatives).

In addition, the way practices interconnect with other practices and how practices are influenced by broader factors (such as policies, systems, processes and procedures) would also influence the use of paper within a workplace. The behaviours that result in paper use (or non-use of the electronic alternatives) are the observable component of the combination and interaction of practice elements.

By framing paper use in this way we also shift the focus of intervention options. Rather than focusing on manipulating the barriers to reducing paper consumption to change an individual's behaviour, interventions from a practice theory perspective are instead about recrafting practices (e.g. reducing the resource intensity of the practice components or elements), substituting practices (e.g. replacing less sustainable practices with new more sustainable ones), and changing how practices interlock (e.g. focusing on the interconnectedness of practices) (Spurling et al. 2013 and Shove, Pantzar and Watson 2012).

In summary, the research outlined in this chapter identifies that there are many environmental impacts associated with paper production, use and disposal. There are also environmental impacts associated with the technological alternatives. In order to reduce the environmental impacts in relation to paper use, universities and similar organisations are encouraged through policy to monitor and reduce paper use and apply best practice approaches in the purchase, use and disposal of office paper products and the technological alternatives. This study will support UOW to monitor and reduce its paper consumption.

Research exploring the reasons and context for paper use identified in this chapter are from overseas situations. This study addresses this gap by exploring the context and reasons for paper use from an Australian based perspective. The literature highlights that the focus of paper reduction initiatives are mainly based on the behaviour theory perspective. This behaviour perspective individualises responsibility and fails to fully acknowledge the various interactions that are occurring. Technologies and everyday activities, procedures and processes, social

factors and the broader contexts are interacting to create more or less sustainable outcomes. An alternative approach to paper reduction interventions is needed. In this study, UOW activities that consume paper are investigated from a broad framing or perspective to inform paper reduction interventions.

2 METHODOLOGY

The objectives of this study are to identify the paper purchased, used and disposed by staff at the University of Wollongong (UOW), the reasons for this consumption and to inform initiatives aimed at reducing paper use.

As outlined in the introduction other studies on overseas organisations and universities have been undertaken to explore paper use however these are all overseas examples. UOW is believed to be typical of other Australian Universities in terms of the actions and activities that are conducted that use paper and hence was chosen as the single site of study (Yin 2003). In addition, understanding the site specific context is relevant for finding practical outcomes at a specific site, such as UOW, as well as to further explore concepts and theories and enabling similar types of issues to be addressed in other contexts (Maruyama and Ryan, 2014).

This study focuses on UOW and originated from a need determined by members of the UOW Environment Unit and UOW Environmental Advisory Committee that the level of paper use in the organisation was of concern and paper reduction initiatives were required. A request was expressed for the level of paper use within the organisation to be explored and to identify practical actions to reduce paper use. The researcher is also a staff member within this organisation enabling ready access to the site, data and knowledge on local conditions and situations.

This study used UOW's paper purchasing and print usage data and also involved identifying the amount of paper leaving UOW and being disposed using a waste audit report previously conducted by UOW and waste collection data. Figure 3 shows the data sources available for office paper purchase, use and disposal. The data sources that were able to be accessed for this study are shown as shaded areas.

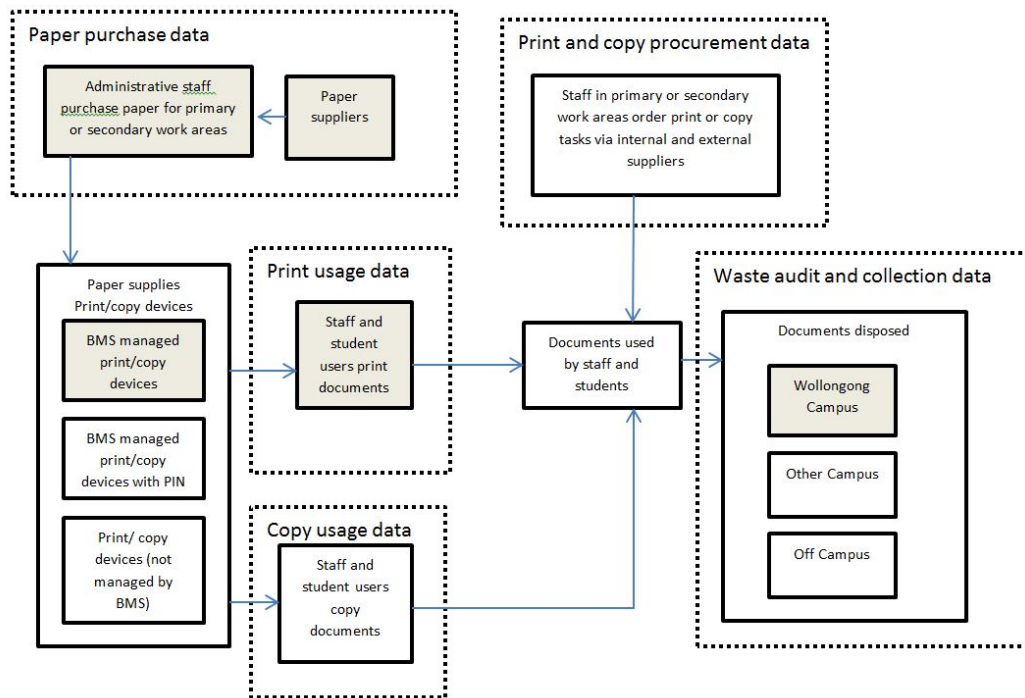


Figure 3: Data sources on paper used and disposed

The context to the paper purchase and print usage data and the reasons for paper use within work areas was also investigated via face to face interviews with staff who are responsible for purchasing paper for their work areas. Previous research within other universities has been conducted that focus on understanding the context and reasons for paper use (Bedard 2008, Hogan 2009, Isaev, Clark and Davidson 2010). These previous studies have all been conducted from a behaviour theory perspective using self-completed questionnaires or surveys, as well as focus groups (Bedard 2008, Hogan 2009, Isaev, Clark and Davidson 2010). These approaches focus specifically on an individual's attitudes, behaviour or practices conducted. The interviews conducted for this study were to obtain information from staff on the activities that occurred in their work areas that result in paper use and not specifically exploring individual behaviours and activities. Interviews were considered the most appropriate method to acquire this information as they not only enable an interviewer to obtain information about actions being undertaken in relation to paper use but also enable clarifying the paper purchase and print usage data. Face to face interviews also allow an interviewer to present information to the interviewee and also support the evaluation and discussion on the paper purchase and print usage data relevant to the work area. Additionally, interviews allow a

means of obtaining detailed data and the ability for respondents to elaborate, clarify and provide more information. There was also less risk that respondents would not answer all questions (Bryman 2001).

Problems associated with using interview methods include respondents misremembering aspects and a failure to provide honest replies due to the perception of threat or perception of the desirability of certain kinds of answers and this may result in inconsistencies where people say how they behave is very different to how they actually behave (Bryman 2001, De Vaus 2002). As the researcher is also a staff member within this organisation this inconsistency in responses was considered to be even more likely to occur. To mitigate this risk the focus of the interview questions were more generalised in nature and were aimed at identifying the context and reasons for paper use within the organisation over the two year period (2010 and 2011) and not about the specific activities and behaviours conducted by the individuals interviewed. Interview responses were compared with the reasons identified in the literature for paper use and intervention options were then determined. Figure 4 provides an overview of the methodology used in order to achieve the three objectives of this study.

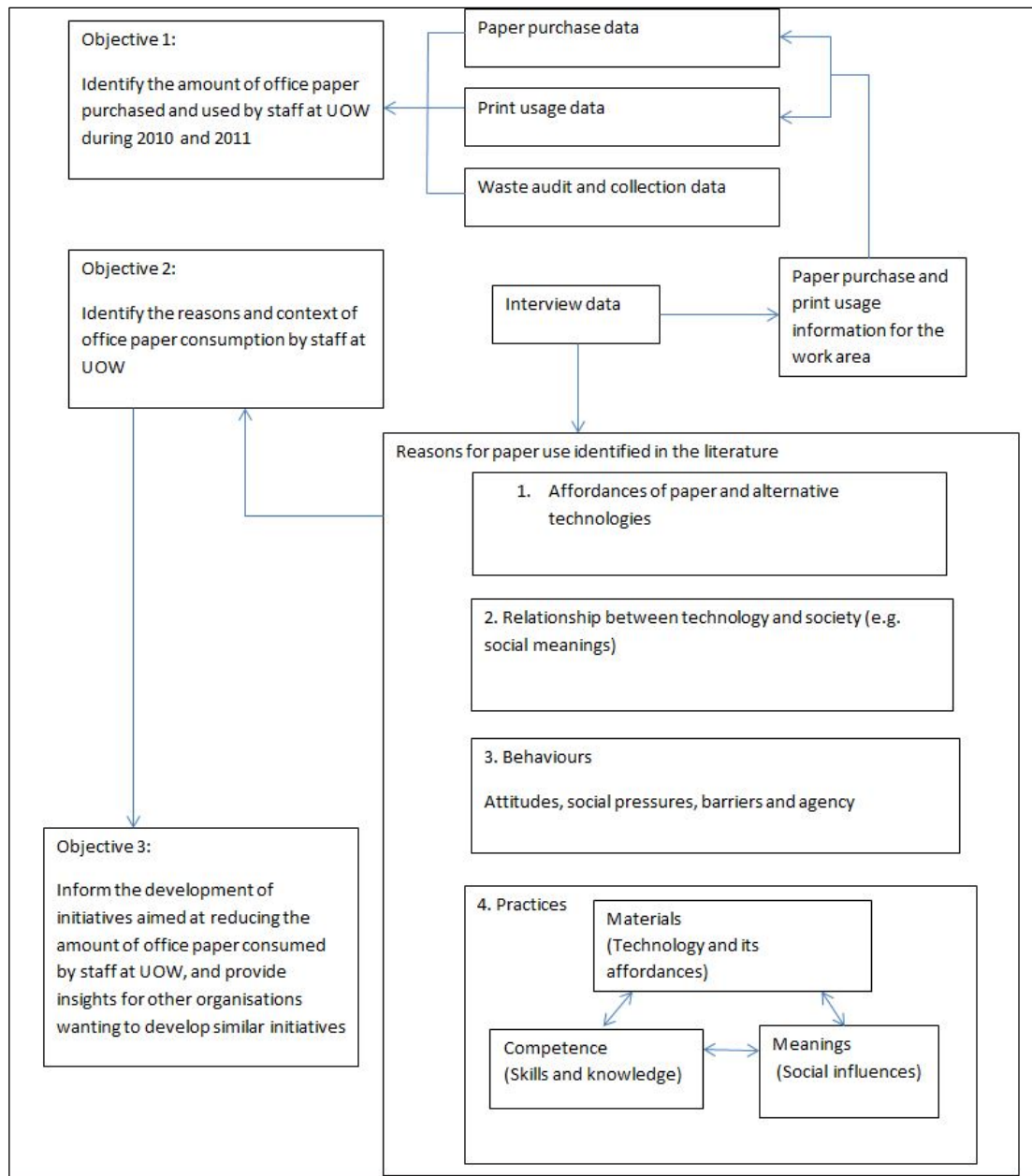


Figure 4: Overview of the methodology used

2.1 Confidentiality

A human ethics requirement of this study is that no individual or work areas are to be identified in the data that is represented in this study. All information identifying work areas was removed and replaced with a code. Information identifying individual staff and students was removed from the relevant data sets and a user identification code was used.

It is also important to note that due to human ethics requirements participants in interviews were required to obtain their manager's approval prior to participation.

2.2 Terminology

2.2.1 Defining paper

For the purposes of this study, paper is defined, as white A4 or A3 office paper (used for print or copy purposes).

In terms of paper quantities, the following were used for this study

1 ream (A3 or A4) contains 500 sheets of paper

1 box A3 paper contains 3 reams

1 box A4 paper contains 5 reams

1 ream A4 paper weighs 2.5kg

2.2.2 Defining work areas

For the purpose of this study, work areas were defined at a primary level grouping (such as a Faculty, Division, or UOW controlled entities) and also at a secondary level grouping (such as a School, Unit, Research Centre, a faculty office, or enquiry counter).

The primary and secondary work area groupings used were based on the UOW organisational structure charts and information on the UOW website and information provided in the datasets that were used (such as the UOW Human Resources Directory). Some areas were unable to be placed into a primary and, or a secondary level due to limited information provided in the data.

Due to confidentiality requirements, the primary and secondary groupings for the work areas identified within all of the datasets were then combined into a single listing and coded with a unique number so that they could not be identified.

2.3 Paper purchased and being used by UOW

2.3.1 Paper purchase data

Data on purchases of paper made by UOW primary and secondary work areas were obtained via request to the UOW Financial Services Division (UOW Financial Services) and the UOW Print and Distribution Services Division (UOW Printery). Interview data (Section 2.5.1) was also used to identify any other suppliers. UOW Financial Services provided information on the preferred suppliers of copy paper for the UOW, which were UOW Printery, Corporate Express and Office Max.

Data obtained from these suppliers was provided in different spreadsheet formats, but all data sets contained the following information: type and size of paper ordered, amount of paper ordered (in boxes, reams or sheets). All suppliers provided data for 2010 and 2011. Specialty papers were identified in order to remove them from the data, as only white office paper is the focus of this study. Additionally, for each paper type purchased, a review of any environmental performance indicators (e.g. eco-label or accreditation, type of bleaching process, recycled-content) was obtained. This was done by searching for the paper type within either the supplier's websites or details contained in the order information or on the actual product label itself.

Office Max purchase data did not identify the internal UOW customer, whereas the other two suppliers provided data on the internal UOW customer who ordered the paper. These internal customer names were compared with the organisational structure charts and website information in order to group them into their primary and secondary work area grouping.

To make the supplier's data sets consistent and comparable, information from each supplier was reviewed, fields were added and data was entered based on the product

information and order details provided. If not specified within the original data the following quantities were used to quantify the amounts ordered:

1 box A3 = 3 reams

1 box A4 = 5 reams

1 ream (A3 or A4) = 500 sheets

With the UOW Printery data, information on paper type and paper size in the orders was limited. Based on knowledge of the organisation and standard paper type ordered, all orders were placed as A4, white, with 0% recycled-content, normal copy paper unless otherwise specified in the order information. It was also not possible to identify quantity of paper for six orders in 2010 and in these cases an estimate of the quantities was used based on the 2010 year average order for that particular work area.

Each of the supplier's datasets was then combined into a single spreadsheet using the fields and data entry options shown in Table 2. Once the order information was collated the work areas were coded and the primary and secondary work area names were then removed from the data.

The combined purchase data was then analysed to determine the following:

- Total purchases (sheets and reams) of A4 for 2010 and 2011;
- Total purchases (sheets and reams) of A3 for 2010 and 2011;
- Total purchases of A4 based on supplier for 2010 and 2011;
- Total purchases of A3 based on supplier for 2010 and 2011;
- Indicators of environmental performance of the paper purchased 2010 and 2011; and
- Total purchases of A4 based on primary work area for 2010 and 2011.

The combined purchase data was also analysed to determine the paper purchases per person for 2010 and 2011 and the paper purchases per person per work area. In order to undertake this analysis, information on the number of people using the paper was obtained. The interview data (Section 2.5.1) identified that higher degree research (HDR) students were also users of the paper purchased within work areas,

Table 2: Paper supplier data was combined using these fields and data options

Data Field	Data options
Year	2010, 2011
Supplier	UOW Printery, Office Max, Corporate Express
Order Description	Product information / order details
Paper Size	A4, A3, A5
Total order number of sheets	Number of sheets ordered in total
Total order number of reams	Number of reams ordered in total 1 ream =500 sheets
% recycled-content	% of recycled-content fibres the paper contained (e.g. 0%, 10%, 50%, 80%, 100%)
Colour or White	White paper or coloured paper
Normal or Specialty paper	Normal copy paper or specialty paper
Indicators of environmental performance (e.g. eco-labels, accreditations & standards)	Forestry Stewardship Council (FSC), National Carbon Neutral Offset Standard (NCOS), Recycled-content PEFC: Program for the Endorsement of Forest Certification (PEFC) Australian Forestry Standard (AFS)
Primary work area grouping	Name of Faculty / Name of Division / Unknown Primary work area groupings were identified and standardised across all data sets
Secondary work area grouping	Name of Unit / Name of School / Unknown Secondary work area groupings were identified and standardised across all data sets
Work Area Code	Code allocated for the combined primary and secondary work areas to de-identify the work areas from the data

and hence both staff and HDR student numbers were obtained to analyse the paper purchases and compare them with the number of people using that paper. The number of Full-time (equivalent) staff members (FTE staff) and HDR student total enrolment numbers were obtained for 2010 and 2011 based on work areas (with permission from the UOW Human Resources Division and UOW Planning, Marketing & Communications Division. It should be noted the FTE staff data is a

snapshot taken in March of each year. These data sources are referred to in this study as UOW person data. UOW person data was provided based on work areas and an attempt to match these to the work areas identified for the purchase data was undertaken. It was found that some of the UOW person data work area allocations did not match the organisational charts, making matching of this data difficult. Some of the primary work area groupings were not able to be matched against this UOW person data. UOW also has a number of controlled entities (e.g. Unicentre, University Recreation and Aquatic Centre-URAC, and UOW Enterprises) and paper purchase data was obtained for these areas in the data provided by the suppliers. However, the UOW person data does not include the employees of these UOW controlled entities. There were also a number of other work areas in the paper purchase data that could not be matched with the UOW person data work area groupings. It is likely that these areas are included in the UOW person data but determining the respective work area in the purchase data was not clear. In some cases the organisational charts have these areas sitting separately to the work area grouping used in the UOW person data. There are also a number of research centres that are joint faculty research centres. These research centres are identified as the purchaser of the paper in the paper data however, the UOW person data only provides number of people to the level of Faculty.

Due to the above, a total of eleven primary work areas in 2010 (primary work areas 03, 05, 15, 19, 20, 36, 39, 49, 50, 53 and 55) and thirteen in 2011 (primary work areas 03, 05, 15, 19, 20, 23, 36, 39, 49, 50, 53, 55 and 56), out of a total of forty work areas, had paper purchases but were unable to be allocated with person data. In 2010, primary work area 23 did not have UOW person data or paper purchase data. Based on knowledge of the UOW this work area did exist during 2010 so the lack of data indicates that primary work area 23 did not purchase paper in 2010 via the procurement means identified so far in this study. It should be noted that in 2011 this work area did purchase via these procurement means and data was available. In 2010 and 2011, primary work area 05 did not have UOW person data but did have paper purchase data.

Based on knowledge of the organisation there were also four areas in 2010 where the person data would not be representative and the analysis of these areas and data was adjusted as described in the following paragraphs.

Three work areas were newly formed during 2010 and would have had a full complement of staff for most of 2010. Since the data is a snapshot taken in March, the 2010 data is not representative of the number of staff who would have been in those areas for most of 2010, and the 2011 figures would be more representative. As a result the 2011 UOW person data was used in the 2010 data analysis for those areas (primary work areas 12, 26 and 27).

The Library is another work area where the person data allocated would not necessarily be representative, as the number of staff working in the Library is available (from the above data source), but the number of students using the Library and using the paper purchased cannot be quantified.

Additionally, there were three work areas where UOW person data was available but there was no purchase data for the work area in either 2010 or 2011. These were primary work areas 6, 8, and 60. It should be noted that primary work area 60 was also a newly formed work area.

As a result, in order to determine the reams per person per year a number of data adjustments were conducted. The A4 paper purchase total for 2010 and 2011 were adjusted as follows:

- The purchase data for work area 05 was removed from the total purchase figure for both 2010 and 2011 as there is no UOW person data for this work area;
- The purchase data for primary work area 23 in 2011 was removed from the data as there is no UOW person data for this work area (and as already mentioned no purchases occurred for this work area in 2010);
- It was assumed that a further ten work areas with purchase data in 2010 and 2011 would have been included in the UOW person data, despite them being unable to be allocated down to work level due to how the work area information was presented. The purchase data for these work areas was

included in the total purchases for 2010 and 2011. (These were primary work areas 03 15, 19, 20, 36, 39, 49, 50, 53, and 55). Primary work area 56 was also included in this total for 2011 only as it had no purchase data or UOW person data in 2010 but had purchase data in 2011; and

- The Library purchase data was removed from the total reams for that primary work area as the UOW person data totals would not be representative of the true numbers of people using this paper.

The UOW person data totals for 2010 and 2011 were adjusted as follows:

- The UOW person data was removed from the total overall UOW person data figures for four work areas as these areas did not have purchase data in 2010 or 2011 but did have UOW person data (primary work areas 6, 8, and 60); and
- It was assumed that two of the three newly formed work areas had the 2011 per person data for most of 2010 and this figure was used in the UOW person data totals for those work areas rather than the 2010 figures (primary work areas 12, 27).

UOW person data was also compared with the printer user numbers for each work area. These were obtained via the UOW print usage data described in Section 2.3.3, to get an indication on how well the UOW person data reflects the number of people using the paper.

2.3.2 Print and copy procurement data

UOW work areas and staff are encouraged to arrange for large print or copy tasks to be sent to UOW Printery for printing rather than copying or printing them on their local printer and this was confirmed via the interviews (Section 2.5.1). Data on the procurement of printed materials (on A4 or A3 paper) conducted by UOW Printery was requested but the data was not readily available due to the way that it is recorded into the ordering software. It is also possible that UOW staff use additional suppliers other than UOW Printery for these tasks.

2.3.3 Print usage data

Data on the print tasks sent to printers was requested and provided by the UOW Information Technology Services (ITS) Division. Business Machine Specialists (BMS) is a company that specialises in the provision and support of IT network services, electronic document management systems and print management services, and they provide printers and copiers to UOW under a lease arrangement. This contract with BMS is managed by UOW's ITS Division and data is provided to ITS for billing and monitoring purposes. Every time an individual username (staff or student) sends a print task to a particular BMS managed printer, data is collected and collated into monthly and yearly reports which are then provided in a spreadsheet format. This data contains information about individual staff and students printing quantities and identifies the number of print jobs sent to a particular printer and the number of "clicks" that a user has made for each print job. BMS staff defined a "click" as a record of a pass of a page through a printer. Table 3 has been provided to explain what this means in relation to a sheet of paper.

Table 3: Example of "click" options and the number of sheets of A3 or A4 paper that it may represent.

Click	A4	A3
1 click	1 single-sided print	N/A
2 clicks	double-sided print (1 sheet) Or 2 single-sided prints (2 sheets)	1 single-sided print (1 sheet)
3 clicks	3 single-sided prints (3 sheets) Or 1 double-sided print (1 sheet) plus a single-sided print (1 sheet)	N/A
4 clicks	4 single-sided prints (4 sheets) Or 2 double-sided prints (2 sheets)	2 single-sided prints (2 sheets) Or 1 double-sided print (1 sheet)

Based on the information in Table 3 the data provides an indication of printer usage rather than direct data on paper usage. It should also be noted that not all printers managed by BMS for UOW have data available. BMS managed printers that operate with a PIN (that is entered by users prior to use) were not provided by ITS for this study. Additionally, not all printers at UOW are managed by BMS. There are still numerous smaller printers in operation and also several areas that have their own shared printers which are not under the BMS contract. The exact number of areas and printers that are not covered by the BMS contract and the print usage data cannot be determined easily so the scope and coverage of this data is unknown. It should also be noted that some of the UOW controlled entities also appear in the print usage data if they use printers managed by BMS.

ITS provided individual user print data for 2010 as a yearly total, and data for 2011 as a monthly totals. To make the data consistent and to be able to analyse the data in relation to year and work area a number of fields were added and other data sets were reviewed and analysed and incorporated into the print data. To do this the following steps were conducted:

1. For each dataset the month and year for the data was added as a field and then these datasets were combined.
2. All names were grouped according to a student or staff category by adding a user type field to the data, and all names were allocated to either a student or staff category within this field. All student user names have numbers and these were identified as students under the staff or student category field. All student identified data was also allocated an unknown work area. The remaining names were then identified as staff.
3. All staff names were compared with two different staff lists (the UOW Human Resources staff listing and the UOW website contact directory) to allow the individual's print data to be allocated to their primary and secondary work area grouping. These directories provide the staff name, position title, faculty or division and school or unit level information about the work area where they are located. It should be noted that the UOW Human Resources directory and the UOW website contact directory are

based on a snapshot in time and were accessed in September 2011 (for the UOW website contact directory), and August 2011 (for the UOW Human Resources directory).

4. Staff member work areas were based on the UOW Human Resources directory information in the first instance. Some staff did not appear in this directory and the UOW website contact directory was used to identify the work areas of those staff members. This situation occurred mainly with UOW controlled entity staff members as they do not appear in the UOW Human Resources directory. Some staff appeared in both the UOW Human Resources directory and the UOW website contact directory and in some cases the work area information was different. In this instance, the UOW Human Resources directory was deemed to be the most accurate and was used instead of the UOW website contact directory. This is because the website contact directory is updated by the user (individual staff member) themselves. Some staff names did not appear in either directory and were allocated to an unknown work area primary and secondary grouping. This may have occurred if the staff have left the university and do not appear in the snapshot directory data but appear in the predating print data. All staff names were then removed from the data and work areas coded to de-identify them.
5. The work areas where the printer is located were also identified based on the printer server information. The printer was then allocated to a primary and secondary work area grouping based on the printer server information, the UOW organisational structure charts and information on the UOW website. These work areas were then coded to de-identify them.
6. Work areas were also grouped according to whether they were an academic work area, administrative work area or other type of work area (e.g. UOW controlled entities, unknown work area, and UOW Accommodation Services). UOW Accommodation Services were placed in this other work type category due to print usage being used by both staff and the students living in student accommodation sites.

All the 2010 and 2011 print data sets were combined into a single data set for review, and analysis was conducted for the following aspects:

- Overall print usage (total users, printers, clicks and jobs);
- Types of users (e.g. students, staff, visitors);
- Primary work areas (print usage, and number of printers and number of users) for both 2010 and 2011;
- Determine if there was a relationship between number of clicks, users, jobs and printers for 2011;
- Determine if there was a relationship between number of clicks and number of jobs within the different work area types (academic, administrative and other) for 2011; and
- Monthly print usage for 2011

2.3.4 Copy usage data

Similar to the print data, BMS also provided data on copying quantities for billing purposes. Unlike the print usage data the copy usage data is not able to differentiate users. When a person makes a photocopy no information is captured on who makes that copy. Copy usage data therefore cannot differentiate between who has made the copy and how much they have copied; it only provides details of the total usage. Copy usage data was not provided by ITS for this study.

2.4 Paper leaving the university as waste or recycling

2.4.1 Waste audit data

The UOW Environment unit has arranged waste audits of the Wollongong Campus to be conducted by consultants. Two waste audits have been conducted one in 1999 and one in 2009 (late May/early June). Waste audit data for 2009 was obtained for this study and included the amount and type of waste disposed over a two week period. Access to this data was provided by the Environment Unit and was used to quantify the amount of paper disposed via the different bin options:

- Paper bins;
- Confidential bins;
- Comingled recycling bins; and
- Mixed waste bins.

Data is not available for the other domestic campus locations or for the areas managed by the UOW controlled entities as this waste audit did not include those areas.

2.4.2 Waste collection data

Data on the number and type of bins collected for disposal, the volumes of the bins and estimated weights of the contents for every bin collected at the Wollongong Campus (excluding the UOW controlled entities e.g. Unicentre) is gathered by the Facilities Management Division, Environmental Services Manager.

Access to the data on the number of Paper bins, Confidential bins and approximate weights of the contents for 2010 and 2011 was requested and provided, for use within this study. This data was used to quantify the amount of paper disposed from the UOW Wollongong Campus only, during 2010 and 2011.

Comparison between this data set and the paper purchase and print usage data is limited as the paper purchase and print usage data have different location and organisation context boundaries to the waste data.

2.5 Context to the paper coming in and leaving the university

2.5.1 Staff interview data

Staff who purchase paper for their work areas were invited to participate in an interview about paper consumption at UOW. Generally, staff who purchase paper for their work areas are Professional Services staff and are in administrative roles. This study does not focus on identifying individual's behaviours or actions in relation to paper use. Instead this study is focused on gaining a broad understanding of the context and reasons for paper use within work areas. The staff who purchase paper were targeted because they are also typically staff with a very good knowledge and understanding of their areas and they have the ability to answer broader questions about the social and organisational contexts of their work environments in relation to paper consumption.

Due to ethics requirements staff participation was on a voluntary basis only and staff were required to obtain their manager's consent prior to participation. It should be noted that the need for manager consent may limit participation.

An email to all staff (professional services and academic staff) was sent inviting the staff who purchase paper for their areas to volunteer to participate. Faculty and School offices were also contacted in person and an information pack was left for them to review and pass on to the appropriate staff members.

Unfortunately calls for interviews were also conducted during a time of upheaval for some work areas as the faculty restructure review was underway, and this is likely to have limited interest in participation in the interviews. In addition, one staff member responded saying that they were interested but they considered that there was no point to participating in the interview as "much of this is out of our control" and as a result it would be a waste of staff time to be involved.

Volunteers who obtained their manager's consent were interviewed at a location and time that was convenient to the staff member (and their manager) during their work day. Interviews took place between July and August 2012.

Participants were interviewed about the following key areas:

1. Recycled-content and carbon neutral paper purchasing: questions were asked to investigate use, attitudes and willingness to purchase recycled-content and carbon neutral paper.
2. Paper Purchasing: questions about paper purchasing were asked to assist with
 - a. Identifying the accuracy of the paper purchasing information obtained via UOW Financial Services, as it is possible that not all paper is purchased via the sources identified.
 - b. Identifying and understanding any trends in paper purchasing quantities that are specific to work areas and to determine if any actions have been conducted to reduce the paper consumption in that area.

3. Print/Copier Demand: questions were asked to identify what proportion of the printers are covered by the print data provided by the ITS and assist with identifying the representative nature of this information. The questions were also asked to assist in identifying what might be the reason for the print totals for the specific printers in those areas and provide context to this data.
4. Staff/Student Paper Demand: questions were asked to obtain some context to the purchasing and print information for that area and included number of staff and students using the paper purchased.

The email invitation, participant and manager information, participant consent forms and the interview questions are provided in Appendix A, B, C, D and E. Staff who agreed to participate and obtained manager consent, were interviewed at a time and location convenient to them during their work day.

Semi-structured interviews were conducted based around the interview questions listed in Appendix E. Responses were recorded by hand using either a laptop or paper and pen, using a pre-prepared form. The semi-structured format allowed for elaboration and further exploration of initial responses.

Purchasing questions were asked to identify paper suppliers, compare results with the paper purchasing data and to gauge the respondent's level of awareness of the purchasing conducted. These questions were analysed and grouped according to the response rather than the work area to assist with maintaining the confidentiality of the participants and their work areas. The responses about paper suppliers were grouped and the number of responses for each supplier was quantified.

Responses regarding the type of paper products purchased revealed that some respondents were unable to identify the actual paper product purchased and had to check before being able to provide a response. Respondents felt the need to check the type of paper purchased during the interview immediately after this question was asked. Some also mentioned that they had checked the type of paper purchased just prior to the interview as they wanted to be prepared for the interview and expected to be asked about the products they purchase. This need to check on the paper products was noted during the interview.

The responses regarding record keeping and the purchase of recycled-content or carbon neutral paper were grouped according to the number of Yes or No responses for each of the questions and then quantified. Similarly, the responses for the question regarding the amount paid per ream of paper were grouped and quantified according to whether they knew or did not know the price paid.

Questions regarding the use, or willingness to use, recycled-content paper or carbon neutral paper, and factors that would influence the decision were asked. These responses were initially grouped according to willingness to purchase each of those types of paper. The factors that would encourage its use, the willingness to trial it and the maximum price they are prepared to pay were reviewed and grouped according to any commonalities in responses.

The paper purchase and print usage records (where available for their work area) were shown to the respondents during the interviews. These records were discussed at each interview in order to clarify the accuracy and representativeness of the paper purchase and print usage data for their work area. Respondents were asked if there were any reasons that they were aware of for any trends (increases or decreases in paper purchases shown). Details on the number and type of printer devices that were relevant for the paper they purchase were also recorded. Analysis of the print usage and paper purchase data alongside the information obtained via these interview responses was conducted to provide a greater understanding of print usage and paper consumption within those specific work areas and to provide a broader understanding of the context and limitations of the print usage and paper purchase data overall.

Questions regarding awareness and knowledge on paper waste, frequency of printing and copying double-sided, and papers printed or copied and left on the printers were asked, with response options being based on either a four or five level Likert scale. For each of these questions the responses were summed and analysed and grouped according to the response rather than the work area.

The responses to questions about activities or tasks that contribute to paper use were collated and analysed without a work area perspective to assist with maintaining the confidentiality of the participants and their work areas. Each response was listed and then the responses were grouped according to any common themes. The number of responses related to each of these themes was then quantified. These responses were also reviewed when analysing the paper purchase and print usage data for the respective work areas, to see if any of the tasks conducted in the work area may have been contributing to the paper purchase and print usage trends.

Questions regarding the barriers to reducing paper consumption, activities that contribute to paper waste and activities that staff were actively doing to reduce paper use were analysed. These open responses were listed as responded and analysed without a work area perspective to assist with maintaining the confidentiality of the participants and their work areas.

In order to inform the development of initiatives aimed at reducing paper use, the responses to the questions about the reasons and activities conducted that contribute to paper use and paper waste were grouped into common themes and compared with the reasons identified in the literature. Interventions to reduce paper use were then identified.

3 RESULTS

3.1 Paper coming into and being used by the university

3.1.1 Paper purchase data

Three suppliers were identified by UOW Financial Services as providing paper to UOW. These were the UOW Print and Distribution Services Division (UOW Printery), Corporate Express and Office Max. No other suppliers were identified during the staff interviews (as detailed in Section 3.3.1). The paper purchase data encompasses UOW domestic campus locations and UOW controlled entities, and includes forty primary level grouped work areas. When combined with secondary level groupings a total of eighty-two work areas were identified for this data. It should be noted that not all work areas identified at UOW were identified in this print purchasing data.

The data provided by the three suppliers was collated for the 2010 and 2011 calendar years. Based on staff interview information and knowledge of the organisation, the paper purchased is used by both staff and students. Students who use this paper within academic areas are primarily Higher Degree Research (HDR) students. Other areas that would see an unquantified number of students (undergraduate and postgraduate) using paper included in this paper purchase data would be places such as the computer laboratories and the student printing areas in the Library.

For the 2010 and 2011 calendar years the number of sheets and reams of A4 and A3 paper was determined (Table 4).

Table 4: UOW paper purchase quantities for 2010 and 2011

Paper size	Total sheets (reams) 2010	Total sheets (reams) 2011
A3	155,500 (311 reams)	232,500 (465 reams)
A4	18,007,100 (36,014 reams)	17,419,640 (34,839 reams)
Total	18,162,600 (36,325 reams)	17,652,140 (35,304 reams)

From 2010 to 2011, the A4 paper purchased reduced by three percent (3%) and there was a fifty percent (50%) increase in A3 paper purchased. Overall there was a decrease in the amount of A3 and A4 paper purchased by approximately 1,000 reams.

Figures 5 and 6 show the number of reams of A4 and A3 purchased in 2010 and 2011 by supplier. The majority of A4 and A3 paper purchased by UOW is via the UOW Print and Distribution Services (UOW Printery).

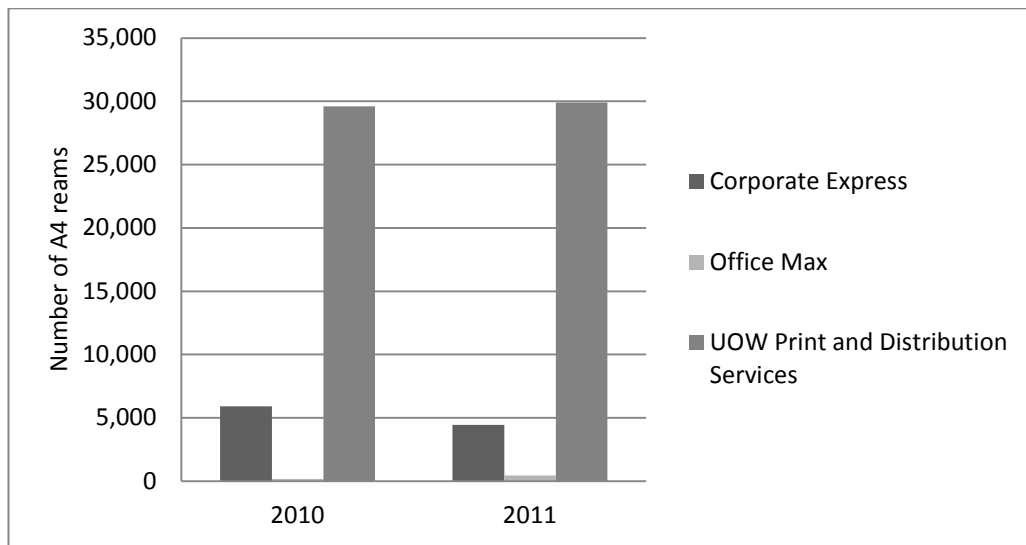


Figure 5: Number of A4 paper reams purchased by UOW based on supplier

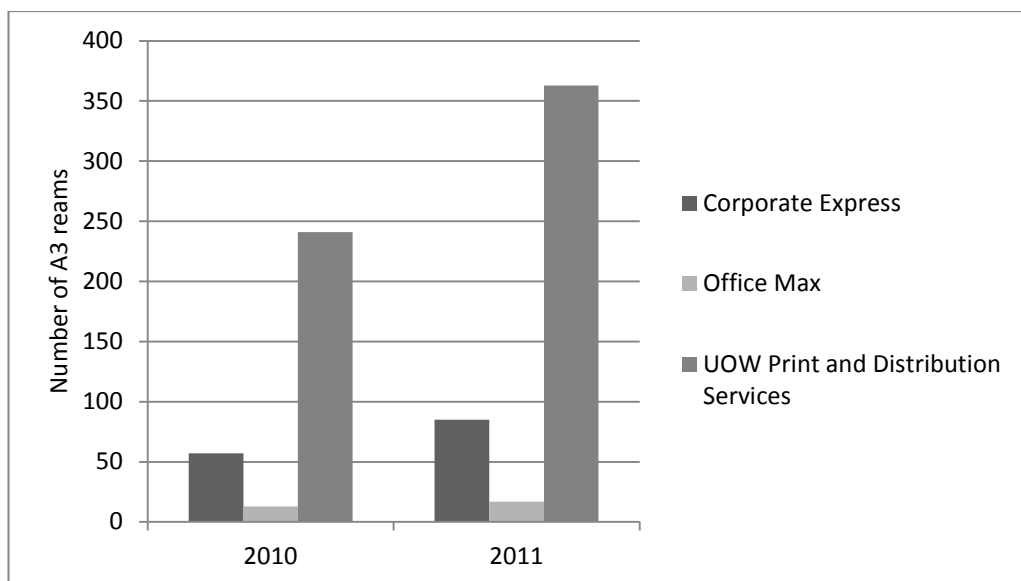


Figure 6: Number of A3 paper reams purchased by UOW based on supplier

As previously described in Section 1.3.4, office paper can have eco-labels or accreditation or standards which can assist in providing information to consumers on the environmental performance of the paper product. The Commonwealth and NSW governments also have targets focusing on the environmental performance of the office paper products that they purchase. The Commonwealth government has a target of 100% use of post-consumer recycled paper (Commonwealth of Australia 2010a) and the NSW Government's current (NSW OEH 2014) target is for the purchase of office paper with either recycled-content, Program for the Endorsement of Forest Certification (PEFC), Forestry Stewardship Council (FSC) or equivalent or paper which is accredited under the National Carbon Neutral Offset Standard (NCOS). The NSW target prior to this was set under the NSW EPA (1997) *Waste Reduction and Purchasing Policy WRAPP* and this target was for a minimum of eighty-five percent (85%) of all copy paper to have recycled-content by 2014.

The A4 paper purchased in 2010 and 2011 by UOW was analysed based on these environmental performance indicators and the results are shown in Table 5. It should be noted that many of the paper products purchased by UOW had more than one indicator of environmental performance. In addition to the indicators of environmental performance identified and listed in Table 5, all paper purchased had some accreditation under ISO 14000 standards and all paper purchased was bleached using Elemental Chlorine Free methods.

Table 5: Environmental performance of A4 paper purchased

Environmental Performance indicator	2010		2011	
	Total A4 reams purchased	Percentage of the total A4 reams purchased	Total A4 reams purchased	Percentage of the total A4 reams purchased
Australian Forestry Standard (AFS)	14,607	(41%)	13,796	(40%)
Forestry Stewardship Council (FSC)	21,362	(59%)	21,039	(60%)
National Carbon Offset Scheme (NCOS)	3,425	(10%)	2,716	(8%)
Program for the Endorsement of Forest Certification (PEFC)	14,609	(41%)	13,800	(40%)
Recycled-content	10,287	(29%)	10,735	(31%)
Unknown / Not identified	42	(0%)	0.28	(0%)

A total of 36,014 reams of A4 paper was purchased in 2010 and 10,287 of these reams (or twenty-nine percent) contained recycled-content. In 2011 a total of 34,839 reams of A4 paper was purchased and 10,735 (or thirty-one percent) contained recycled-content. Total purchases of A4 reams for primary work areas in 2010 and 2011 are shown in Figure 7 below.

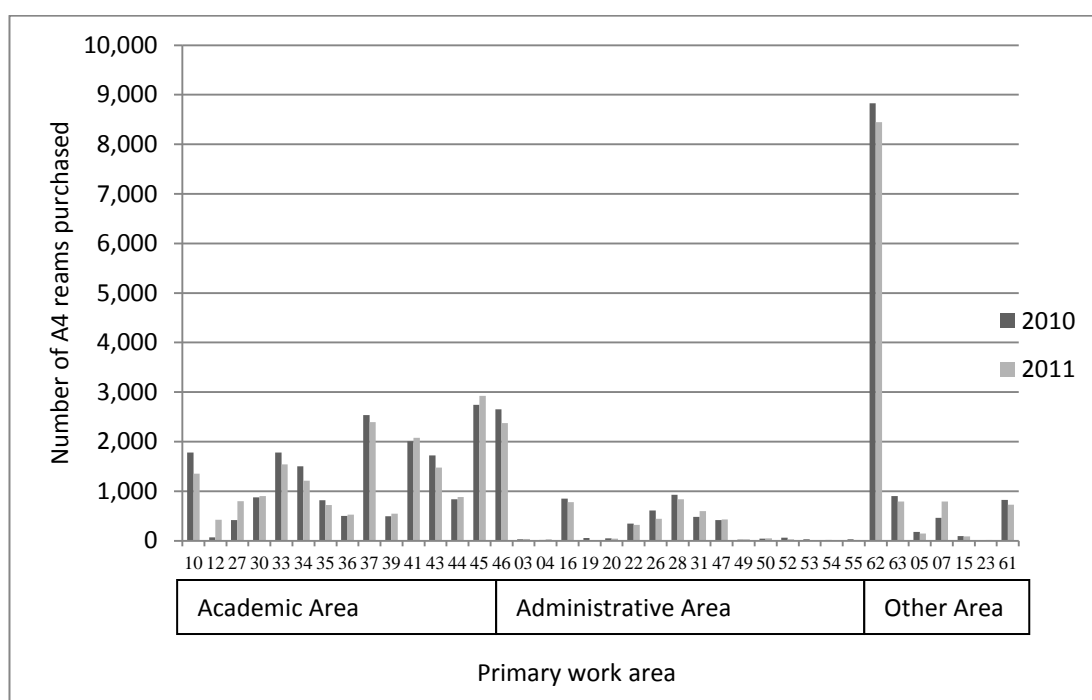


Figure 7: Number of reams purchased for each primary work area in 2010 and 2011.

Primary work area 62 purchased approximately three times as much paper as the work area with the next highest paper purchases. The average reams purchased per primary work area in 2010 was 923 reams and in 2011 the average reams purchased per primary work area was 893 reams. Primary work areas 10, 33, 34, 37, 41, 42, 45, and 46 are academic based work areas and purchased between 1000 and 3000 reams which was also above average. The remaining primary work areas purchased less than 1000 reams. The unknown grouping (purchases made where a work area could not be identified or purchaser information not available or limited) is one percent (1%) of the purchases for both 2010 and 2011.

The purchases per person per year were analysed (with data adjustments as described in the methods) and the results are shown in Table 6.

Table 6: Paper purchases per person per year

	Total A4 reams	Total persons*	Total A4 reams per person
2010	29,489	3,323	9
2011	28,424	3,709	8

(*Total person relates to FTE staff numbers and HDR student total enrolment numbers)

Table 6 shows that there was a slight reduction in the amount of paper used per person with nine reams per person being used in 2010 and eight reams being used per person in 2011. The reams per person are at or below the target set by the Commonwealth of Australia (2010a) which is nine reams per person per year. Purchase quantities per person for each primary work area were also analysed and the results are shown in Figure 8 and provided in Table format in Appendix F and G. In 2010, primary work area 26 purchased sixty-two reams per person which was well above the average of twenty-one reams per person per work area. In 2011, primary work area 26 purchased forty-five reams per person which was well above the average of twenty-seven reams per person per work area.

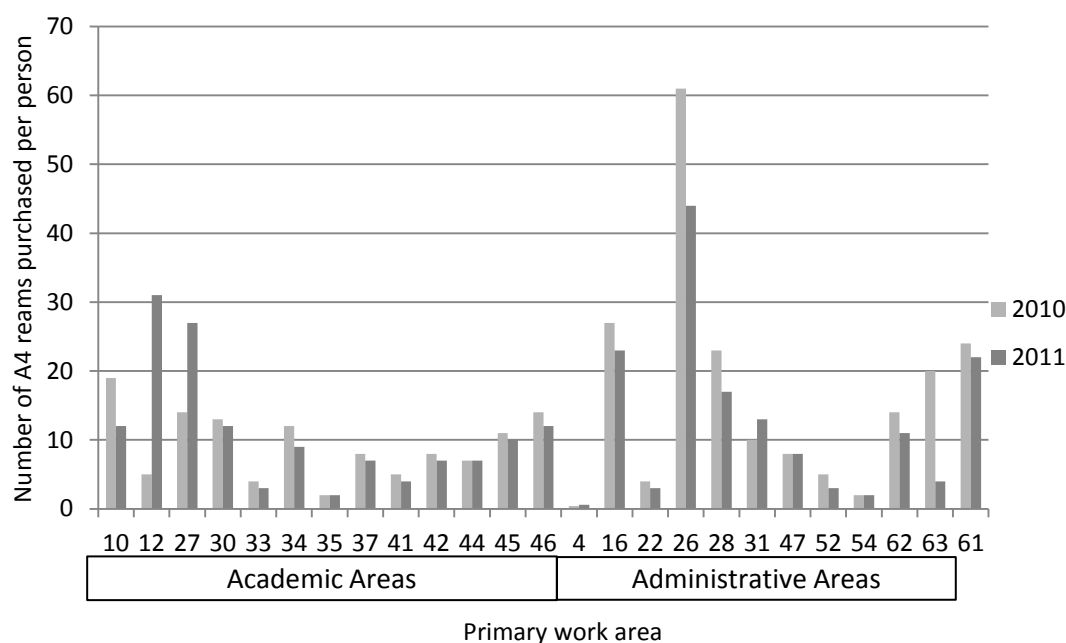


Figure 8: Paper purchase quantities per person for each work area

Primary work areas 12, 16, 27, 28 and 61 were also above the average reams per person. Primary work areas 16 and 28 are administrative areas and the work tasks conducted may explain the higher paper use. It is possible that for primary work areas 12, 27 and 61 student paper use is the reason for the higher paper usage in these areas. Primary work areas 12 and 27 are academic based work areas and a number of postgraduate students are located in these areas and primary work area 61 is also a more student intensive (postgraduate and undergraduate student) area.

3.1.2 Printing and copy procurement data

Interviews (Section 3.3.1) confirmed that UOW work areas and staff are encouraged to arrange for large print or copy tasks to be sent to UOW Printery for printing rather than copying or printing them on their local print and copy device. Data on the procurement of printed materials (on A4 or A3 paper) conducted by UOW Printery was requested but the data was not readily available due to the way that it is recorded into their ordering software. It is also possible that UOW staff use additional suppliers (other than UOW Printery) for these tasks.

3.1.3 Print usage data

Print usage data was provided by ITS for the printers managed by BMS. It encompasses most of the UOW printers and includes printers in areas from UOW domestic campus locations and UOW controlled entities that have printers managed by BMS.

However, information obtained from ITS and the staff interviews (Section 3.3.1) indicates that there are a number of printers that are not included in this data. These printers are:

- managed by BMS but are not on the BMS print usage reports (e.g. printers with PIN operated functions) . There were approximately thirty-two printers in this situation in September 2010; and
- not managed by BMS. It is not possible to quantify the number of these printers and there is no data on their print usage (e.g. small personal use printers on staff desks).

The data provided was collated for the 2010 and 2011 calendar years into one data set. This data included print usage for four hundred and forty-five printers (2010) and four hundred and twenty-five printers (2011). This data includes prints conducted by staff, students and visitors based on user name. The majority of users in this data are staff (refer to Table 7).

Table 7: Numbers and types of users in the print data

Type of user	Admin	Other	Staff	Student	Visitor	Total users
2010	3	5	2,314	1,301	19	3,642
2011	4	5	2,667	1,286	17	3,979

The UOW print usage data encompasses UOW domestic campus locations and UOW controlled entities and includes twenty-six primary work areas.

For the 2010 and 2011 calendar years the overall print usage data has been analysed to provide an overall summary in terms of printers, users, clicks and print jobs. This data is shown in Table 8 and indicates that from 2010 to 2011 there was an increase in number of users and also print usage (clicks and jobs) and a decrease in the number of printers.

Table 8: Summary of print usage data for 2010 and 2011

	2010	2011
Total number of printers	445	425
Total number of users	3,642	3,979
Total number of clicks	10,548,518	12,531,956
Total number of print jobs	1,773,568	1,990,473
Average number of clicks per user	2,896	3,149
Average number of print jobs per user	486	500
Average number of clicks per printer	23,704	29,487
Average number of jobs per printer	3,985	4,683
Average clicks per job	6	6

Despite a decrease in the overall number of printers, the print usage (clicks and jobs) increased. This increase is possibly the result of more users (as user numbers increased), and indicates that the users were doing more printing (as the average

number of jobs per printer increased and the average number of clicks per user also increased).

For the 2010 and 2011 years the print usage data for each primary work area has been analysed and is shown in Figures 9 to 17. A summary of the data is also provided in table form in Appendix 8 and 9.

The number of clicks for each primary work area for 2010 and 2011 provides an indication of the print usage for each primary work area and the results are shown in Figure 9.

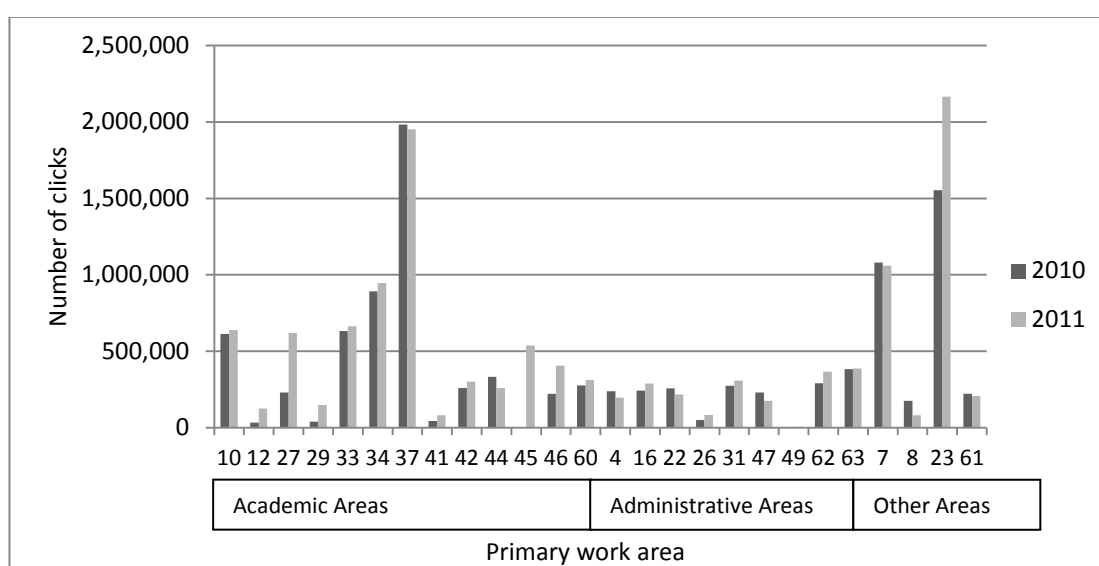


Figure 9: Number of clicks for each primary work area in 2010 and 2011

Primary work areas 23 (administrative work area) and 37 (academic work area) have high print usage compared to other work areas and much higher than the average of 481,998 clicks per work area in 2010 and 405,712 clicks per work area in 2011. Primary work areas 10, 33 and 34 (academic work areas) and primary work area 07 (the unknown work area) were above average clicks in both 2010 and 2011. Primary work area 27 and 45 (academic work area) were above average only in 2010.

Each primary work area was reviewed in order to compare work areas relative to the number of people (users) and the number of printers. Results are shown in Figures 10 and 11. Figure 10 shows the number of printers in each primary work

area. The average number of printers per primary work area was seventeen in 2010 and twenty-six in 2011. Primary work areas 23 (administrative work area), 33 and 37 (academic work areas) had over fifty printers in their work area. This is much higher than the average in 2010. Primary work areas 10 (academic work area), 42 (academic work area) and 7 (unknown work area) also had above the average number of printers in 2010. In 2011, primary work areas 10, 23, 33, 37 and 45 had above the average number of printers. In 2011, primary work areas 23 and 37 (academic work area) had over fifty printers which is nearly double the average.

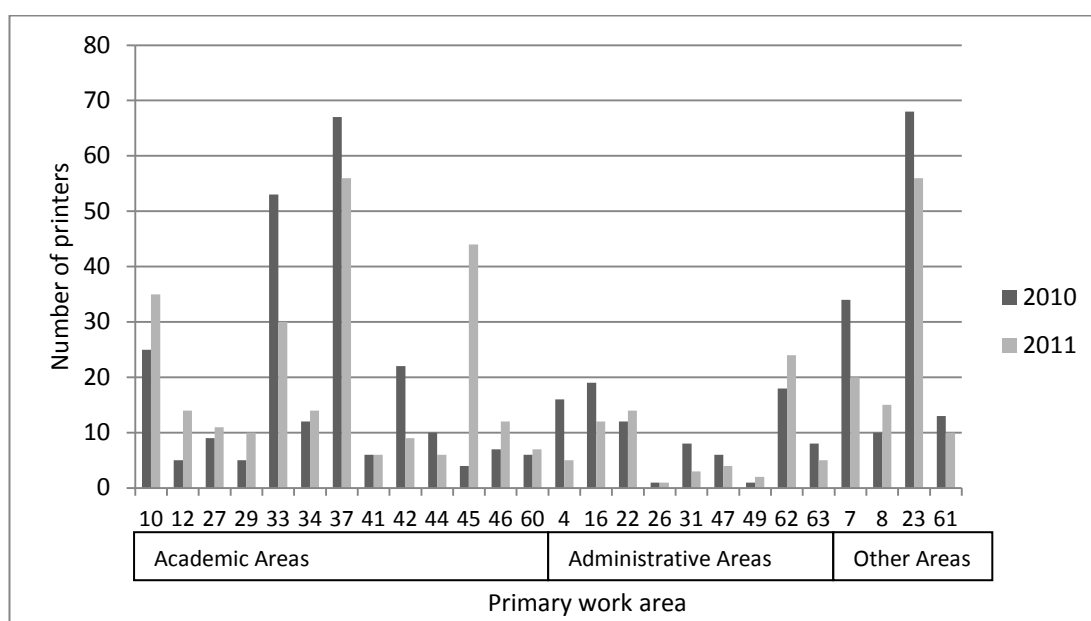


Figure 10: Number of printers in each primary work area for 2010 and 2011

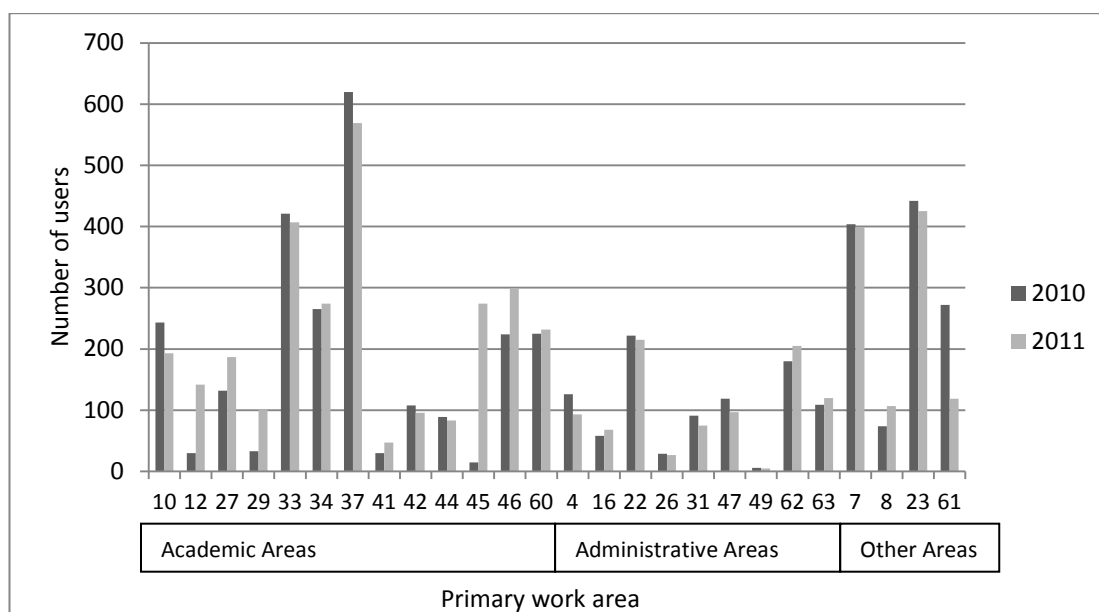


Figure 11: Number of users in each primary work area in 2010 and 2011

The average number of users per primary work area in 2010 was one hundred and seventy-six and in 2011 it was one hundred and eighty-seven. Figure 11 reveals that primary work areas 23 (administrative work area), 33 and 37 (academic work areas), and primary work area 07 (the unknown work area) had close to or above four hundred users which was well above the average. Primary work areas 10, 22, 34, 45 (2011 only), 46, 60, 61 (2010 only), 62 (2011 only) also had above average numbers of users.

When comparing primary work areas across each of these Figures (Figures 9, 10 and 11) it can be seen that some work areas with a high number of printers and high number of users also have a high number of clicks (e.g. Work areas 23 and 37). However this is not always the case, for example primary work area 46 had a high number of users but a lower number of printers and lower number of clicks.

Each work area was also reviewed with a focus on the work load of the printers within each primary work area. The data was examined to determine the number of users associated with each printer within the primary work area, how many clicks were printed by the printers within the primary work area and how many jobs were sent to the printers within the primary work area. Results are show in Figures 12, 13 and 14.

The number of users per printer gives an indication of the number of people using the printers within the primary work area. The average number of users per printer for each primary work area is thirteen in 2010 and fifteen in 2011.

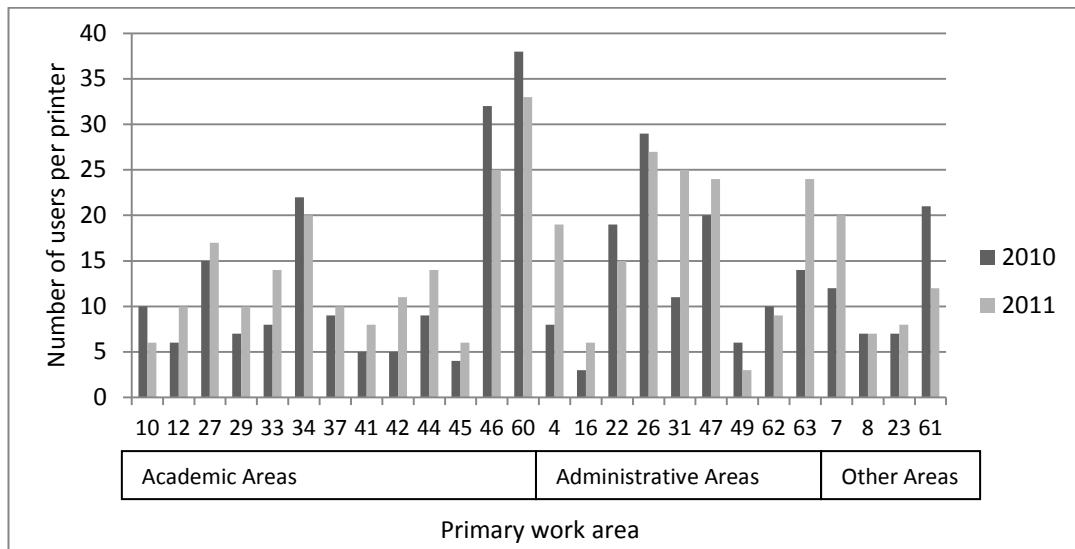


Figure 12: Number of users per printer within each primary work area

Figure 12 reveals that primary work areas 22, 26, 47 and 61 (administrative work areas), and 27, 34, 46 and 60 (academic work area) have above average number of users per printer in both years. Primary work area 4, 31, and 63 (administrative work areas) and 7 (unknown work area) have above average users per printer in 2011 only. Work areas 26, 46 and 60 have a high number of users per printer; however as can be seen in Figure 9 these work areas do not have a high total number of clicks.

The number of clicks per printer provides an indication of the volume of printing being conducted by the printers within the work area. The average number of clicks per printer in 2010 for each primary work area is 24,432 and the average number of clicks per printer for each primary work area in 2011 is 35,603.

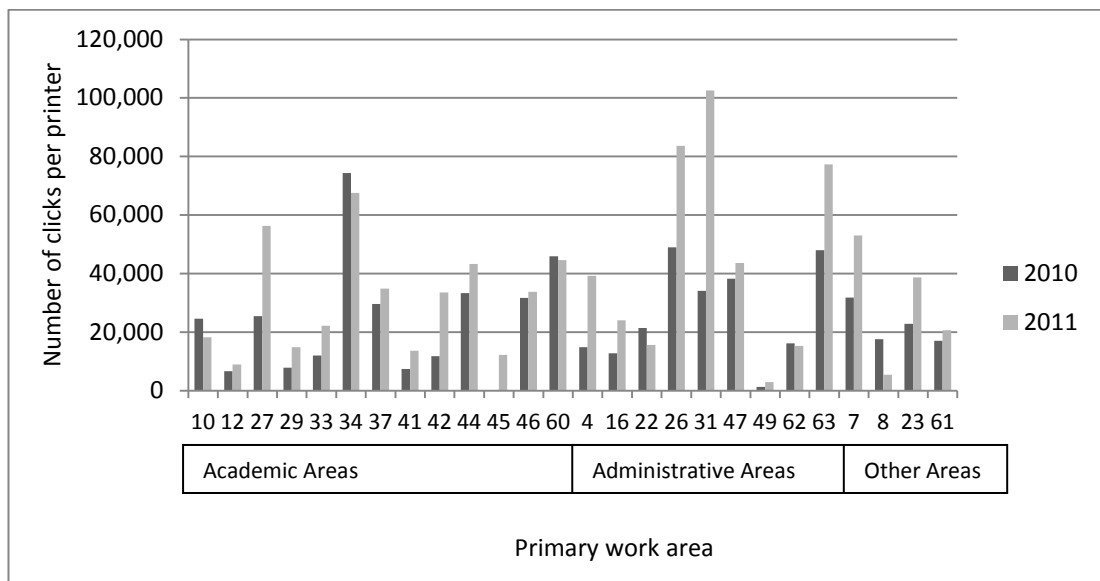


Figure 13: Number of clicks per printer within each work area

Figure 13 reveals that in primary work area 7 (unknown work area), primary work areas 26, 31, 47 and 63 (administrative area) and primary work areas 27, 34, 44 and 60 (academic areas) have above average clicks per printer. Primary work areas 10, 37, 46 (academic work areas) have above average number of clicks per printer in 2010 only.

The number of jobs per printer for each work area provides an indication of the number of documents sent to each printer within the work area. The average number of jobs per printer is 7,467 in 2010 and 6,914 in 2011. Figure 14 shows that primary work area 23 (administrative area) and 37 (academic area) have well above the average number of jobs per printer in 2010, and primary work area 31 (administrative area) has well above the average number of jobs per printer in 2011. Work areas were also reviewed with a focus on the printing generated by the user.

Figures 15, 16 and 17 show the number of clicks per user, the number of print jobs per user and number of clicks per job for each work area. The number of clicks per user provides an indication of the volume of printing conducted by each user within the work area. The average number of clicks per user for each work area was 2,039 in 2010 and 2,420 in 2011. Primary work area 7 (unknown work area), 10, 16, 34, 37, 42 and 44 (academic work areas) and 23, 31, and 63 (administrative work areas)

had above average number of clicks per user in 2010 and 2011. Primary work area 26 and 27 (academic work areas) had above average number of clicks per user in 2011 only.

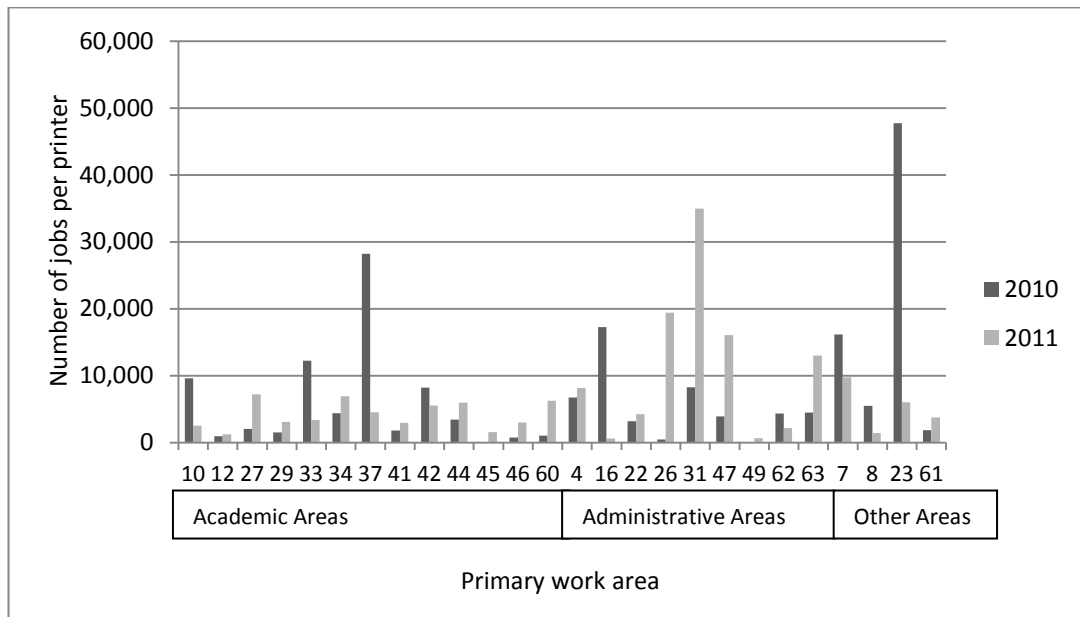


Figure 14: Number of jobs per printer for each work area

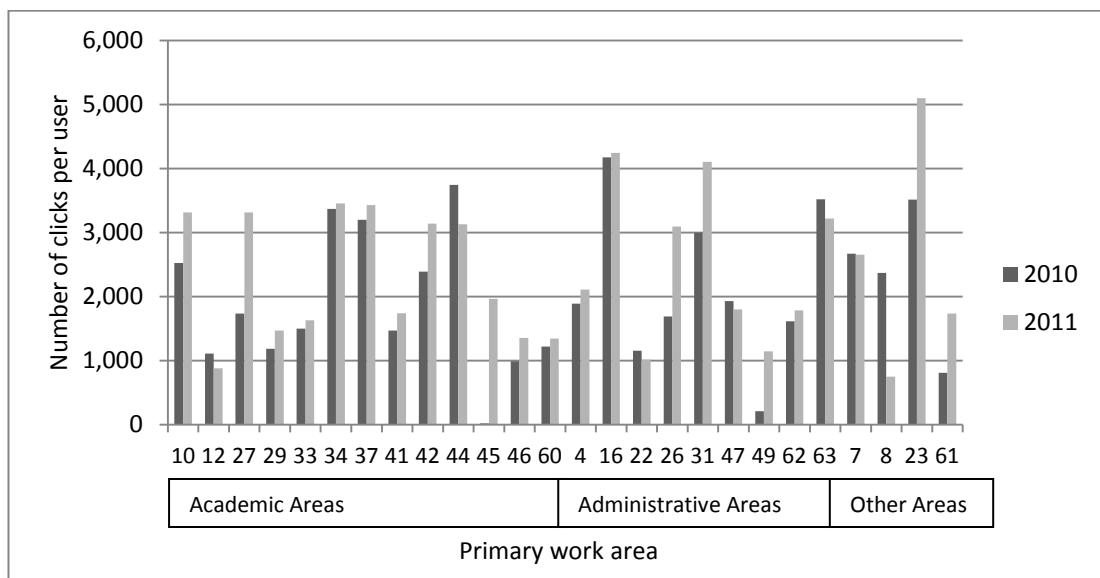


Figure 15: Number of clicks per user for each work area

The number of jobs per user provides an indication of the number of print documents the users within a work area send to a printer.

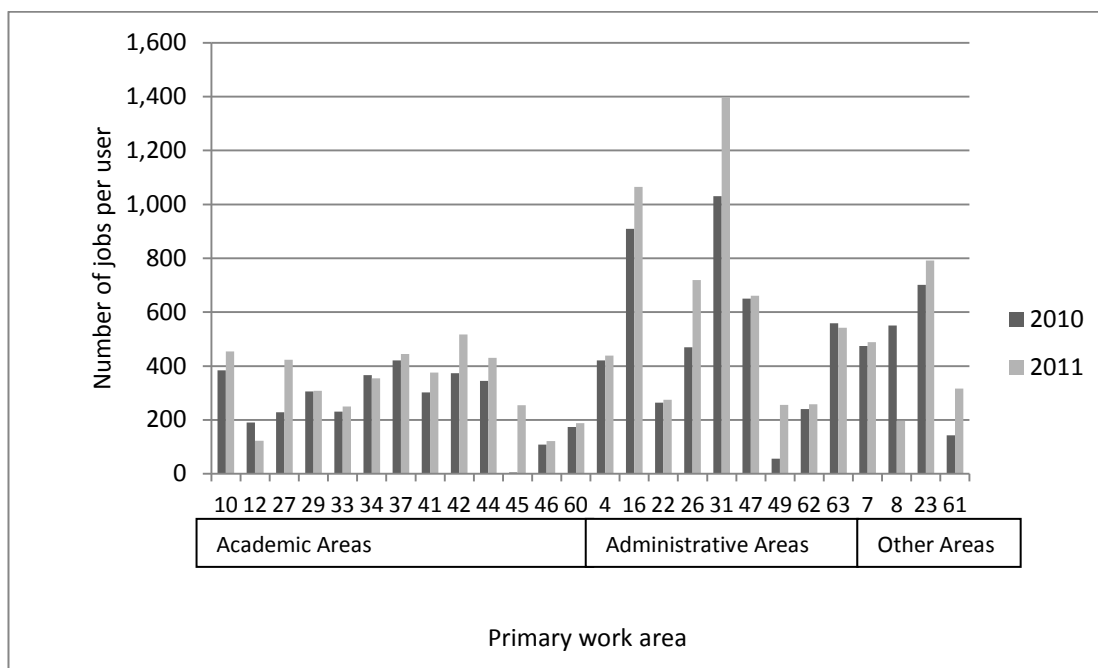


Figure 16: Number of jobs per user for each work area

As shown in Figure 16 the average number of jobs per user for each work area in 2010 was three hundred and eighty-one, and in 2011 the average jobs per user for each work area was four hundred and forty-eight. Areas with above average number of jobs per user in 2010 and 2011 were primary work areas 7 (unknown work area), 16 and 26 (academic work areas) and 23, 31, 47 and 63 (administrative work areas). Areas with above average number of jobs per user in 2010 only were primary work areas 4, 10, 37 (academic work areas). Primary work area 42 (academic work area) had above average number of jobs per user in 2011 only.

The total number of clicks per job provides an indication of the total amount of pages printed in the print jobs sent to the printers by the users in each work area. It is likely that the total number of clicks per job for each work area would be used to measure and monitor print usage by UOW management. The average number of clicks per print job for each work area in both 2010 and 2011 was six. In relation to actual paper used this could be six sheets of A4 paper single-sided, or three A4 sheets if double-sided. As seen in Figure 17, primary work areas 10, 27, 33, 34, 37, 44, 46 and 60 (academic work areas) and 62 (administrative work area) had above average clicks per print job (in both 2010 and 2011) and primary work areas 12 and 45 (academic work area) had above average clicks per print job in 2011 only.

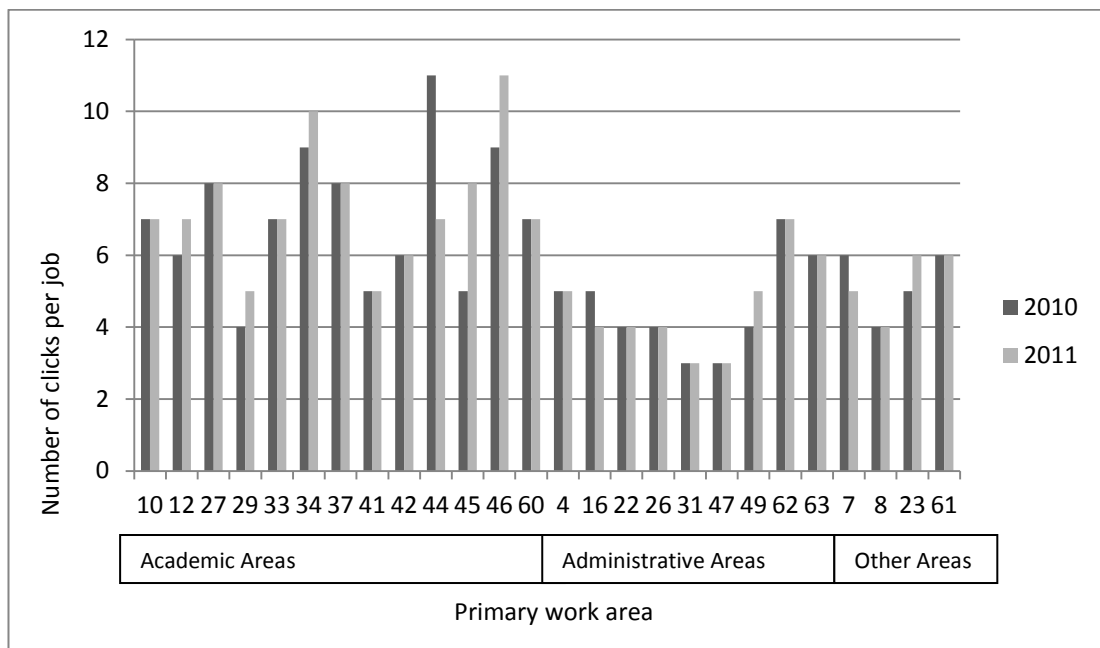


Figure 17: Number of clicks per job for each work area

The number of clicks and jobs within a work area varies quite a lot between users and between work areas. A work area with a smaller number of clicks per job does not necessarily indicate that smaller documents are always printed in the work area, or that larger documents are always printed in work areas with higher number of clicks per job. This is demonstrated in Figure 18 and 19 where the total clicks and total jobs for each user in work areas 23 and 37 are shown for 2011. As can be seen in Figure 17, primary work area 23 had below average total clicks per job. Figure 18 demonstrates that the majority of users in work area 23 during 2011 printed under 3,000 jobs and under 26,000 clicks and that there is a weak positive correlation between the number of jobs and number of clicks within this work area. There are also a few outliers; one user has a low total number of jobs (ten) but a very high total number of clicks (257,310). Assuming that the printing conducted for this outlier was conducted double-sided and using A4 paper, then the amount of paper consumed by that individual user equates to approximately two hundred and fifty-seven reams consumed in ten print jobs during 2011. Another user has a high number of jobs (9,659) compared to the other users in the work area and also a high number of clicks (84,817). Again if we assume that the printing conducted by this user was conducted double-sided using A4 paper then this user consumed eighty-five reams of A4 paper in 9,659 print jobs during 2011. Whether these represent an error in the data or actual print use is unknown.

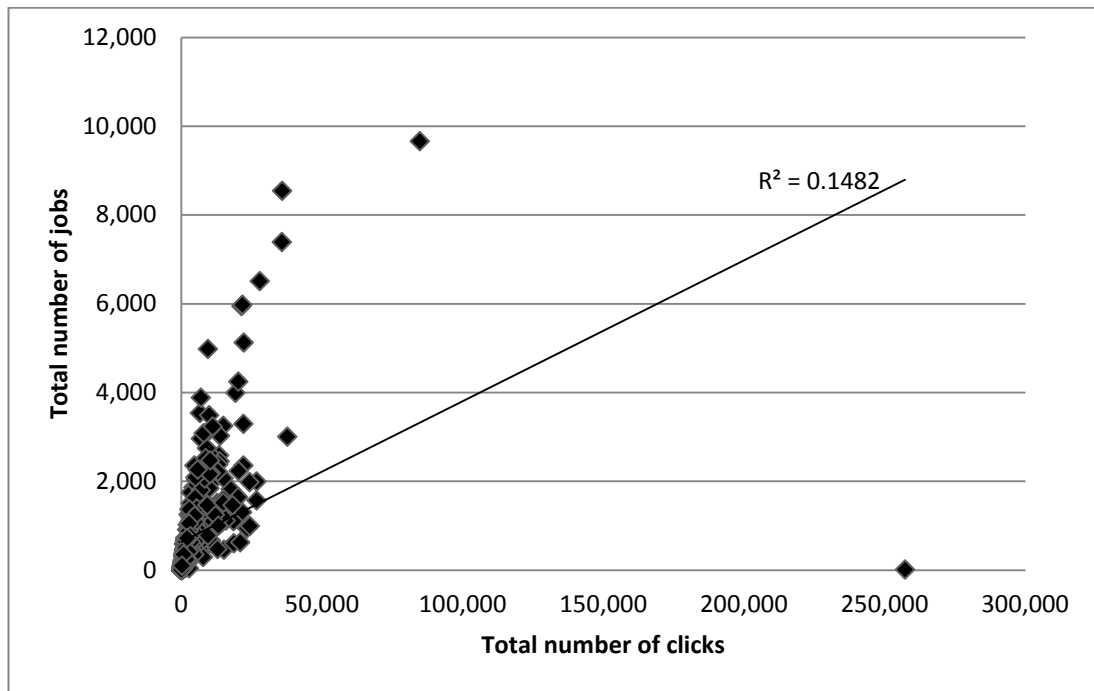


Figure 18: Total clicks and total jobs for each user in work area 23 in 2011

Work area 37 had above average total clicks per job (Figure 17). Figure 19 demonstrates that there is a range of total clicks and total jobs conducted by users in the work area during 2011 but there was a stronger positive relationship between the number of jobs and number of clicks by the users in this work area.

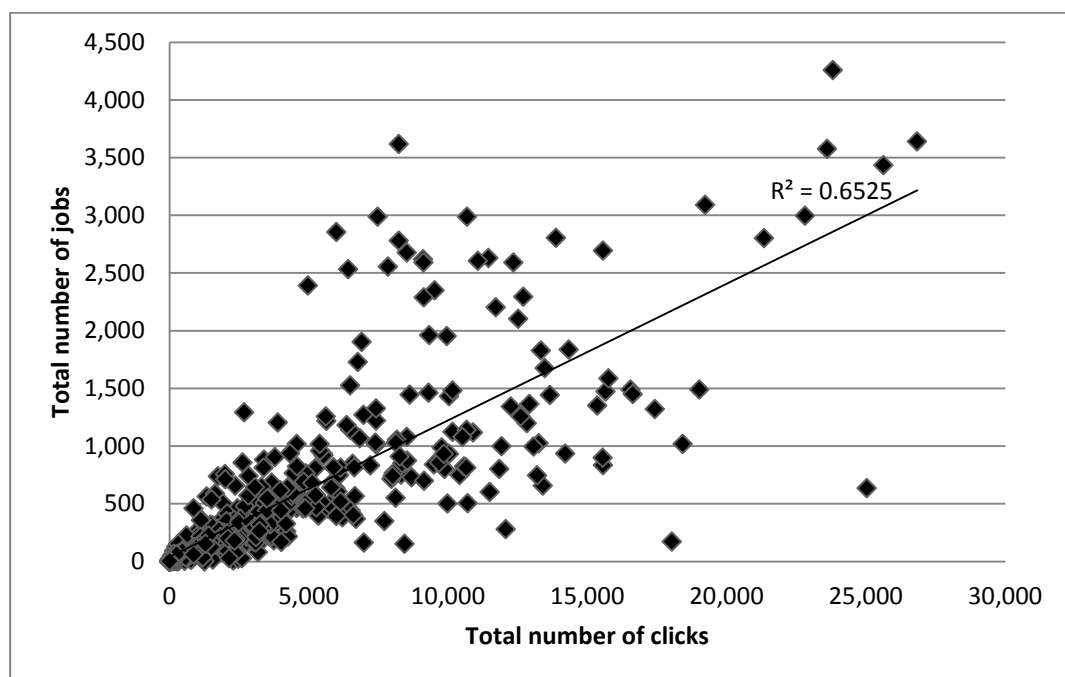


Figure 19: Total clicks and total jobs by each user in work area 37 in 2011

It is also important to note that the actual number of clicks for each print job by each user is not available within the data provided. The data provides a total for the year only for each user. It is therefore not possible to undertake an analysis of the size of the documents being printed within each work area by the users to determine the frequency of printing of smaller sized or larger sized documents.

The data was also analysed to see if there was a relationship between the number of number of printers and number of clicks in work areas (Figure 20). It is expected that the more printers there are in a work area then the more printing would be conducted. As revealed in Figure 20 there is a positive correlation between the number of printers and number of clicks. Work areas with more printers are more likely to have more clicks, however this is not always the case as some work areas had equivalent number of clicks but more printers than other work areas.

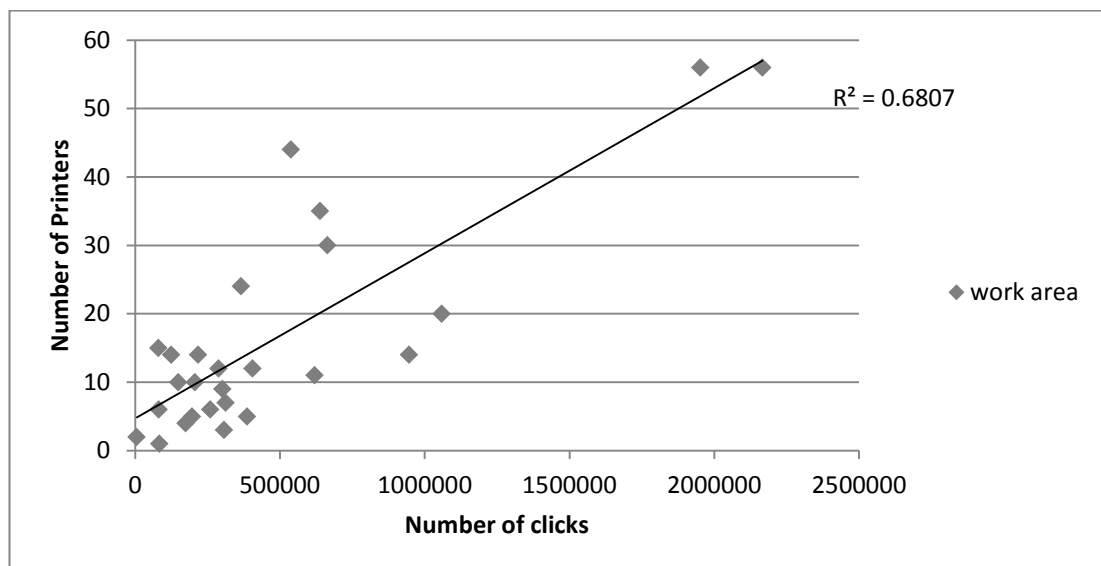


Figure 20: Relationship between number of printers and number of clicks in 2011

It is also expected that more printers would be provided in work areas with more users and the data was analysed to confirm if this is the case. As revealed in Figure 21 there is a positive correlation between the number of printers and number of users. Work areas with more users are likely to have more printers. However, some work areas with a similar number of users had a difference of approximately twenty printers. This may be due to the nature of the work area in terms of spatial location making more printers necessary.

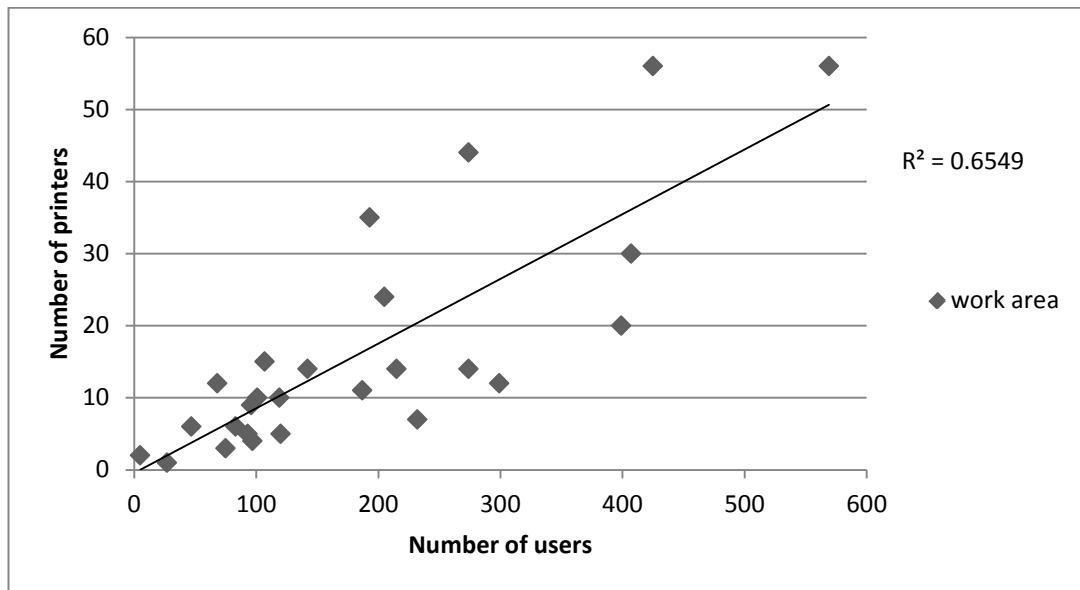


Figure 21: Relationship between number of users and number of printers in 2011

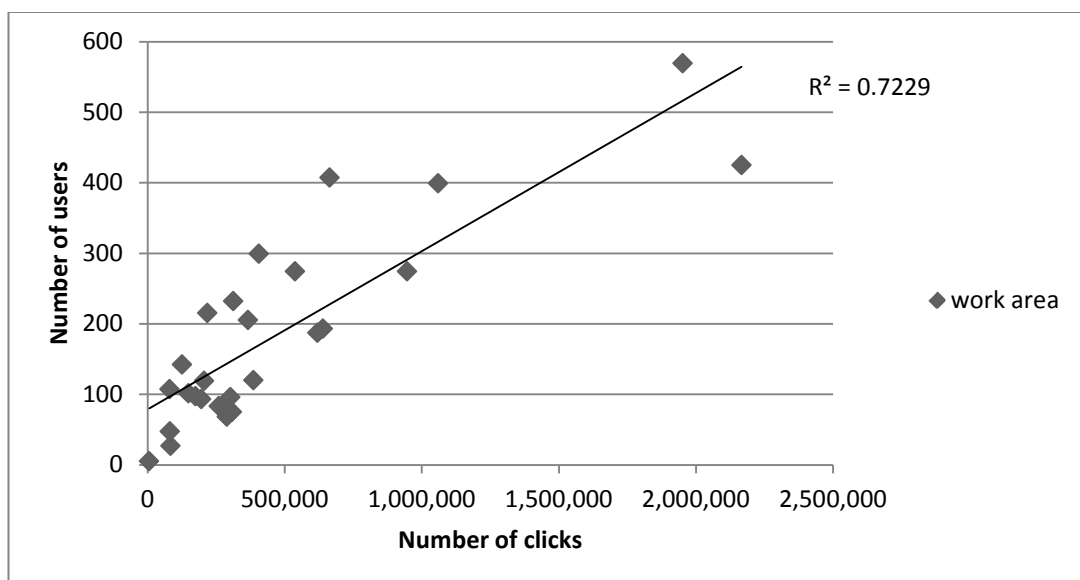


Figure 22: Relationship between the number of clicks and number of users in 2011

It is also expected that the more users and more print jobs conducted in a work area then the more clicks there would be. Figure 22 reveals that there is a positive correlation between the number of clicks and number of users for work areas in 2011. However, in some work areas with similar numbers of clicks there is a difference of approximately two hundred users. This difference may be due to the types of tasks conducted by the users of these work areas.

Figure 23 reveals that there is also a positive correlation between the number of clicks and number of jobs conducted in 2011. Work areas with more clicks are likely to have conducted more print jobs.

An analysis based on the type of work area was also conducted for the 2011 data in order to determine if there is any relationship between the type of work area and the amount of printing conducted. This analysis indicated that there was a positive relationship between the number of clicks and the number of jobs for the different work area types (academic, administrative and other) as shown in Figure 24. However, there was a stronger correlation between clicks and jobs in academic work areas than in administrative work areas. There was also a strong positive relationship between the number of clicks and jobs within the other work area category (which includes UOW controlled entities and student accommodation services).

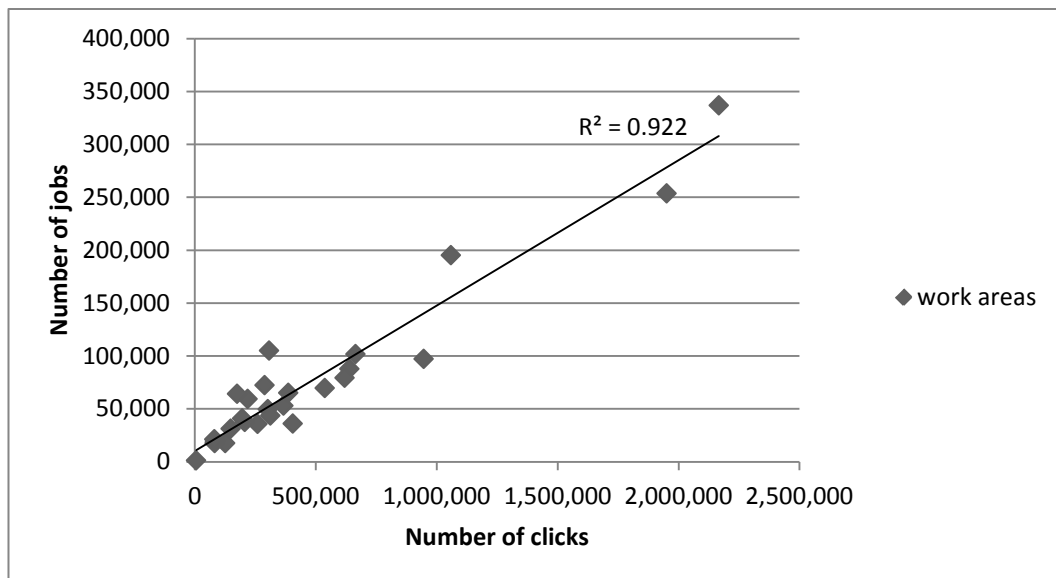


Figure 23: Relationship between the number of jobs and number of clicks in 2011

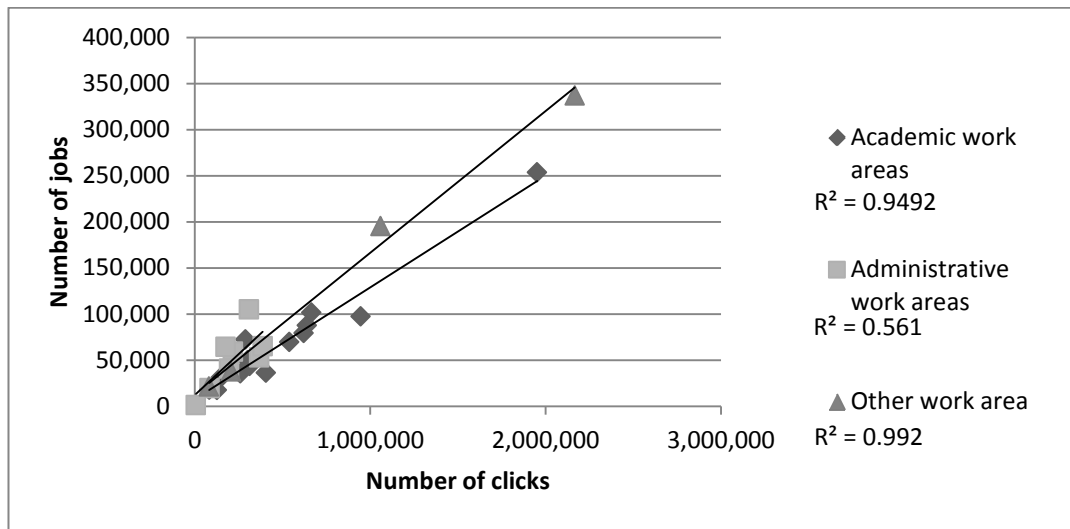


Figure 24: Relationship between number of jobs and number of clicks in 2011 based on work area types

Print usage data in 2011 was provided for each month. Figure 25 shows number of clicks per month during the 2011 year with the number of clicks increasing during the first few months of the year and peaking in April with 1,800,000 clicks. The number of clicks then decreases between April and June. The number of clicks then increases to another peak in August. The number of clicks again reduces between August and September and slightly increases from September to October then reduces to the end of the year.

Figure 25 provides an indication of print volumes through the year and shows that in 2011 a larger volume of printing is conducted in April (just before recess and exams) and again in August (when spring session commences). A lower volume of printing is being conducted in December and January when there are fewer students and staff on campus. The increase in print volume in February seems to coincide with the start of session.

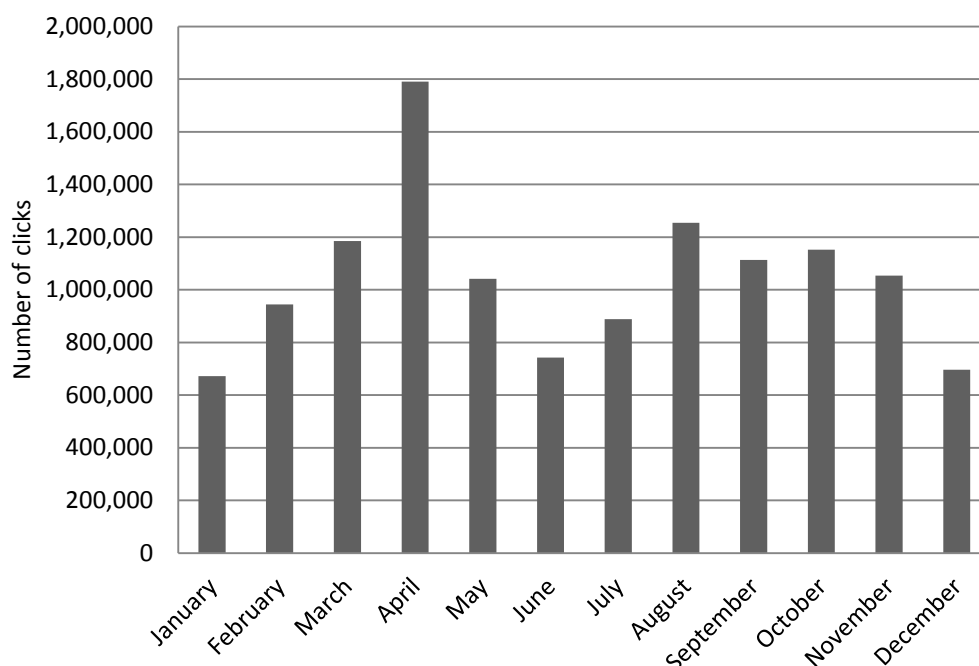


Figure 25: Number of clicks per month for 2011

3.1.4 Copy usage data

Copying conducted at BMS managed printers is not able to be tracked to user. Each work area is billed for the copying tasks conducted on BMS managed devices. However, data on copying conducted at each printer was unable to be provided by ITS.

3.2 Paper leaving the university as waste or recycling

Waste data was obtained from the Facilities Management Division to determine the amount of paper leaving UOW. This data was from two different sources and covers Wollongong Campus only:

- Waste audit of Wollongong Campus in 2009; and
- Yearly waste collection data for the Confidential and Paper bins (from Wollongong Campus).

3.2.1 Waste audit data

A UOW Wollongong Campus waste audit was conducted in 2009 (in late May to early June) and the data from this audit was provided by the UOW Environment

Unit for use in this study. This waste audit data was reviewed to determine the quantity of office paper disposed of and which type of bin it was disposed in. The results are shown in Table 9.

Table 9: Quantity of office paper disposed at Wollongong Campus

Bin Type	Kg/week of office paper	% of total paper disposed	Paper as a % of waste disposed in the bin
Comingled recycling bin (recycling)	24	1	3
Paper bin (recycling)	741	43	72
Confidential bin (recycling)	857	37	99
Mixed waste bin (landfill)	377	19	6
Total	1,999	100%	22%

The 2009 waste audit results indicate that:

- Office paper made up twenty-two percent (22%) of the total waste disposed (9,286 kg) of at Wollongong Campus via the different waste and recycling streams; and
- A total of 1,999kg (eight hundred reams) per week of office paper was disposed of at Wollongong Campus. This amount equates to 41,578 reams per year (assuming that the audit weekly results are representative of a yearly total).

This data also indicates that at that time, most office paper was disposed of via a type of recycling bin with forty-three percent (43%) being disposed in a Paper bin, thirty-seven percent (37%) disposed in a Confidential bin and one percent (1%) going in a Comingled recycling bin. Nineteen percent (19%) of office paper was being placed in a Mixed waste bin and the contents of these bins are sent to landfill. This equates to approximately 7,900 reams worth of paper being disposed to landfill at UOW Wollongong Campus during 2009.

Based on knowledge of the organisation, it is likely that this breakdown of the disposal methods will have changed significantly since then, due to a new office-based recycling model that was introduced in the later part of 2009 at Wollongong Campus. This office-based recycling model has provided a Comingled recycling bin at every desk (whereas before it was a Mixed waste bin with no recycling available at the desk) and either a Mixed waste bin (shared amongst a number of desks) or a smaller individual Mixed waste bin for every desk. The Paper bins and Confidential bins provided were not changed. It is likely that most paper is still disposed of via the Paper and Confidential bins but the proportion of paper disposed of via the recycling bin will have increased. This assumption cannot be confirmed until another audit is conducted at Wollongong Campus.

3.2.2 Waste collection data

Data is collected by UOW Facilities Management Division for the Wollongong Campus on the number of bins serviced by the waste contractor and also the estimated weight of these bins. This data is shown in Table 10 and shows the approximate amount of paper that would have been disposed via the Paper and Confidential bins as a yearly total.

Table 10: Wollongong Campus waste disposed via Paper and Confidential bins

Year	Paper (blue) Bins (kg)	Confidential (red) Bins (kg)	Total Weight (kg)
2010	30,702	19,053	49,755
2011	33,199	19,332	52,531
2012	47,961	20,976	68,937

The waste audit results in 2009, indicated office paper made up seventy-three percent (73%) of the contents of the Paper bins and ninety-nine percent (99%) of the Confidential bins. Assuming these proportions are correct for 2010, then the total amount of office paper disposed in the paper bin in 2010 was 22,320kg and the total amount of office paper disposed of in Confidential bin in 2010 was 18,843kg. This means that a total of 41,164kg of office paper was disposed in 2010 via both the Confidential and Paper bins. The 2009 waste audit also indicated that eighty percent (80%) of paper that was disposed of from Wollongong Campus was placed

in the Paper bins (forty-three percent, 43%) and the Confidential bin (thirty-seven percent, 37%). Based on these percentages the total paper disposed during 2010 was actually 51,454kg ($[20 \times 41164 / 80] + 41164$) or 20,582 reams. Comparing this to the paper purchase data figures from 2010 (Table 4: 36,014 reams) the paper disposed in 2010 equates to approximately fifty-seven percent (57%) of volume of the A4 paper that was purchased during 2010 was disposed during 2010.

3.3 Context to the paper coming into and leaving the university

3.3.1 Staff interview data

Interviews were conducted to provide context the amounts of paper coming into and leaving UOW. During 2012, five interviews were conducted with staff who purchase office paper for their work areas. These were all staff in administrative type roles from Division, Faculty, School and Unit level areas. Additional interviews would have been beneficial and helped to improve purchase and print data accuracy and provided a broader sense around the context and issues associated with paper use at UOW. However, due to ethics requirements of this study all staff who participated in the survey did so voluntarily and required manager approval. Calls for interviews were also conducted during a time of upheaval for some work areas as the faculty restructure review was underway and this is likely to have caused limited interest in participation in the interviews.

Staff interviewed were from primary work areas 33 (two interviewed within this primary work area were from separate secondary level work areas), 42, 47 and 63. Interviews covered a range of work areas at UOW, with two from administration areas and three from academic areas. A copy of the interview questions are provided in Appendix 5.

A summary of the results relating to the paper purchasing and type and price of paper purchased are provided in Table 11.

Table 11: Summary of paper purchase responses

	Number of respondents (out of 5)
Purchase via UOW Printery	4
Purchase via Corporate Express	1
Aware of current paper product purchased	2
Aware of price per ream of paper purchased	1
Kept local records of paper purchased	2
Purchased recycled-content paper products	2
Purchased carbon neutral paper products	4

Four respondents purchased their paper via UOW Printery, and the remaining respondent purchasing their paper from Corporate Express.

None of those who purchased paper via the UOW Printery were aware of the price per ream of paper that these work areas paid. They were also unable to recall the type of paper they purchased. The respondents each checked on the type of paper stock that they had in the office to provide that information either just prior to, or during the interview. In contrast, the respondent who purchased via Corporate Express was aware of the price they paid and also the paper product that was purchased.

Only two respondents kept separate records of the paper purchasing for their work area and were readily able to provide information on the history of their paper ordering. No other work areas kept records on their purchasing activity other than the financial documents and processes which were available by searching the financial system. The reason provided for keeping separate records on paper purchased related to tracking and monitoring purchases and being able to readily find information on paper purchases rather than having to search via the financial system.

One work area currently purchased recycled-content paper, and an additional work area had purchased recycled-content in the past but no longer did so because they had switched from ordering via Corporate Express to the UOW Printery in the last 12 months, and the standard paper supplied by the UOW Printery is not recycled-content. Four work areas purchased via the UOW Printery, whose standard paper supply was carbon neutral (at the time of interview in 2012). It should be noted that the paper supplied by the UOW Printery changed sometime during late 2011 to early 2012 as the paper product became accredited under the National Carbon Offset Scheme.

Staff were also asked about their willingness to trial either recycled-content or carbon neutral paper products (if they did not use these already). Respondents from work areas that did not currently purchase recycled-content (four work areas) would be prepared to trial the use of recycled-content in their work areas. One respondent stated that a business case would be needed to demonstrate the cost benefit of purchasing any paper products that are different to their current purchasing in order to promote the change to senior management. Respondents from these work areas also stated that they would not be prepared to pay any more than they were currently paying for the purchase of recycled-content paper instead of their current paper type. However, it should be noted that these respondents all stated that they were not aware of the current price they are paying for their current paper type.

One respondent identified problems with the use of recycled-content paper. This respondent currently purchased recycled-content in their work area. This respondent stated that they had experienced a problem with one hundred percent (100%) recycled-content paper as it tended to jam the print and copy devices. So they now purchased eighty percent (80%) recycled-content to avoid this problem. They also wanted to purchase an Australian made product and there was no one hundred percent (100%) recycled-content paper on the market made in Australia at the time of the interview.

The respondent who purchased recycled-content paper stated they had done so for five years and that the reason for choosing recycled-content paper was to make a difference, for environmental benefits and to set an example to other work areas.

Carbon neutral paper was purchased by four of the respondents, as this was the type of paper provided by UOW Printery. The respondent who currently did not purchase carbon neutral paper would be willing to trial it. The factors that would encourage them to purchase carbon neutral would be if the environmental benefits were better than other paper options. They were also unsure of what carbon neutral actually meant and this would need to be communicated before they would be able to make a decision or be encouraged to purchase this paper. Those respondents who already purchase carbon neutral paper stated that they had done so for approximately one year and that the only reason for choosing carbon neutral paper was because it was the paper now supplied by UOW Printery.

For each interview, the paper purchasing and print data records for that work area were reviewed and discussed (when available) as part of the interview to assist with determining the accuracy and representativeness of the data, identify trends and provide context to the data. The results are described in more detail for each work area.

Primary work area 33 (academic work area)

According to the UOW organisational charts, primary work area 33 was made up of fifteen secondary work areas. However, many of the secondary work areas were research centres and the paper purchases and print usage data may fall within one of three secondary work areas. Total A4 paper purchases for primary work area 33 was 1,778 reams in 2010 and 1,538 reams in 2011 and the number of printers identified for this primary work area was thirty-five in 2010 and twenty-nine in 2011. Two interview respondents were from two of these secondary work areas, 33179 and 33180 and their responses on print and purchase demand from these work areas are described below.

Secondary work area 33179

Purchase data for secondary work area 33179 indicates that it purchased seven hundred and eighty-eight A4 reams in 2010 and seven hundred and five A4 reams in 2011. The respondent from secondary work area 33179 was able to identify that the purchasing data for their area was accurate as they did keep records of their purchases. The respondent attributed the decrease in paper usage from 2010 to 2011 to documents such as subject outlines and practical notes being sent to UOW Printery to be copied rather than being printed at the local printers.

The respondent was able to identify that there were twenty-six printers in their area on the BMS system and an additional four printers that were not and that the paper purchased serviced all those printers. They also identified that the high use printers were those that were able to print in colour. The respondent was unable to identify the number of people who use the paper within their work area.

It is interesting to note that a manager in their area had raised concerns in the past about the heavy use of a particular printer in the work area from time to time. Investigation was conducted and it was found to be due to it being used on weekends for personal use. Corrective action was taken as a result.

Secondary work area 33180

As identified in the paper purchase data, the secondary work area 33180 purchased one hundred and sixty reams of A4 paper in 2010 and one hundred and thirty reams in 2011. The respondent from secondary work area 33180 was unable to confirm that the quantities of paper purchased from the purchasing data were accurate, as they did not keep records on the amounts of paper being purchased. However, the respondent indicated that the paper usage was consistent throughout the year as they order the same amount on a regular basis.

The respondent indicated that two printers were used in this secondary work area and were covered by the paper purchased; this had recently increased with the addition of one printer. The respondent was also able to identify that there are

approximately eleven staff and an unknown number of students using the printers in that work area.

A subsequent review of the paper purchase and print data was conducted to determine the accuracy of primary work area 33's purchases and print demand. On reviewing the purchase data for primary work area 33 it was found to cover only three (3) secondary work areas (two that were interviewed and one other). It is not clear whether all purchasing data for this entire work area has been identified as a result. Many of the secondary work areas were research centres and the paper purchases are likely to fall within one of three secondary work areas but this is not able to be confirmed. The other secondary work areas identified in the organisational charts may be purchasing paper via other procurement means. As a result of this information it is likely that the total purchase quantities and per person analysis for this work area (as quoted in Section 3.1.1) may not be accurate. A review of the print data indicated it was also not clear whether printers from all three secondary work areas were included in the primary work area print usage data. Interviews with the other secondary work areas would greatly assist and address the data gaps identified for this primary work area.

Primary work area 42 (academic based)

This primary work area is made up of a total of eleven of secondary work areas according to the organisational charts and an interview was conducted with a respondent from one of these secondary work areas, 4279. In 2010 primary work area 42 purchased 1,724 A4 reams and 1,475 A4 reams in 2011 and according to the print usage data the primary work area had twenty-two printers in 2010 and nine printers in 2011.

Secondary work area 4279

Paper purchased for primary work area 42 was not allocated to any secondary work areas within the purchase data. As a result the primary work area's data was presented and discussed at the interview. The respondent from secondary work area 4279 did not keep accurate records of purchases but, they did indicate that they

purchase about ten boxes every two months which is about three hundred reams a year.

During the interview it was identified that the paper purchased was used to supply three printers and these were all BMS managed. An additional eleven printers were identified within the primary work area from the UOW print usage data. The respondent also indicated that there were printers on staff desks that would not appear in this data. They also identified that there were printers within their primary work area that were PIN operated for copying.

The respondent was unable to identify the number of people who use the paper that is purchased within their work area. However, they were able to identify that there was a primary work area policy to have prints and copies over two hundred pages to be conducted by the UOW Printery and that this policy was enforced.

Based on this information it is clear that for primary work area 42 there were other secondary work area purchases that appear in the paper purchase data. It is also clear that there is a gap in the total amount of paper used as some is being copied via UOW Printery and no data is available for this aspect of paper use. The interview was also able to clarify that there are other printers in use within this work area that do not appear in the BMS data.

Primary work area 47 (administrative area)

Paper purchasing data for primary work area 47 indicated that four hundred and twenty A4 reams were purchased in 2010 and four hundred and thirty A4 reams was purchased in 2011. The respondent from work area 47 was able to confirm that the quantities of paper purchased from the purchasing data were reasonably accurate, as they kept records on the amounts of paper being purchased. Monthly based purchase data indicated that there was a slight variation in the order records kept by the respondent for each month compared to the purchase data. This variation was minor, and on review of the data and further discussion the respondent considered that this was due to the purchase data records being based on when the order was dispatched or paid for and the respondent's records were based

on when the order was made. The respondent also indicated that the paper usage was consistent throughout the year as ordering had not varied month by month, however they were able to identify an increase in A3 paper purchases as being a result of a special task that was required during 2011.

Five printers were identified as being used in this work area and covered by the paper purchasing. The print usage data identified six printers and on review it was clear that one printer was located in another work area and not relevant to primary work area 47 and the paper purchasing conducted by the respondent did not include the supply of paper to this printer.

They were able to identify that approximately fifty-two people used the paper that they purchased. This corresponds well with the UOW person data for this work area indicating that the purchase quantities per person calculated for this work area are very accurate.

Work area 63 (administrative work area)

Paper purchase data (Section 3.1.1) indicates that primary work area 63 purchased eight hundred and ninety-nine reams of A4 paper in 2010 and seven hundred and ninety reams during 2011. The respondent from primary work area 63 was unable to confirm that these quantities of paper purchased from the purchasing data were accurate, as no records were kept on the amounts of paper being purchased by the respondent. However, the respondent stated that the purchase quantities per order were fairly consistent (approximately six boxes at a time and that these would last about two to three weeks on average), but this varied according to peak session times including enrolment, orientation, graduation and exam periods.

The respondent was also able to identify that some copying tasks had been shifted from in house to being done at the UOW Printery, and that this may have been the reason for the reduction in paper purchases in that work area from 2010 to 2011. The reason for this shift was that it was quicker to send those copying tasks to the UOW Printery rather than do them in-house.

The respondent confirmed that this primary work area was made up of several secondary work areas and that one secondary work area (6310) was not covered by the purchasing conducted by the respondent. On subsequent review of the purchasing data (after the interview) it was confirmed that there was no purchase data for this secondary work area (6310). When asked how many printers the paper they purchase supplied, this respondent stated that the paper they purchased was used in two printers. However, when shown the list of printers from the print data they were able to identify that four printers on the list were relevant for that work area (and an additional five printers were identified as not covered by the purchasing of the respondent, as they were from the secondary work area already identified as being excluded). The respondent was unable to quantify the number of people who would use the paper purchased for their work area. As a result clarification of the UOW person data and the print user data for this work area was unable to be made.

The respondent was able to identify peak times in print usage which reflected the work tasks conducted by that work area throughout the year and this roughly matches the print usage monthly trends for this work area in 2011 as shown in Figure 26. In particular the increase in usage matches the start of session and orientation and enrolment periods in March and in August.

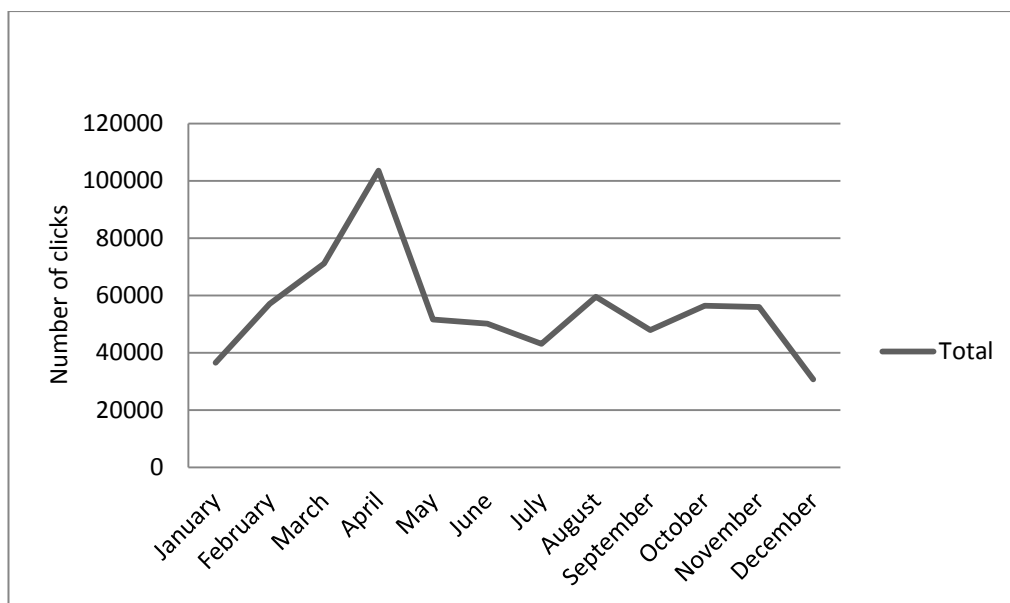


Figure 26: Monthly number of clicks in 2011 for work area 63

Questions related to paper consumption and knowledge of actions that contribute to paper waste and actions or behaviours that are relevant to the paper consumption within the work areas were asked during the interviews. The responses to questions regarding respondent's knowledge on paper waste, frequency of double-sided print and copy, and papers printed or copied and left uncollected are shown in Tables 12, 13 and 14.

Table 12: Knowledge of the amount of paper wasted in work areas

Based on your knowledge of your area, do you consider that there is Very High/High/Average/Low/Very Low amount of paper being wasted in your area?	Number of responses (out of 5)
Very High	0
High	1
Average	2
Low	2
Very Low	0

As can be seen in Table 12, there is a perception that an average or low amount of paper is being wasted by the majority of those interviewed. Only one respondent stated that there was high amount of paper wasted in their work area.

Table 13: Knowledge on frequency of double-sided print or copying

Based on your knowledge of your area, do staff and students Always/Mostly/Occasionally/Never print or photocopy double-sided?	Number of responses (out of five)
Always	0
Mostly	3
Occasionally	0
Never	0
Not answer the question but provided a comment instead	2

Respondents considered that double-sided printing or copying is mostly occurring (Table 13). Two respondents were unable to answer the question and instead one respondent indicated that double-sided print and copying occurred but it varied depending on the task. Scanning tasks were indicated as having printing conducted single-sided. This is because if pages are scanned that are a mix of double and

single-sided, the scanned file ends up with blank pages. The other respondent indicated that the default on the print and copy devices is double-sided for print but it is not double-sided for copying.

Table 14 reveals that most respondents considered that printed or copied documents were occasionally left at the printer with one respondent considering that it occurred mostly within their work area.

Table 14: Knowledge of papers printed or copied and left uncollected

Based on your knowledge of your area, do staff and students Always/Mostly/Occasionally/Never leave papers that were printed/copied uncollected?	Number of responses (out of 5)
Always	0
Mostly	1
Occasionally	4
Never	0

The final questions asked in the interviews were about actions or behaviours that are relevant to the paper consumption and any actions being conducted specifically to reduce paper use. Table 15 describes the types of activities and tasks and documents that the respondents provided in response to being asked about the activities and tasks that they considered to be responsible for the most paper being consumed.

The tasks or activities considered to be responsible for the most paper use as shown in Table 15, are diverse and reflect the work areas interviewed and the nature of the work conducted in those areas. Most responses were provided in terms of the types of documents produced. The work activities that these documents can be grouped into are event or project management, policy and procedure preparation, meetings, teaching, research, student communication, records management, staff recruitment and financial management. Many of these documents relate to knowledge type work (e.g. thesis preparation and journal printing, policy drafts) and many relate to administrative type work (e.g. draft correspondence, financial activities, forms, human resources documents, meetings agendas). Many of these types of activities occur within both academic and administrative areas (such as financial management and meetings), whereas others are specific to academic areas only (teaching and

Table 15: Task/activities considered responsible for the most paper being consumed

Based on your knowledge of your area, what activities/ tasks do you consider being responsible for the most paper consumed? (No.) – Number of respondents identifying this activity/task	
Agenda documents (3)	Graduation information (1)
Construction plans (1)	Human Resources activities (2)
Copying and scanning of forms and keeping them on file (1)	Human Resources notification letters (1)
Course notes (1)	Itinerary/travel documents (1)
Course guides (1)	Journal printing (1)
Student hand-outs (1)	Meeting minutes (3)
Draft correspondence (1)	Presentations (1)
Drafts of thesis (1)	Policy drafts (1)
Event preparation (1)	Recruitment documents (1)
Exam running sheets (1)	Rosters (1)
Exam timetable (1)	Student records (1)
Finance activities (3)	Security plans for every major event (1)
	Student communication (1)

research related activities) and administrative areas only (event and project management, procedure and policy preparation).

The barriers the respondents identified to reducing paper consumption are listed in Table 16. Many of these responses can be grouped into themes to do with lack of knowledge, habits and availability of alternatives.

The actions and activities the respondents considered to contribute to office paper waste are shown in Table 17. Many of these actions are consistent with the barriers identified in Table 16 and included lack of knowledge and awareness of printer defaults and operator errors, failure to collect prints as a result of habit, forgetfulness or poor organisation, lack of access to electronic alternatives for the processing of forms and lack of confidence in work process.

Table 16: Barriers to reducing paper consumption

Based on your knowledge of your area, what do you consider are the barriers to reducing paper consumption by staff and students in your area?
<p>Attending meetings with agenda documents, minutes and larger documents to review.</p> <p>Communication.</p> <p>Completion, tracking and authorisation of forms which are not all electronic.</p> <p>Lack of workflow.</p> <p>Doesn't seem to be an alternative way of doing some tasks.</p> <p>Education on, and availability of, alternatives.</p> <p>Habits.</p> <p>Lack of knowledge of paper consumption.</p> <p>Unaware of paper types and options.</p> <p>Lack of electronic devices used as alternative to paper.</p> <p>No accountability to hitting the print button.</p> <p>Organisation and preparation.</p> <p>Prints not being picked up straight away, other people put them in the recycle bin so the person needs to print it again.</p> <p>The repetition and printing of form copies down the chain (each area keeping a copy).</p> <p>Thinking differently.</p>

Table 17: Actions and activities considered to contribute to the amount of office paper waste

What are the common actions or activities that you are aware of in your area that contribute to the amount of office paper waste?
<p>When a new printer comes in it is a result of operator error and glitches in defaults that make the printouts to not be doubled-sided.</p> <p>Printing of journal articles as people do not like to read from the screen.</p> <p>Forgetting to pick up printed documents from the printer. In our area we try and give documents to them if there is a name on it. If not emails are sent out asking for people to collect the document, especially if it is a large print.</p> <p>People printing print jobs and not picking them up. Why are they printing if they are not collecting them? Are these documents not necessary?</p> <p>Not picking up printouts at the time of printing.</p> <p>Copies of documents being printed to keep on file. They are needed but there is no alternative available.</p> <p>The electronic records management system is not available across the organisation so this means that local copies are required to be kept here for future reference.</p>

Table 18 lists the actions as stated by respondents as being undertaken within the work area to reduce paper consumption.

Table 18: Actions being undertaken to reduce paper consumption

Based on your knowledge of your area, what are some of the things that staff or students are actively doing to reduce their paper consumption?
<p>Recycle trays for unwanted printouts.</p> <p>Having the paper in the cupboard out of sight and also they have to walk past me when they come to take it.</p> <p>People seem to think about it before they print and are more aware, such as reducing agendas and other documents being printed and double-sided printing as a default.</p> <p>Encouraged to scan.</p> <p>Reuse paper as scribble pads.</p> <p>Not aware of anything specifically. Don't print emails generally, not printing everything. There is awareness there.</p> <p>Won't print meeting papers will read electronic copy on devices, scanning onto intranet site so no copies printed for faculty meetings, try and do it as much electronically.</p>

The actions that respondents identified that were being done to reduce paper consumption (Table 18) included not printing emails, double-sided printing, not printing meeting documents and making documents accessible via electronic means. Having a tray near the printer for uncollected or unwanted prints was also identified as a paper reduction action as this allowed people to collect forgotten prints before they are placed in the recycling or waste bins.

Overall, the staff interviews were exceedingly helpful in providing information that assisted in determining accuracy and representativeness of the purchase and print demand in their work areas. Interviews were also very helpful in identifying some of the possible reasons for paper use within UOW. Interview responses also reflected the types of work tasks conducted in the work areas with some commonalities.

4 DISCUSSION

A number of improvements to data systems are required to fully comprehend the amount of paper the University of Wollongong (UOW) purchases and uses. Since this is a key finding of this study, rather than discussing the issues of data quality separately, this chapter has been structured so that it initially discusses the quality and limitations of the data obtained on the paper purchased, used and disposed. This chapter then focuses on the reasons and context for paper consumption in relation to what was found in this study and in the literature.

4.1 Paper coming into and being used by the university

4.1.1 Paper purchase data

As identified in the results, during 2010 and 2011 respectively, UOW purchased 36,014 A4 reams and 34,839 A4 reams. This is based on information obtained from three suppliers (UOW Printery, Corporate Express and Office Max). However, additional suppliers may also exist as centralised purchasing of office paper does not occur at the UOW and each work area purchases their own paper according to their own requirements. Preferred suppliers have been stipulated by UOW Financial Services Division but a review of the paper purchases from the three preferred suppliers indicated that not all work areas had paper purchases attributed to them. As a result, it is possible that not all paper purchases have been identified, or there are other data discrepancies (such as paper purchases being allocated to other work areas). Purchases of office paper using petty cash or credit card may also be occurring and these types of purchases are not able to be readily tracked in the finance system. By interviewing individual work areas, particularly those where purchase data was not identified, may make it possible to determine if all purchases have been captured.

Interview data indicated that work areas are encouraged to have larger print or copy jobs sent to the UOW Printery for printing on commercial printing machines. The quantity of paper procured and consumed as a result of this practice could not be determined due to the way the data is recorded and captured in the UOW Printery software system. This is a significant gap in accurately identifying the amount of paper purchased and consumed by UOW overall. Based on knowledge of the

university and interview responses, the types of documents that would be sent to the UOW Printery for printing would include documents such as course notes and subject outlines, enrolment, orientation documents and exam papers. This means that the actual paper used by the university is likely to be underestimated.

In terms of data improvements, Corporate Express and Office Max provide data on the orders of paper in such a way that the data of different sized paper and the details of the type of product paper purchased are provided in separate fields, making analysis of the purchases easy as no data manipulation is required. However, with the UOW Printery paper order, data is combined into one field for both A4 and A3 paper purchases and for different paper types. Data manipulation is required to separate the A4 purchases and the A3 purchases and the paper products for each order. Additionally, only limited information on the paper product type is included in the UOW Printery dataset. It is only via my knowledge of UOW that the paper products available from this supplier are known.

Having to manually separate this raw purchasing data is both time-consuming and adds the potential for data gathering and analysis errors to occur. Improvements to the capturing of this data by UOW Printery could reduce the potential for error and save time in data manipulation. Improvements in the way the data is captured would make it easier to undertake regular paper purchase reporting and analysis.

The paper purchase results indicated that ninety-nine (99%) of UOW's paper purchases in 2010 and 2011 have some sort of an environmental performance indicator. Twenty-nine percent (29%) of the paper purchased by UOW in 2010 and thirty-one percent (31%) in 2011 contained recycled-content. Comparing these purchases with the Commonwealth and NSW government targets on the environmental performance of paper purchased indicates that these paper purchases by UOW are well below the NSW target that existed at that period of time, which was a minimum of eighty-five percent (85%) of purchases contain recycled-content (NSW EPA, 1997).

These 2010 and 2011 purchases would meet the current environmental performance target set by the NSW Government (NSW OEH 2014) to purchase recycled-content, carbon neutral or Program for the Endorsement of Forest Certification (PEFC) or Forestry Stewardship Council (FSC) paper. However, these purchases are well below the Commonwealth of Australia (2010a) current environmental performance target (minimum of 100% of purchases to be recycled-content).

Interviews and the purchase data indicate that most paper is purchased via the UOW Printery and that their standard paper is now carbon neutral (but not at the time of the data capture). UOW Printery supply recycled-content but is not the standard and must be specifically requested by work areas. Those interviewed who purchased recycled-content did so via other suppliers and those that did not purchase recycled-content would consider purchasing it if it was not going to result in additional cost. If UOW was to aim at achieving the Commonwealth government target of purchasing all office paper containing recycled-content, then an understanding the reason for the current paper product provided to UOW as the standard by the UOW Printery would need to be determined. As identified in the interviews, cost is expected to be a significant factor in choosing to purchase recycled-content at UOW. However, most interview respondents were not aware of their paper purchase costs. Two actions would be of benefit

- a. A regular review of office paper product options and their cost at a centralised (UOW Financial Services Division) procurement policy level,
- b. The development of a preferred product purchasing list that support the environmental performance targets that UOW is aiming to achieve and that addresses the cost issues.

Alternatively, procurement via one supplier using competitive processes (such as using a competitive tender process) may enable greater purchasing power, reduce the costs of paper purchased and also enable environmental performance and data and reporting requirements to be included in tender specifications.

The results of the number of reams purchased for each primary work area indicated primary work area 62 purchased three times as much paper as work areas with the

next highest purchases. Exploring the results in the datasets for this work area was conducted to determine the reason for the large amount of paper purchases. It was found that for this primary work area the bulk of purchases were being conducted by one particular secondary work area. Comparing the UOW person data, the print user data and based on knowledge of this secondary work area it would seem that the total number of people using the paper in that secondary work area is very much under-represented in the UOW person data. It is likely that a larger number of people (undergraduate and coursework postgraduate students) would be using the paper purchased for this area (much higher than the number of people using paper in other work areas). This work area was therefore excluded from the overall per person calculations. It also highlights that an understanding of the amount of paper purchased for each work area relative to the number of people (staff or student) who use the paper is necessary and that it is important to ensure that the person figures used are as accurate as possible. Work areas with undergraduate and coursework postgraduates using paper purchased need to be identified and ways of determining accurate information on the number of people using the paper in those areas needs to be established. Interviews with work areas to identify which areas have undergraduate students and coursework postgraduate students that also use the paper purchased would be beneficial.

The number of reams purchased per person provides an understanding of the purchases made relative to the number of people in the work area and the organisation. The usual university per person metric is equivalent full-time students load (EFTSL). However, for most areas at UOW the paper is used by staff and higher degree research (HDR) students only, with a few areas that have undergraduate and postgraduate coursework students using the paper as well. The EFTSL is not likely to accurately reflect the number of people consuming the paper purchased and the total staff numbers and total HDR student numbers was more appropriate and was used in the per person calculations (UOW person data). However, some work areas were missing purchase data and some were missing UOW person data and some work areas (based on knowledge of the work area) had person data that was under-representative of the actual number of people likely to be using the paper (e.g. the secondary work area identified in primary work area 62

where there are likely to be undergraduate and postgraduate coursework students using the paper purchased). The overall paper purchases per person calculations undertaken were therefore adjusted to exclude those primary and, or secondary work areas with missing or under-representative person data (where known) or missing purchase data. It is important to be clear that the result of the paper purchased per person presented in this study does not represent all purchases and all work areas. Overall, UOW purchased nine A4 reams per person in 2010 and eight A4 reams per person in 2011. This is at, or below, the target set by the Commonwealth of Australia (2010a), which is nine reams per person per year.

Reviewing work area purchases per person showed that primary work area 26 was found to have a much higher per person paper purchases than other work areas in both 2010 and 2011. Work area 26 is a UOW administrative work area containing predominantly staff, and (based on knowledge of the work area) undertakes similar work tasks as that of primary work area 47. Despite this similarity in work tasks, the purchase quantities per person from work area 26 are much higher than that of work area 47. The number of people identified in the UOW person data (ten) seemed reasonably accurate (based on knowledge of the work area) however, when comparing the results of work area 26 within the print usage data this work area had twenty-seven users having access to the printers within that work area. No interviews were conducted in this work area and therefore clarification on the reasons for this discrepancy was unable to be determined.

A comparison between UOW person data and the print usage data was conducted for each work area. This comparison indicated that printer user numbers tended to be much higher in most work areas than the number of people identified in the work area via the UOW person data (Staff and HDR student numbers). The reason for this difference in number of people between the data sets may be a result of the following:

- The UOW person data that was provided for this study was not categorised into work areas that reflected the organisational structure, so errors in allocation of this information may have occurred;

- The UOW person data is a snapshot in time only and does not necessarily reflect staff movements within, leaving or coming into the university;
- UOW person data does not account for undergraduate and postgraduate coursework student paper use and only includes staff and HDR student use;
- The print usage data indicated that some users are utilising the paper purchased from more than one work area. This may be due to staff movements, part-time and casual staff who work in multiple areas and staff printing outside their work area;
- It is possible for individuals to have more than one user name (staff and also a student user) and therefore they may appear more than once in the printer usage data for the same work area;
- Print usage data may also not accurately represent the number of individuals using the paper within a work area as individuals may also undertake copying tasks in the work area and therefore not appear in the printer user information; and
- Print usage data is also only available for some of the printers (not all) at UOW. Some work areas do not have BMS managed printers and therefore do not have printer usage data at all. Some work areas have BMS managed printers but not all printers within the work area are BMS managed and therefore not all printers are covered by the print usage data.

The use of the UOW person data for the per person analysis of paper consumption has a number of limitations but it has fewer limitations than the print usage data (as it includes areas where printer user information is not available). Improving the accuracy of the UOW person data would be beneficial and would improve the accuracy of the purchases per person calculations. Obtaining information on UOW controlled entity staff numbers and getting a better understanding of the number of undergraduate and postgraduate students using the paper in particular work areas (such as the Library and in student computer laboratories) will fill some of the data gaps and improve accuracy. The UOW person data could also be improved by providing it in such a way so that it aligns with the organisational structure. Interviews would be beneficial for some work areas in order to explore the possible reasons for work areas having higher paper purchase per person results.

4.1.2 Print and copy procurement data

Data on the print and copy tasks (using A4 and A3 office paper) procured by UOW were not able to be obtained from the UOW Printery because of the way the data is recorded. During the staff interviews, two respondents stated that the reason for reductions in paper purchased for their work area was because they were encouraged to send large print or copy jobs to the UOW Printery rather than print internally on the local printer. This is a data gap in understanding the paper consumption of the organisation and potentially represents a significant proportion of the paper consumed.

4.1.3 Print usage data

The print usage data provides an indication of the demand for paper within particular work areas for printing activities. This data is useful in indicating how busy the printers in different work areas are by the number of jobs being sent to each printer and by the number of clicks sent to each printer. It is also of assistance in showing the amount people are printing, by the number of jobs sent by each user and the number of clicks sent by each user within a work area. It is important to be aware that not all printers are managed by BMS and therefore not all printers are covered by this data. The proportion of printing conducted and captured by the print usage data and the scope and coverage of this print data is unknown. Understanding the number of printers that are not covered by the print usage data was not possible to quantify. Interviews were helpful to identify data discrepancies and identified additional printers not included in the print usage data but staff may not be aware of all printers present.

Identifying the user's work areas was also not an easy process. The UOW human resources directory and UOW website contact directory were helpful tools but there were still users who could not be allocated to work areas. Analysis of the print usage data was conducted based on the printer work areas. The printer work areas were identified based on the print server information. How often this printer server information list is updated is unknown. The number of users for each work area for the print data analysis was deduced from the number of users that appear in the

print data for the printers in that work area. It is also important to be aware that some users print outside their work areas and can appear twice or more in the data.

The print usage data indicates that there is a lot of variability in the print usage between work areas. In general, the data trends indicate that work areas with more users are likely to have more printers, work areas with more clicks are likely to have more users, and work areas with more clicks are likely to have conducted more print jobs. Academic work areas with high clicks are also likely to have a higher number of print jobs.

When reviewing the total clicks and total jobs for each user in two work areas, it was found that the total number of clicks and total number of jobs varies quite a lot between users and between the two work areas. It also demonstrates that a work area with a smaller number of clicks per job does not necessarily indicate that smaller documents are always printed in the work area, or that larger documents are always printed in work areas with higher number of clicks per job. It is also important to realise that the data is an aggregated yearly total of the print jobs and print clicks for each user. As a result in order to gain a better understanding on the frequency of printing smaller or larger documents it is considered more appropriate to obtain data on the clicks conducted for every individual print job for each user in a work area. This print frequency data could then be used in conjunction with diaries or interviews with individuals to provide an understanding of the tasks being conducted that generated their print demand. It would also assist in determining whether individuals are printing smaller (or larger) documents more frequently and for what sorts of tasks.

4.1.4 Copy usage data

Data on copy usage was not available for this study. Copy usage was not identified by staff within the staff interviews as a cause of paper usage. Reference was made to the printers defaulting to double-sided printing but not defaulting to double-sided copying. This implies that paper, when consumed for copying, could more readily be done as single-sided rather than double-sided. In the absence of data on copying it is not possible to identify the proportion of printing versus copying for paper use.

This is a data gap in understanding how paper is consumed within UOW. Access to this data for work areas would be helpful in clarifying how paper is consumed at UOW and whether it is consumed mostly as a result of printing or for copying tasks.

4.1.5 Work areas in review

Some work areas are reviewed in this section in order combine the results from the purchase and print usage together with insights obtained during staff interviews and to explore what might be able to be deduced from the combining and comparing the datasets. Comparing and combining the datasets, and being aware of the context of the work areas, has revealed that this is particularly useful. However, it is difficult to make this review meaningful in this report without disclosing information that would identify the work area and breach confidentiality requirements of this study. An attempt has been made to provide an indication of the context and nature of the work conducted within these areas without disclosing specific information about the work areas.

Primary work area 33

Primary work area 33 is an academic area that undertakes a range of teaching and research activities. According to the UOW organisational charts, primary work area 33 was made up of fifteen secondary work areas. Many of the secondary work areas were research areas and the paper purchases and print usage data may fall within one of three secondary work areas. Two of these secondary work areas (33179 and 33180) were interviewed. Based on paper purchase data most purchases are conducted by the secondary work area that was not interviewed. Purchases are also likely to be underestimated as, according to the interviews, large copying tasks are sent to UOW Printery for printing. The paper purchasing data for work area 33 (academic work area) indicates that this work area is one that purchases above average number of A4 reams but the reams per person was below average. It is possible that the number of people used for the reams per person calculation may not accurately reflect the number of people using the paper but this was not able to be confirmed by the interview responses.

Based on the information provided by the secondary work areas it is likely that the number of printers for this primary work area do not accurately reflect the number of printers used in this work area across all the secondary work areas as the two work areas interviewed make up the total number of printers allocated in the BMS data for this work area without taking into account the third secondary work areas printers.

The print usage data identified that this work area had above average number of clicks, above average number of users and also above average number of printers. However, the number of users per printer was below average indicating that the number of printers for the number of people within this work area is not high. The number of clicks per user and clicks per printer were also below average, but the total number of clicks per job was above average. If not all the printers for this work area appear in this print usage data it is likely that this data may under represent the actual usage in this work area. An interview with the other secondary work area would greatly assist and address the data gaps identified for this primary work area and improve the data accuracy.

Primary work area 42

Work area 42 is an academic work area that includes both teaching and research activities. The paper purchase data indicates that it purchased above average number of reams in total (1,724 reams in 2010 and 1,475 reams in 2011) but an average number of reams were purchased per person (eight reams per person in 2010 and even reams per person in 2011). The paper purchased for primary work area 42 was not allocated to any secondary work areas within the purchase data. The interview conducted with secondary work area 4,279 indicated that they purchase about ten boxes every two months which is about three hundred reams a year. Based on this information it is clear that other secondary work areas are included in the purchases for primary work area 42. The interview also identified that there was a primary work area policy to have prints and copies over two hundred pages to be conducted by the UOW Print and Distribution. This indicates that the amount of paper purchased within this work area is likely to underrepresent the actual amount of paper consumed by the work area.

In relation to the print usage data, primary work area 42 had above average clicks per user and average clicks per print job in 2010 and 2011. The interview with secondary work area 4279 also indicated that the paper it purchased was used to supply three printers and these were all BMS managed. An additional eleven printers were identified within the primary work area from the UOW print usage data. The interview was also able to clarify that there are other printers in use within this work area that do not appear in the BMS data. It is therefore likely that the print usage data is under representative of the printing conducted in the work area.

Primary work area 47

Work area 47 is an administrative work area that provides a range of support and administrative services for UOW. The paper purchase data for this work area indicates that the paper purchasing for this work area was well below average for the organisation (four hundred and twenty reams in 2010 and four hundred and thirty reams in 2011). An interview was conducted with this work area and this confirmed that this data was accurate. The interview also confirmed that the person data used to calculate the purchase quantities per person was accurate.

The print usage data for this area indicated that it has above average number of users per printer. This indicates that this work area has more people using fewer printers than other work areas. The interview identified that the number of printers for this work area was reasonably accurate with only one printer listed that should not be included. The number of clicks per printer was higher than average, indicating that the printers are being used more than other printers as there are fewer printers per person than in other work areas. The higher than average jobs per user indicate that the people in this work area are printing more frequently than other work areas. However the number of clicks per user was below average indicating that the amount of paper consumed in the print jobs conducted is likely to be less than other areas and this is confirmed by the paper purchasing.

Primary work area 63

Work area 63 is an administrative work area that provides diverse administrative services. This work area purchased eight hundred and thirty reams of A4 paper in 2010 and seven hundred and ninety reams of A4 paper in 2011 which was below average compared to other work areas. An interview with staff in this work area identified that some copying tasks were no longer conducted in-house and were now being done at the UOW Printery. The respondent confirmed that one secondary work area (6310) is situated in another location of UOW was not covered by the purchasing conducted by the respondent. On subsequent review of the purchasing data (i.e. after the interview) it was found that there was no purchase data for this secondary work area. An interview with the secondary work area not included in the purchase data but would greatly assist in filling this data gap.

The total number of users and the total number of printers within this work area are below the average. The number of printers was confirmed during the interview and included the printers from the secondary work area not covered by the paper purchase data. The total number of clicks for this work area is just below average. However, this area had a high number of users per printer, high number of clicks per printer above average clicks per user and jobs per user. This indicates that there are a larger number of people using each printer and this is reflected in the volume being printed by each printer in this work area. The above average jobs per user indicate that more print documents are being sent to the printers in this work area per person than most other work areas.

Overall this review of specific work areas comparing information across the datasets and interviews provided a more holistic view of the paper usage and printer demand for particular work areas and the importance of the interviews in clarifying the accuracy and representativeness of the data obtained. This review also revealed that obtaining print usage data on the frequency of printing larger or smaller clicks per job by each user within a work area would be a useful tool to understanding the frequency of individuals to print smaller or larger print jobs and obtaining information on copying would also be helpful.

4.2 Paper leaving the university as waste and recycling

4.2.1 Waste audit and waste collection data

A waste audit was conducted for UOW in 2009 and includes only the Wollongong campus whereas the print and purchase data covers other campus locations. The waste collection data is also only Wollongong Campus based. As a result the total amount of paper waste disposed by the entire University could not be quantified.

Waste collection data for Wollongong Campus is based on the number of bins serviced per week and the estimated weight of each bin. The estimation is based on average weight of the bins put out for collection during a sample period. This means that the waste collection data is based on an estimate and not the actual weights.

Despite these limitations waste data is useful in that it gives an indication of the amount of paper waste disposed by the university at the Wollongong Campus. Undertaking additional waste audits over time including all domestic campus locations, and obtaining waste collection data for all domestic campus locations would assist in quantifying the total amount of paper waste disposed by the UOW overall.

The use of both the waste audit and the waste collection data in combination was helpful in identifying the amount of paper disposed via landfill and recycling during 2009 and 2010. The data indicated that nineteen percent (19%) of paper disposed (equivalent to 7,900 A4 reams) was placed in a bin destined for landfill. However, the waste disposal options available in Wollongong Campus office areas has changed since this study was conducted, and it is likely that the amount of paper placed in recycling will have increased as a result. Analysis of more recent waste audit data is required to confirm this.

This waste data also enabled the ability to compare the amount of paper purchased and disposed for the same period. The results indicated that approximately fifty-

seven percent (57%) of volume of the A4 paper purchased during 2010 was disposed during 2010 (20,585 reams). Since the waste data is for Wollongong Campus only and the purchase data includes other campus locations, it is important to note that the actual percentage of paper purchased and disposed in the same year is likely to be higher than fifty-seven percent (57%) if the paper waste data for other campus locations is taken into account. Whether the paper was purchased and disposed within the same year is unknown. Based on interview responses in relation to paper waste it is expected that a proportion of paper does in fact end up in the waste stream within the same year that it is purchased (in some cases the very same day). However, it is expected that a proportion would also be used and filed for later reference and eventually disposed of sometime later, and it may not necessarily be disposed of at UOW. Further research would be helpful to understand the type and lifecycle of documents at UOW and how long they are used before being disposed.

4.3 Context to the paper coming into and leaving the university

Identifying the reasons for office paper consumption by staff at UOW was another objective of this study. A number of reasons for paper consumption were identified, via staff interviews. There were many commonalities between the reasons for paper use identified within this study and those in the literature.

The final objective of this study was to inform development of initiatives that are aimed at reducing the amount of office paper consumed by staff at UOW and provide insights for other organisations wanting to develop similar initiatives. Suggested initiatives focusing on paper consumption are discussed in this section and are based on the insights into the reasons for paper consumption obtained as part of this study and intervention methods identified in the literature.

Only five interviews were undertaken as part of this study. Additional interviews would have helped to improve purchase and print data accuracy for more work areas, and provided a broader sense of some of the context and issues associated with paper use at UOW. In particular, interviews targeting work areas where purchase information is lacking would assist in identifying additional suppliers or whether the lack of purchase information is due to data discrepancies. However,

since the interviews were on a voluntary basis only and they needed manager approval (due to ethics requirements) more interviews were unable to be obtained.

When volunteers to participate in the interviews were called one staff member responded saying that they were interested but they considered that there was no point to participating in the interview as “much of this is out of our control” and as a result it would be a waste of staff time to be involved. This response itself is very insightful as it indicates that there is a perception that individual responsibility is limited and that high level organisational response is required. This perception may have limited the number of staff responding and participating in this study. Calls for interviews were also conducted during a time of upheaval for some work areas as the faculty restructure review was underway and this is likely to have limited interest in participation.

In terms of improving the interview questions, some staff had difficulty in answering the question regarding knowledge on the frequency of double-sided print or copying indicating that this question could have been worded differently. An alternative question(s) –what tasks require double-sided printing (copying) and how often are those tasks are conducted? – may have provided better responses.

The reasons identified for paper use at UOW are discussed below and have been grouped into key themes and compared with the reasons for paper use identified in the literature.

4.3.1 Habit, convenience and skill or knowledge levels

Some of the insights identified by respondents include that print errors and printing single rather than double-sided is occurring as a result of lack of knowledge of the printer or copier settings which was consistent with the results found by Isaev, Clark and Davidson (2010). The convenience and easiness of printing along with a lack of accountability and habit was also considered to be a reason by interview respondents for paper use within UOW and again this was consistent with the results found by Isaev, Clark and Davidson (2010).

A lack of awareness within the organisation about the amount of paper consumed was identified by respondents as a barrier. Staff do not have access to print usage data for their work area or individually. Work areas also do not keep records of paper purchases. There is no reporting or quantifying the paper used by the organisation overall. This lack of awareness, knowledge of paper use and habitual practices that might contribute to paper consumption highlights the “invisibility” of paper consumption within UOW and this may be contributing to the perceived lack of personal accountability of paper consumption. Applying behaviour change interventions and improving knowledge and awareness of paper use and practices will support individuals to reduce paper use.

Paper is also being used when printing is left on the printers. The respondents who identified this as a reason for paper use were expressive in their frustration at this practice and voiced concern about what could be done about it. The reasons for leaving printed documents on the printers may be due to habit, lack of organisation, forgetfulness and the high pace of daily life. The response to this issue in one work area was to provide a tray to place forgotten prints before throwing them out (in a recycling bin) if they haven’t been collected after a period of time. This work area has seemingly found a solution that works for them within their work area and this may well work for other areas. Paper use that is generated as a result of errors or failure to collect print outs, not printing double-sided and due to formatting issues could be avoided by improving knowledge, via technological improvements or by identifying and addressing the root causes for these practices. UOW is currently trialling an electronic improvement option, a swipe and print option which is currently (late 2014 to early 2015) being trialled by ITS in a few areas of UOW. This involves purchasing an additional electronic device to attach to the existing printers. Under this trial when staff send print tasks to the printer they must swipe their access card for the documents to actually print. Staff will also need the access card to undertake copy tasks. Reducing paper use was the reason provided for the trialling of this device. Staff in work areas using the swipe to print device have an opportunity to cancel a print job prior to printing. Forgotten print documents and some printing as a result of errors will be reduced. Printing conducted out of habit may also to some extent be reduced. The swipe to print will also improve the

reporting of individual staff or student and work area print and copy use and how much paper was saved as a result of cancelling print jobs. Significant paper savings are expected as a result of using the swipe to print devices within work areas. However, the scope of the swipe to print device to reduce paper use beyond forgotten print documents and print errors is limited as it does not address the key fundamentals about the reasons people are printing in the first place and whether this printing is within their control to do anything about. Reflecting on this in relation to the concepts of friction and traction (Head et al. 2013), this swipe to print device has the potential to be an area for friction in achieving sustainable outcomes. This device does not address the key reasons for printing and, as revealed in the following sections, much of this printing is beyond the scope of individuals to do anything significant about. As a result it is likely to generate cynicism towards management around the motives for the use of this device.

The interviews have revealed a number of processes and work activities that result in paper use. These work processes are described in more detail below and are particularly useful in highlighting some of the reasons for paper use. It is also important to recognise that given the interviews were conducted in 2012 a number of changes have occurred since this time that are of relevance to current paper use. These include that technologies such as tablets and other mobile devices have become more common and that the internet is also much more accessible. Wi-Fi access is now available across most areas of UOW and internet is also much more accessible elsewhere in the community with mobile and other technologies. There have also been shifts in teaching requirements such as the requirement for electronic course materials being available and online submissions of assessment tasks. These changes are discussed when reflecting on paper use and the work processes and activities identified in the interviews.

4.3.2 Financial processes

Financial processes were identified as one of the activities contributing to paper use within UOW. Based on knowledge of the work process and interview discussions, financial processes could be viewed as an example of the coevolution of work processes and new technologies where paper and electronic options are used in

combination to undertake the tasks involved (see also Sellen and Harper 2002). For instance, purchase order forms are accessed online then printed and manually completed with a manager's signature which is needed for approval. The information contained on the form is then transferred into the electronic financial system and the paper copy of the purchase order is then scanned as a record. The need for a manager's signature is also a key component for the reason for the need to print and the lack of alternatives (electronic signature approvals) is preventing reduced paper use in this situation.

The interviews also identified another example with the processing of invoices. Invoices need to be printed for authorisation of payment, information contained on the invoice is then transferred into the electronic financial system and then the invoice with the signature approval is scanned with a group (or batch) of other invoices. The invoices are scanned and printed single-sided as most invoices are single-sided. However, some invoices are double-sided or more than one page in length and these are printed or copied to single-sided, and then single-sided scanning of the group of invoices is conducted. Scanning double-sided for the one or two invoices that are more than one page would create blanks with all the single-sided paged invoices in the scanned document. So the process of single-sided copying of double-sided invoices that are then scanned is to avoid the blank pages in the scanned batch of invoices.

The reason for not having electronic signatures in these processes is unknown. Whether the lack of electronic signature approvals is about a lack of trust in the authorisation methodology, about the lack of technology being made available or some other reason is unknown and was unable to be determined as part of this study.

Most individuals (in non-senior roles) are unable to do anything significant about paper use when undertaking these financial processes and instead an organisation level response to address paper use as a result of these processes is required.

4.3.3 Lack of confidence in work processes

Another reason for paper use was highlighted by comments from respondents about a lack of confidence in work processes combined with a lack of access to electronic alternatives that has resulted in copying and filing of documents so they can be kept at each stage of the approval process (across multiple work areas). The respondents that mentioned this issue stated that the keeping of copies of forms at a local level has been due to the forms often getting lost after they leave their office for higher level signing and submission. This means that the forms have to be recompleted and signed and again be forwarded to higher levels for approval and submission. The work flow for these processes is also not electronic. In order to overcome the lack of confidence in these work practices and address this barrier to reducing paper use staff that are involved in the process should be encouraged and supported to find and implement ways to improve these processes.

4.3.4 Meetings

As identified in the interviews, attending meetings with agenda documents, minutes and larger documents to review, were all activities that contribute to paper use within UOW. The findings made by Sellen and Harper (2002) that the features and properties of paper support the tasks required within a meeting context, may not be as relevant today. The use of portable electronic options (e.g. tablets and iPad) and Wi-Fi internet connectivity are now more frequent and accessible. Instead the reasons for paper use for meetings may be about habit and convenience, social norms, skill and familiarity with paper rather than the electronic options, perceptions about the ease of use and lack of access to the electronic alternatives.

The use of electronic options (e.g. tablets and iPads) and Wi-Fi internet connectivity across most areas of UOW has increased since the interviews were conducted in 2012 and the use of tablets and iPads in meetings is also more frequent. However, access to such devices for all staff is not currently the norm in the workplace. This suggests that there is scope for increasing access by having such devices available for loan or available for a trial period. In addition, applying behaviour interventions that focus awareness in the workplace about the tasks that the portable electronic options best support and to offer training to improve

knowledge and skills in their use would be of benefit to ensure that the electronic options are chosen and used based on the tasks that are most likely to reduce paper use.

4.3.5 Reading journal articles

Consistent with studies by Taipale (2014), Fortunati and Vincent (2014), and Franze, Marriott and Wybrow (2014), paper use for reading of journal articles has continued at UOW despite the increase in accessibility of electronic journal articles. It is of relevance to note that the accessibility to journals has changed significantly over the last twenty years at UOW. In the past journals were only able to be accessed by going to the Library and finding the journal in paper copy or via microfiche, whereas today journals are readily able to be accessed by staff and students electronically online from any location connected to the internet.

The interview responses identified that printing of journal articles contributes to paper use within UOW and that students and staff were perceived to not like to read journal articles from the screen. However, this view does not account for the numerous factors (beyond the individual) that contribute to paper use for journal article reading. Paper used for printing journal articles may be the result of the features and properties of paper that support reading (Sellen and Harper 2002), and also support tasks that involve understanding and interpreting information (Franze, Marriott and Wybrow 2014). Lack of access to electronic alternatives and, or internet connectivity in places where people want to read (e.g. bus, train, waiting rooms) is also likely to be a contributing factor. Other factors of relevance for reasons for printing journals for reading include habit, social norms, skill and familiarity with paper compared to the electronic alternatives. The actual and perceived convenience of using paper for journal reading, as well as the ease of making notes and flipping between sections of the document in paper form is also relevant.

Despite making a conscious effort to reduce paper use, I encountered a number of situations where paper was used for this study. Paper was mainly used as a result of this study for reading of journal articles and for reviewing thesis drafts. A difficulty

in reading and interpreting or “digesting” information from the screen was encountered particularly for complex or larger documents. Also a contributing factor to printing of some documents was my lifestyle, as a working mother, any spare time available to read journals did not necessarily happen while sitting at a desk with a computer screen but happened when waiting at my daughter’s swimming or dancing lessons or elsewhere while out and about. Attempts to use portable devices for this purpose resulted in connectivity issues with my computer, and some files not able to be viewed on my device. In addition, my e-reader does not allow for annotation or note taking which made the use of paper necessary in order to take hand written notes. Despite this, many journal articles were not printed and were read on a computer device sitting at a desk. By using two computer screens, my laptop and connecting another larger screen, I found it easier to read a journal article on one screen and write and make notes using the other screen rather than trying to do both tasks on the one screen and switching between windows. All these factors and examples suggest that interventions that are focused not only on the individual but also acknowledge the complexity of the reasons for paper use involved in the reading of journal articles and similar reading and reviewing tasks is needed.

4.3.6 Human resources activities

Human resources activities were also identified as contributing to paper use at UOW. Recruitment processes such as printing job application submissions for shortlisting, and printing notification letters were examples of paper use highlighted by the interviews. However, the practice of the Human Resources Division of printing all job applicant submission documents and providing them to the interview panel for shortlisting is no longer happening (based on knowledge gained in my work role during 2015). Electronic copies of the job applications are instead being provided to the interview panel. The reason provided for this change in practice was to reduce paper use. Yet, how the interview panel members review applications and whether they are now printing these documents for themselves is unknown and it could be just shifting the printing to the staff on the interview panel.

4.3.7 Teaching and research activities

A similar situation may also be occurring with teaching materials such as course notes, course guides and student handouts. These teaching materials were identified in the interviews as contributing to paper use at UOW. It should be noted that those interviewed were not in teaching roles and therefore were unable to elaborate on this aspect of paper use and the existing electronic alternatives available. It is known that online teaching tools are available and were used to provide electronic copies of course materials at the time of the interviews. Since this time it is a UOW policy requirement that teaching materials are available online and assessment tasks are now also required to be submitted online. How students and staff interact with these electronic materials, whether the course notes, guides and student handout documents are printed by students and whether academic staff print the assessment tasks submitted to them online for them to assess is unknown. Further research is required and questionnaires or interviews would be helpful to determine whether these policy and procedure requirements are shifting the printing or are actually making a difference to reduce paper use.

Draft thesis documents were another activity that respondents considered was contributing to paper use within UOW. Draft thesis documents are printed for review by the student and also the supervisors. Printing thesis draft documents may be conducted due to the features and properties of paper that support the reading as discussed previously in this section and are also likely to be due to the features and properties of paper that support reviewing tasks (Taipale 2014, Fortunati and Vincent 2014, and Sellen and Harper 2002). Habit and convenience, skill and familiarity with paper compared to the electronic alternatives, perceptions about the ease of use as well as portability of paper enabling it to be able to be read wherever needed may also be contributing factors. From my own perspective, printing drafts of this thesis enabled me to find formatting, grammatical and typing errors that somehow were overlooked or harder to see in the electronic form. The preference of my supervisor for hard copy was also a deciding factor to the printing of drafts of this document.

The human resources, teaching activities and the printing of draft thesis documents for review are examples that highlight the potential for paper use to continue in some processes despite electronic options being available. Any changes to work processes introduced with the aim of reducing paper by shifting to electronic alternatives needs to be particularly mindful of the possibility that it may not actually replace the use of paper but instead shift who is printing and using the paper. It is likely that tasks most vulnerable for paper use to shift within the work process are those where paper best supports the tasks that are being conducted. Activities that involve the reading of larger and, or complex documents, non-linear reading tasks, and reviewing activities have been found to be more suitable to be conducted on paper rather than the electronic options (Taipale 2014, Fortunati and Vincent 2014, and Sellen and Harper 2002). These types of activities are likely to be more vulnerable to this potential for paper use to shift in the process and therefore caution should be exercised when modifying work processes that involve these sorts of activities.

There have also been numerous changes (some have been identified and acknowledged already in this document) that have already had an influence on paper use and the environmental impacts associated with paper use or electronic alternatives within the organisation during the period of this study. Innovation in digital technologies, changing funding models and increased competition for students is expected to continue to transform the university sector and how education is delivered and accessed. Acknowledging that change has, and will, continue to occur is essential and is highly relevant in relation to paper use. Methods to support organisations to be flexible enough to deal with change and to minimise the associated environmental impacts are needed.

Overall the interview responses have identified numerous reasons for paper use within UOW. The common policy approach applied to reduce paper use would be to develop initiatives to change individual's behaviour, improve knowledge and improve the technological options available. Applying behaviour change approaches and improving skills and knowledge, and reducing barriers to address paper use as demonstrated in previous studies have and will make a difference to

reducing paper use by individuals. However, the reasons identified in the interviews also suggest that although there is scope for individuals to make a difference to paper consumption, by improving their skill and knowledge on printer settings, and other electronic alternatives and for individuals to be mindful of paper use and make changes wherever possible to their individual work processes, there are limitations to this as many of the reasons identified for paper use are beyond the scope of individuals to do anything significant about. This view is shared by staff, as demonstrated by the response and reason for refusal to participate in the interviews and also the interview response “there doesn’t seem to be an alternative way of doing some tasks”.

A review of the literature highlights that the focus of past studies on paper reduction initiatives are based on the behaviour theory perspective. This study instead has broadened the framing of the issue and results identified demonstrate that intervention options need to move beyond the behaviour theory viewpoint in order to achieve a sustainable outcome overall. The need for UOW and other organisations to broaden the focus away from the individual and, as suggested in Spurling et al. (2013), focus on the upstream or primary reasons for paper use is recommended. Interventions that are more holistic and focus not only on the knowledge, skills, and awareness and technological improvements but also on the upstream or primary reasons for paper use are needed. Interventions that acknowledge the complexity of the reasons associated with paper use and the dynamic nature of change may have more success.

5 CONCLUSIONS AND RECOMMENDATIONS

Organisations such as the University of Wollongong (UOW) have a role to play in implementing sustainable work practices and reducing the environmental impacts of their operations. Paper is consumed at UOW as part of everyday work activities despite electronic alternatives being available. Reducing paper consumption, purchasing eco-labelled paper products and using electronic alternatives are seen as ways to reduce the environmental impacts associated with paper consumption. Identifying the amount and type of paper consumed and the reasons and context for paper use are important steps in understanding how to reduce paper consumption within an organisation.

This study aimed to understand how office paper is being used by staff within UOW. This chapter is structured around the three proposed objectives.

5.1 Objective 1: Identify the office paper purchased, used and disposed by staff at UOW during 2010 and 2011 calendar years.

Identifying the amount of paper purchased and used by the UOW during 2010 and 2011 was achieved through obtaining data on paper coming into and being used by UOW and the amount of paper leaving UOW. Data on paper purchases and print usage has provided an indication of the amount of paper purchased and used by UOW overall and based on work area. A total of 36,014 reams and 34,839 reams of A4 paper were consumed by UOW in 2010 and 2011 respectively based on data obtained from three suppliers (UOW Printery, Corporate Express and Office Max). This equates to nine A4 reams of paper per person per year in 2010 and eight reams per person per year in 2011 which compares favourably with the Commonwealth of Australia (2010a) per person target.

However, data limitations in this study may mean that the total purchases and per person quantities were likely underestimated. UOW needs to work on addressing these data limitations to improve data accuracy on paper purchases and establish accurate baseline data. UOW cannot properly monitor paper use if it cannot measure it accurately. That which can't be measured also can't be managed. Having accurate data available to staff will also address the "invisibility" of paper

consumption as a result of a lack of knowledge and awareness of paper use, and habitual practices that contribute to paper consumption.

The paper purchasing data also revealed that ninety-nine (99%) of UOW's paper purchases in 2010 and 2011 have some sort of environmental performance indicator, with twenty-nine percent (29%) in 2010 and thirty-one percent (31%) in 2011 containing recycled-content. Based on this information UOW is meeting the current NSW government target (NSW OEH 2014) for the environmental performance of paper purchases. However, it did not meet the NSW government target (NSW EPA 1997) at the time which was to purchase a minimum of eighty-five percent (85%) of purchases containing recycled-content. UOW does not meet the current Commonwealth Government (Commonwealth of Australia 2010a) environmental performance target to purchase all paper with recycled-content. UOW would benefit from setting minimum procurement standards for paper products to reduce the environmental impacts generated by the paper that it does consume.

Print usage data was also found to be a good indicator of paper demand from printing activities and provided insights into how busy printers are within particular work areas. Print usage data showed that there was a lot of variability in print usage between work areas. In general, print usage data indicated that work areas with more users are more likely to have more printers, work areas with more clicks were more likely to have more users and work areas with more clicks were also more likely to have more print jobs. Future research that obtains data on every print job conducted by individuals within work areas and compares this information with diaries and interviews would be beneficial, and would provide knowledge on the frequency of printing smaller or larger documents at UOW. In addition obtaining data on copying demand would provide knowledge on how paper is consumed and whether it is for printing or copying tasks. Research in these areas would provide a better understanding of the context of paper use that could not be explored fully within this study, and may identify additional reasons for paper use.

Reviewing the data across various datasets was also useful in providing context for particular work areas and to understand the accuracy and representativeness of the print and purchase data for those areas. Some of the data limitations and gaps were also identified via staff interviews. Staff interviews were important in clarifying and confirming the accuracy of the data obtained and highlighted areas for future work to improve data accuracy.

In terms of paper leaving UOW as waste, this study identified that waste audit and waste collection data provided useful information on the amount of paper disposed via landfill and recycling. The data reviewed in this study indicates that nineteen percent (19%), equivalent to 7,900 A4 reams, of paper disposed is being placed in a bin that goes to landfill, and eighty-one percent (81%) is placed in a bin that goes to be recycled. This indicates that there may be some scope for UOW to reduce the amount of paper going to landfill. It should be noted that the available disposal method options have changed since this time and this is likely to have increased the amount of paper going to recycling, but analysis of more recent waste audit data is needed to confirm this. In addition, although the data on purchases includes the entire organisation and the waste data only captures information for the Wollongong Campus, approximately fifty-seven percent (57%) of the volume of A4 paper purchased in 2010 was disposed of during 2010 (20,585 reams). If waste data for the entire organisation was able to be included in this calculation, it is likely that this percentage of paper purchased and disposed during the same year would be higher. Whether the paper was purchased and disposed in the same year is unknown however it is probable that at least some of the paper does in fact end up in the bin within the same year of purchase and it is also probable that some of this paper is also disposed offsite and not at UOW (and not captured in this data at all).

Despite these limitations, the amount of paper purchased and the amount of paper disposed within the same year suggests that there considerable scope for reductions in paper consumption. It also highlights a research opportunity to explore the paper consumed and how long particular documents are used before they are placed in the bin. Understanding the lifecycle of particular types of documents would enable

organisations to focus on the tasks that consume paper that are used and disposed of within a short time frame.

5.2 Objective 2: Identify the reasons and context of office paper consumption by staff at UOW.

Identification of the reasons and context for paper use at the UOW was achieved through information obtained via interviews with staff within work areas and comparing these results with those identified in the literature.

A review of the literature identified that there are a range of factors and complex reasons for paper use, highlighting the need to broaden the focus beyond individual behaviour change initiatives that have been used in previous paper reduction studies. This study also confirms the need to broaden the focus beyond the individual as although some of the activities that consumed paper and the reasons for paper use identified at UOW suggested that individuals have a role to play in reducing paper use, many of the reasons identified were beyond the control of the individual.

The reasons stated by staff for paper use within UOW included lack of awareness within the organisation about the amount of paper consumed, convenience and easiness of printing along with a lack of accountability and habit. These focus on the individual and the need for individuals to change their behaviour. However, this study has found that many reasons identified for paper use within UOW are beyond the influence of an individual and instead requires systemic change to address the upstream or primary reasons for paper use.

This study identified that some paper use within UOW is due to processes that actually require paper to be used. Work processes such as many financial processes require the need to print as part of the process and although the technology exists (e.g. electronic approvals and workflows) it is not available or has not been implemented by the organisation. Another reason for paper use identified in this study was about a lack of confidence and trust in a process due to past experiences where documents have been lost. This lack of confidence has resulted in copying of forms and filing of documents at a local level.

Other reasons identified in (Taipale 2014, Fortunati and Vincent 2014, and Sellen and Harper 2002) relate to the affordances of paper that make it highly suited to particular tasks compared to the electronic alternatives that are available. The tasks identified as being more suitable for paper include reading large documents, non-linear reading and reviewing tasks (Taipale 2014, Fortunati and Vincent 2014, and Sellen and Harper 2002). These types of tasks are commonplace in teaching and research areas in a university setting. Examples of these sorts of tasks were identified in this study and include reviewing of job applicant submission documents, teaching materials such as course notes and student handouts, reviewing draft thesis documents and reading journal articles. Some work processes (such as job application review processes) that involve these sorts of tasks, have been changed in order to reduce paper use. However, these changes to the process may just be shifting where in the process these documents are being printed and by who. Further research is needed to determine whether this is actually occurring however the potential for this shifting process to occur is present and should be acknowledged.

As technological improvements are made the affordances of the alternative electronic technologies may become better suited to tasks that are current more suited for paper. Improved familiarity with the use of these new technological options may also increase the positive affordances of these technologies compared to paper. However, in the meantime it is necessary to acknowledge the suitability of paper for particular tasks, and care should be taken to avoid policies that instead of reducing paper use may actually shift where paper is used and who uses it within the work process.

Paper use for activities such as the reading journal articles and reviewing draft thesis documents also relate to individual habits, skill and familiarity with paper compared to the electronic alternatives and convenience. Where and when journals are read and documents reviewed in amongst other daily tasks are also factors, highlighting that paper use for many activities is not simple and is due to a complexity of reasons.

Meetings were also identified as an activity contributing to paper use at UOW. Unlike the example above electronic portable devices are now available that are well suited for tasks within a meeting context. The reasons for paper use within a meeting context at UOW are potentially about habit, convenience, social norms and skill and familiarity with paper compared to the electronic options. However, access to electronic options for all staff is not currently the norm.

These examples all highlight it is important to extend paper reduction interventions beyond the individual and focus not only on improving skill, knowledge and awareness but also on addressing the primary reasons for paper use and acknowledge the complexity of factors associated with paper use.

5.3 Objective 3: Inform the development of initiatives aimed at reducing the amount of paper consumed by staff at UOW and provide insights for other organisations wanting to develop similar initiatives.

The final objective of this study was to inform the development of initiatives aimed at reducing paper consumption. The following recommendations are proposed to support UOW and other organisations to address paper consumption and thereby reduce the environmental impacts of their operations associated with paper use.

Processes that support the capture of paper purchasing, print and copy usage and waste disposal data are important for providing an understanding of paper purchase, print and copy usage demand and paper disposed as waste. This study identified that UOW's data systems currently do not allow for a full understanding of paper purchased, used and disposed by UOW as many data limitations were identified. UOW's data systems should be improved so that paper purchase, use and disposal is made part of the reporting processes across the entire organisation.

Utilising ICT alternatives (for tasks they best support) can reduce paper consumption however it might result in less sustainable outcomes. To mitigate this UOW should establish purchasing guidelines that set minimum requirements for the environmental performance of products purchased (paper products and ICT items).

This will enable UOW to meet best practice and address organisational priorities and reduce the environmental impacts associated with the paper and the ICT products it uses.

A regular review of office paper product options and their costs is needed at a centralised procurement policy level, and a preferred product purchasing list that supports the environmental performance targets the organisation is aiming to achieve, and that addresses the cost issues would be of benefit. Alternatively, procurement via one supplier using competitive processes (such as using a competitive tender process) may enable greater purchasing power, reduce the costs of paper purchased and enable environmental performance as well as data and reporting requirements to be included in tender specifications.

Tools should also be developed and provided to enable and support the capture and monitoring of paper purchasing and print and copy use not just at an organisational level but also at a work area level and for an individual. This will allow the practice of consuming paper to be visible within the work area and enable staff to track their own paper consumption and identify the work tasks they are personally doing that consume paper.

A review of work processes (such as financial and records management processes) that actually require paper to be used should be conducted. Identification of methods to reduce paper use and improve workflow would be of benefit. These may involve the introduction of other electronic options into the process (e.g. electronic approvals). However it is important to recognise the unpredictability of outcomes, as introducing other electronic options may result in more paper use, and monitoring is needed. Staff involvement in any review of processes is also important. It is the staff of the organisation who know their jobs best, and it is the staff within the organisation who have the knowledge on how to make genuine and long lasting change for improved work practices. Involvement of staff is also needed in order to identify where a lack of confidence in the process is occurring and to determine how best to address this to reduce paper use.

This study identified that changing from paper to electronic options for tasks that are considered more suitable for the use of paper (e.g. reading large complex documents, non-linear reading and reviewing tasks) has the potential to create a shift in who is printing and when paper is used in the process.

Further research is recommended to confirm whether this shift in paper use within the process is actually occurring. Acknowledging the potential for paper use to shift as a result of changes to processes is required. Caution should be exercised when reviewing processes that involve tasks that are, based on the literature, more suitable for the use of paper.

Improving awareness about the tasks that portable electronic options best support, establishing opportunities to loan or trial the use of these devices and offering training to improve knowledge and skills in their use would be of benefit to ensure that the electronic options are chosen and used for tasks that they best support (such as tasks involved in meetings).

This study has identified how paper is being used by staff at UOW and highlights that individual level response to paper use does not address all factors associated with paper use, and other systemic interventions are required. Existing policies and guidelines available to support organisations to achieve paper reductions suggest that reductions can be achieved through technological improvements and behaviour interventions. However, the complexity of reasons for paper use identified in the literature and in this study suggests that such approaches are not likely to result in achieving their intended outcomes. Existing policies and guidelines fail to acknowledge the interaction and connections between the technologies and everyday activities, procedures and processes, social factors and the broader contexts involved in paper consumption within a workplace and how these all interact to create more or less sustainable outcomes.

6 APPENDICES

Appendix A: Email invitation to participate in interview about paper

-----Original Message-----

From: all_general_staff-bounces@mailman.uow.edu.au [mailto:all_general_staff-bounces@mailman.uow.edu.au] On Behalf Of alisons@uow.edu.au

Sent: Thursday, 26 July 2012 5:09 PM

To: all_general_staff

Subject: Volunteers needed for UOW research project on paper

.....
This message was generated by the UOW Message Centre. To verify the authenticity of this message or view the message archive go to <https://intranet.uow.edu.au/portal/messaging/>

.....
We are inviting staff of UOW that purchase paper for their work areas/units to participate in a study conducted by researchers at the University of Wollongong.

What is it about?

The purpose of the research is to identify the amount of office paper purchased and used by staff for printing at UOW and the reasons for office paper consumption by staff at UOW. The goal of this research is to better inform the development of initiatives that are aimed at reducing the amount of office paper consumed by staff at UOW.

What would I have to do?

1. Obtain Managers permission to participate
2. Undertake an interview to provide a better understanding of the type and quantities of office paper purchased, printer/copier demand, staff/student paper demand within your work area/unit

Participant and Manager information sheets are available by emailing alisons@uow.edu.au.

How long would it take?

The interview will take approx 40 minutes

Intended use of the research

The data collected will be kept confidential and work area and participants will not be identified. The information collected from participating in this research will be used in a Masters Thesis document, journal publications, presentations and to be used by the UOW

Environmental and Sustainability Initiatives Unit and University Environmental Advisory committee to inform UOW wide initiative and policy development.

For more information please contact either Alison Scobie on 42213626 or Prof Lesley Head on 42213124.

UOW Ethics Number HE12/017

Regards,

Alison Scobie

Environmental Education and Compliance Officer
Environmental and Sustainability Initiatives Unit
Facilities Management Division

all_general_staff mailing list

all_general_staff@mailman.uow.edu.au

http://mailinglists.uow.edu.au/mailman/listinfo/all_general_staff

Appendix B : Participant information sheet



PARTICIPATION INFORMATION SHEET FOR UOW STAFF

TITLE: Understanding printing behaviours and paper consumption at the University of Wollongong (UOW)

PURPOSE OF THE RESEARCH

We are inviting staff of UOW that purchase paper for their work areas/units to participate in a study conducted by researchers at the University of Wollongong. The purpose of the research is to identify the amount of office paper purchased and used by staff for printing at UOW and the reasons for office paper consumption by staff at UOW. The goal of this research is to better inform the development of initiatives that are aimed at reducing the amount of office paper consumed by staff at UOW.

INVESTIGATORS

Prof Lesley Head

Alison Scobie (B.Env.Sc Hons)

Faculty of Science,
School of Earth and Environmental Sciences
University of Wollongong

Masters of Environmental Science Research
Student
School of Earth and Environmental Sciences
University of Wollongong

Environmental Education and Compliance
Officer

Environmental Sustainability Initiatives Unit
Facilities Management Division
University of Wollongong

02-42213124

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lhead@uow.edu.au

alisons@uow.edu.au

METHOD AND DEMANDS ON PARTICIPANTS

If you choose to be included, you will require your Managers approval to participate in this study.

Participants in the study will be asked to participate in an interview by a member of the research team. On this visit the researcher will conduct a 40 minute interview and responses will be typed/or hand written. The interview is to provide a better understanding of the type and quantities of office paper purchased, printer/copier demand, staff/student paper demand within your work area/unit.

Typical questions in the interview include: What type or brand of office paper do you purchase for your work area? How often do you purchase this office paper? Are there periods or times in the year when you needed to purchase paper more frequently or less frequently? Which of these printers are serviced by the paper that you purchase? Based on your knowledge of your area which printers use the most amount of paper and what do you consider to be the reason for the higher paper consumption for those printers? How many staff (academic/ general) and how many students (undergrad/post grad) (approx.) use the paper that is purchased? Based on your knowledge of your area, What activities/ tasks do you consider to be responsible for the most paper being consumed? What are the common actions/activities that you are aware of in your area that contribute to the amount of office paper waste?

Information has also been obtained from UOW Finance and Print and Distribution Services on paper purchases and print data information obtained from Information Technology Services for some of the managed print/copy devices will also be analysed as part of this research for your work area/unit. Your interview will assist in understanding the context and of the data obtained from these sources for your work area/unit.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 40 minutes of your time for the interview we can foresee no risks for you. Your involvement in the study is voluntary and you may withdraw your participation from the study at any time and withdraw any data that you have provided to that point. Refusal to participate in the study will not affect your relationship with the University of Wollongong.

FUNDING AND BENEFITS OF THE RESEARCH

This study is supported in kind by the UOW Environmental and Sustainability Initiatives Unit. This research will provide a basis for the development of initiatives aimed at reducing paper consumption at UOW. Findings from the study will be published in a Masters of Environmental Science Thesis report, an internal UOW report to the Environmental Advisory Committee and possibly published in relevant journals. The information gathered will be used by the Environmental and Sustainability Initiatives Unit and UOW Environmental Advisory Committee to inform UOW wide initiative and policy development.

With the approval of the yourself, your manager, ITS, Finance and Print and Distribution Services a report for your work area can also be made available to you and your manager at the completion of this study.

Confidentiality is assured, and you and your work area/unit will not be identified in any part of the research. The data from each work area/unit will be allocated a nominal coding which will enable the results of the research for your work area to be made available to you and your Manager only, whilst maintaining confidentiality.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the UoW Ethics Officer on (02) 4221 4457 or email rso-ethics@uow.edu.au.

Thank you for your interest in this study

Alison Scobie
Masters Env Science Research Student
alisons@uow.edu.au

Appendix C: Letter of information for UOW Managers



INFORMATION FOR UOW MANAGERS

Dear UOW Manager

We are inviting staff of UOW who purchase paper for their work areas/units to participate in a study conducted by researchers at the University of Wollongong. The purpose of the research is to identify the amount of office paper purchased and used by staff for printing at UOW and the reasons for office paper consumption by staff at UOW. The goal of this research is to better inform the development of initiatives that are aimed at reducing the amount of office paper consumed by staff at UOW.

The project is entitled **Understanding printing behaviours and paper consumption at the University of Wollongong (UOW)**. We write to seek your approval and assistance to conduct research and to involve your staff member as a participant.

INVESTIGATORS

Prof Lesley Head

Alison Scobie (B.Env.Sc Hons)

Faculty of Science,
School of Earth and Environmental Sciences
University of Wollongong

Masters of Environmental Science Research
Student
School of Earth and Environmental Sciences
University of Wollongong

Environmental Education and Compliance
Officer

Environmental Sustainability Initiatives Unit
Facilities Management Division
University of Wollongong

02-42213124

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lhead@uow.edu.au

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METHOD AND DEMANDS ON PARTICIPANTS

If you agree for your staff member to be included, your staff member will be asked to participate in a 40 minute interview provide a better understanding of the type and quantities of office paper purchased, printer/copier demand, staff/student paper demand within your work area/unit.

Typical questions in the interview include: What type or brand of office paper do you purchase for your work area? How often do you purchase this office paper? Are there periods or times in the year when you needed to purchase paper more frequently or less frequently? Which of these printers are serviced by the paper that you purchase? Based on your knowledge of your area which printers use the most amount of paper and what do you consider to be the reason for the higher paper consumption for those printers? How many staff (academic/ general) and how many students (undergrad/post grad) (approx.) use the paper that is purchased? Based on your knowledge of your area, What activities/ tasks do you consider to be responsible for the most paper being consumed? What are the common actions/activities that you are aware of in your area that contribute to the amount of office paper waste?

Information has also been obtained from UOW Finance and Print and Distribution Services on paper purchases and print data information obtained from Information Technology Services for some of the managed print/copy devices will also be analysed as part of this research for your work area/unit. The interview will assist in understanding the context and of the data obtained from these sources for your work area/unit.

POSSIBLE RISKS, INCONVENIENCES AND DISCOMFORTS

Apart from the 40 minutes of your staff member's time for the interview we can foresee no risks. Your staff member's involvement in the study is voluntary and he/she may withdraw from the study at any time and withdraw any data that has provided to that point.

FUNDING AND BENEFITS OF THE RESEARCH

This study is supported in kind by the UOW Environmental and Sustainability Initiatives Unit. This research will provide a basis for the development of initiatives aimed at reducing paper consumption at UOW. Findings from the study will be published in a Masters of Environmental Science Thesis report, an internal UOW report to the Environmental Advisory Committee and possibly published in relevant journals. The information gathered will be used by the Environmental and Sustainability Initiatives Unit and UOW Environmental Advisory Committee to inform UOW wide initiative and policy development. Confidentiality is assured, and your work area/unit and participating staff member will not be identified in any part of the research.

University of Wollongong NSW 2522 Australia
www.uow.edu.au

With the approval of the yourself and the participating staff member, ITS, Finance and Print and Distribution Services a report for your work area can also be made available to you and the participating staff member at the completion of this study.

Confidentiality is assured, and your work area/unit and participating staff member will not be identified in any part of the research. The data from each work area/unit will be allocated a nominal coding which will enable the results of the research for your work area to be made available to you and participating staff member only, whilst maintaining confidentiality.

ETHICS REVIEW AND COMPLAINTS

This study has been reviewed by the Human Research Ethics Committee (Social Science, Humanities and Behavioural Science) of the University of Wollongong. If you have any concerns or complaints regarding the way the research about the conduct of this research, you can contact the Ethics Officer, on (02) 4221 4457 or email rso-ethics@uow.edu.au

Thank you for your interest in this study.

Alison Scobie
Masters Env Science Research Student
alisons@uow.edu.au

Appendix D: Participant consent forms



PARTICIPANT CONSENT FORM

RESEARCH TITLE - Understanding printing behaviours and paper consumption at the University of Wollongong

RESEARCHER'S NAME - Alison Scobie Masters Env Science Research Student

I have been given information about *Understanding printing behaviours and paper consumption at the University of Wollongong* and discussed the research project with Alison Scobie who is conducting this research as part of a Masters of Environmental Science Research degree supervised by Professor Lesley Head in the Faculty of Science, School of Earth and Environmental Sciences at the University of Wollongong.

I have been advised of the potential risks and burdens associated with this research, which include burden of time and maintaining privacy and confidentiality of myself and my work area and have had an opportunity to ask Alison Scobie any questions I may have about the research and my participation.

I understand that my participation in this research is voluntary, I am free to refuse to participate and I am free to withdraw from the research at any time. My refusal to participate or withdrawal of consent will not affect my treatment in any way /my relationship with the School of Earth and Environmental Science or my relationship with the University of Wollongong.

I understand that my participation also requires my Managers consent and my Manager must also sign this consent form. If I have any enquiries about the research, I can contact Alison Scobie 42213626 and Professor Lesley Head 42213124 or if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 4221 4457.

By signing below I am indicating my consent to participating in (or permitting my staff member to participate in) a 40 minute interview about paper consumption in my work area. I understand that the data collected from my participation will be kept confidential and my work area and my details will not be identified. I understand that the information collected from my participation will be used in a Masters Thesis document, journal publications and to be used by the Environmental and

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www.uow.edu.au

Sustainability Initiatives Unit and University Environmental Advisory committee to inform UOW wide initiative and policy development and I consent for it to be used in that manner.

Signed (staff participant)

Date

...../...../.....
Name & Position Title (please print)

Signed (Manager of staff participant)

Date

...../...../.....
Name & Position Title (please print)

.....

PARTICIPANT CONSENT FORM – Post Interview

RESEARCH TITLE - Understanding printing behaviours and paper consumption at the University of Wollongong

RESEARCHER'S NAME - Alison Scobie Masters Env Science Research Student

I have participated in the interview and by signing below I give my consent to information gathered from my interview to be collated with other data on print and paper purchasing for my work area/unit and for it to be provided in report form to my manager.

I request/ do not request (please circle relevant text) to view a copy of the report prior to it being provided to my Manager.

If I have any enquiries about the research, I can contact Alison Scobie 42213626 and Professor Lesley Head 42213124 or if I have any concerns or complaints regarding the way the research is or has been conducted, I can contact the Ethics Officer, Human Research Ethics Committee, Office of Research, University of Wollongong on 4221 4457.

Signed _____ (staff participant) _____ Date

...../...../.....

Name & Position Title (please print)

.....

Appendix E: Interview Questions

Target: staff who purchase paper for their work areas at UOW

Work area/Unit: <insert code>

Paper purchasing and use of recycled-content paper

UOW ESI unit work is investigating use, attitudes and willingness to purchase recycled - content paper within areas of the University of Wollongong. Since the same staff are to be approached by Alison Scobie these questions have been included in this interview. Please note the answers to these 13 questions will be used by the UOW ESI unit.

What brand/type of office paper (printer/copier paper) do you currently purchase? [open]

Where (who) do you purchase this office paper from? [UOW Printery, Corporate express, Office Max, Other specify]

How often do you purchase this office paper? [weekly, fortnightly, monthly, other specify]

Do you keep a record on how much paper you purchase? [Yes/ No]

If yes, using your records how many reams of office paper did you purchase in 2010 and in 2011? [open]

If no, thinking back approximately how many reams of office paper did you purchase in 2010 and in 2011?[open]

How much do you currently pay per ream? [open]

Are you the staff member that is responsible for deciding which paper is purchased? [Yes/ No] If no, please nominate the relevant staff member's name and position title [open]

What factors are considered when deciding which type of paper is purchased for your area? [open -List these factors then ask them to rank them according to least important to most important]

For those that do not currently purchase recycled-content paper

Would you consider purchasing recycled-content paper? [Yes/ No]

If no, What are the reasons why you would not consider purchasing recycled-content paper? [open] If yes, What factors would be necessary to encourage you to purchase recycled - content paper? [open]

Would you be prepared to trial the use of recycled-content paper in your area? [Yes/ No]

What is the maximum price per ream that you consider your area would be prepared to pay for recycled-content paper? [open]

For those that already purchase recycled-content paper

Are you aware of any concerns or issues resulting from the use of recycled-content paper in your area? If yes, what were the concerns/issues. [open]

What do you consider the benefits to be in purchasing recycled-content paper for your area? [open]

How long have you been purchasing recycled-content and what was the reason for using recycled-content paper? [open]

Understanding paper purchase trends

Paper purchasing information has been obtained where possible from UOW financial records and UOW print and distribution services but it is possible that not all paper purchasing has been obtained via these sources. These questions are being asked to assist with determining the accuracy of the paper purchasing information already obtained and determine the representativeness of this information. The questions will also assist with understanding any trends in paper purchasing quantities that are specific to those work areas and to determine if any actions have been conducted to reduce the paper consumption in the area.

Thinking about the paper you purchased for your area in 2011 and 2010:

Are there periods or times in the year when you needed to purchase paper more frequently or less frequently? [open]

Based on your knowledge of your area what do you think is the reason for that [increase or decrease or no change] in annual paper consumed in 2011 compared to 2010? [open]

Have concerns been raised by Heads/ Managers, Deans/ Directors in your area about the amount of paper being purchased or used in printer/copiers? What are the concerns that have been raised? What actions (if any) have been implemented as a result of these concerns? Are you aware whether these actions have made a difference? [Open]

Understanding the printer/copier demand

Printer data information has been obtained from UOW ITS for some of the managed print/copy devices across UOW. This data identifies monthly print use of individual users (UOW staff/Students) to specific printers. Not all printers are covered by this data. These questions will assist to determine what proportion of the printers are covered by the ITS data and assist with determining the representativeness of this information. The questions will also assist in determining what might be the reason for the print totals for the specific printers in those areas and provide context to this data.

Please list of all the printers for your area [open]

Which of these printers are serviced by the paper that you purchase? [open]

Based on your knowledge of your area which printers use the most amount of paper and what do you consider to be the reason for the higher paper consumption for those printers?

Graphs from the ITS printer data showing monthly total of prints for each printer in that work area and total monthly prints for that work area (combining all printers and combining all users so individuals are not identified) to be prepared and used as discussion point for these questions. Note these graphs show print information only (not photocopy). This question is to get some context to the ITS printer information for that area.

Based on your knowledge of your work area can you explain reasons for the print use shown in the graphs? Are there particular work tasks or activities conducted to explain the months that are higher or lower? Are you aware of any reason why X printer is higher or lower in total monthly print use? Does this data correspond with trends in your paper purchasing? [open]

Understanding paper consumption – Staff/Student demand

The purpose of these questions is to get some context to the purchasing and ITS printer information for the work area.

How many staff (academic/ general) and how many students (undergrad/post grad) (approx.) use the paper that is purchased? [open]

Based on your knowledge of your area, What activities/ tasks do you consider to be responsible for the most paper being consumed? [open]

Based on your knowledge of your area, What do you consider are the barriers to reducing paper consumption by staff and students in your area? [open]

Based on your knowledge of your area, do you consider that there is Very High, High, Average, Low, Very Low amount of paper being wasted in your area? [Very High, High, Average, Low, Very Low]

What are the common actions/activities that you are aware of in your area that contribute to the amount of office paper waste? [open]

Based on your knowledge of your area, What are some of the things that staff/ students are actively doing to reduce their paper consumption? [open]

Based on your knowledge of your area, Do Staff/Students always, mostly, occasionally, never print or photocopy double-sided? [always, mostly, occasionally, never]

Based on your knowledge of your area, Do Staff/Students always, mostly, occasionally, never leave papers that were printed/copied uncollected ? [always, mostly, occasionally, never]

Appendix F: Paper purchase quantities per person for each primary work area 2010

Work area	No Reams 2010	No. people 2010	No. reams per person 2010
03	32	no data	no data
04	20	52	0.4
05	180#	no data	no data
07 *	465	2	233
10	1,778	95	19
12	66	14	5
15	95	no data	no data
16	850	32	27
19	55	no data	no data
20	50	no data	no data
22	349	92	4
23	no data	no data	no data
26	610	10	61
27	415	30	14
28	925	40	23
30	875	67	13
31	480	46	10
33	1,778	432	4
34	1,501	124	12
35	820	401	2
36	500	no data	no data
37	2,536	337	8
39	495	no data	no data
41	2,005	447	5
42	1,724	214	8
44	840	127	7
45	2,745	244	11
46	2,655	191	14
47	420	54	8
49	25	no data	no data
50	40	no data	no data
52	60	12	5
53	30	no data	no data
54	15	7	2
55	30	no data	no data
56	no data	no data	no data
61	825	34	24
62	2,481	174	14
63	899	45	20

Appendix G: Paper purchase quantities per person for each primary work area 2011

Work area	No. Reams 2011	No. People 2011	No. reams per person 2011
03	35	no data	no data
04	30	51	0.6
05	145#	no data	no data
07 *	791	2	396
10	1,354	113	12
12	425	14	31
15	85	no data	no data
16	780	34	23
19	10	no data	no data
20	40	no data	no data
22	318	101	3
23	20#	no data	no data
26	440	10	44
27	800	30	27
28	840	50	17
30	901	73	12
31	600	46	13
33	1,538	460	3
34	1,215	130	9
35	720	413	2
36	530	no data	no data
37	2,395	348	7
39	545	no data	no data
41	2,080	508	4
42	1,475	206	7
44	885	120	7
45	2,925	290	10
46	2,375	194	12
47	430	52	8
49	30	no data	no data
50	50	no data	no data
52	30	12	3
53	5	no data	no data
54	10	6	2
55	15	no data	no data
56	5	no data	no data
61	730	34	22
62	2,197	189	12
63	790	223	4

Appendix H: Summary of Print Usage data for each Primary work area for 2010

Primary work area	No. Printers	No. of users	Users per printer	No. of clicks	No. of jobs	No. of clicks per job	Clicks per user	Clicks per printer	Jobs per user	Jobs per printer
4	16	126	8	237,934	53,101	5	1,888	14,871	421	6,743
7	34	404	12	1,079,659	191,993	6	2,672	31,755	475	16,158
8	10	74	7	175,211	40,667	4	2,368	17,521	550	5,496
10	25	243	10	613,889	93,307	7	2,526	24,556	384	9,600
12	5	30	6	33,265	5,729	6	1,109	6,653	191	955
16	19	58	3	242,139	52,744	5	4,175	12,744	909	17,278
22	12	222	19	256,148	58,669	4	1,154	21,346	264	3,171
23	68	442	7	1,553,401	310,281	5	3,515	22,844	702	47,736
26	1	29	29	48,995	13,640	4	1,690	48,995	470	470
27	9	132	15	228,927	30,158	8	1,734	25,436	229	2,056
29	5	33	7	39,162	10,084	4	1,187	7,832	306	1,528
31	8	91	11	273,015	93,771	3	3,000	34,127	1,031	8,244
33	53	421	8	632,572	97,083	7	1,503	11,935	231	12,222
34	12	265	22	892,260	97,016	9	3,367	74,355	366	4,393
37	67	620	9	1,983,149	261,001	8	3,199	29,599	421	28,205
41	6	30	5	44,126	9,072	5	1,471	7,354	302	1,814
42	22	108	5	258,338	40,247	6	2,392	11,743	373	8,199
44	10	89	9	3,33,316	30,657	11	3,745	33,332	345	3,445
45	4	15	4	341	68	5	23	85	5	18
46	7	224	32	2,22,016	24,238	9	991	31,717	108	757
47	6	119	20	2,29,659	77,401	3	1,930	38,277	650	3,903
49	1	6	6	1,271	333	4	211	1,271	56	55
60	6	225	38	2,75,040	39,218	7	1,222	45,840	174	1,046
61	13	272	21	220,812	38,783	6	812	16,986	143	1,854
62	18	180	10	290,454	43,331	7	1,614	16,136	241	4,333
63	8	109	14	383,419	60,976	6	3,518	47,927	559	4,475
Ave	17	176	13	405,712	68,214	6	2,039	24,432	381	7,467
Max	68	620	38	1,983,149	310,281	11	4,175	74,355	1,031	47,736
Min	1	6	3	341	68	3	23	85	5	18
Total	445	4,567	334	10,548,518	1,773,568	151	53,015	635,237	9,904	194,153

Appendix I: Summary of Print Usage data for each Primary work area for 2011

Primary work area	No. of printers	No. of users	Users per printer	No. of clicks	No. of jobs	Clicks per job	Clicks per printer	Clicks per user	Jobs per user	Jobs per printer
4	5	93	19	196,102	40,798	5	39,220	2,109	439	8,160
7	20	399	20	1,059,233	195,186	5	52,962	2,655	489	9,759
8	15	107	7	80,595	21,091	4	5,373	753	197	1,406
10	35	193	6	639,148	87,679	7	18,261	3,312	454	2,505
12	14	142	10	125,224	17,430	7	8,945	882	123	1,245
16	12	68	6	288,584	72,411	4	24,049	4,244	1,065	603
22	14	215	15	217,985	59,161	4	15,570	1,014	275	4,226
23	56	425	8	2,166,136	336,722	6	38,681	5,097	792	6,013
26	1	27	27	83,628	19,425	4	83,628	3,097	719	19,425
27	11	187	17	619,653	79,180	8	56,332	3,314	423	7,198
29	10	101	10	148,587	31,079	5	14,859	1,471	308	3,108
31	3	75	25	307,613	104,871	3	102,538	4,102	1,398	34,957
33	30	407	14	663,939	101,547	7	22,131	1,631	250	3,385
34	14	274	20	946,047	97,135	10	67,575	3,453	355	6,938
37	56	569	10	1,951,531	253,441	8	34,849	3,430	445	4,526
41	6	47	8	81,820	17,669	5	13,637	1,741	376	2,945
42	9	96	11	301,441	49,652	6	33,493	3,140	517	5,517
44	6	83	14	259,582	35,649	7	43,264	3,128	430	5,942
45	44	274	6	538,051	69,672	8	12,228	1,964	254	1,584
46	12	299	25	405,461	36,083	11	33,788	1,356	121	3,007
47	4	97	24	174,543	64,153	3	43,636	1,799	661	16,038
49	2	5	3	5,733	1,282	5	2,867	1,147	256	641
60	7	232	33	312,339	43,643	7	44,620	1,346	188	6,235
61	10	119	12	206,546	37,622	6	20,655	1,736	316	3,762
62	24	205	9	366,133	52,878	7	15,256	1,786	258	2,203
63	5	120	24	386,302	65,014	6	77,260	3,219	542	13,003
Ave	16	187	15	481,998	76,557	6	35,603	2,420	448	6,914
Total	425	4,859	380	12,531,956	1,990,473	156	925,676	62,923	11,652	179,761

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