

End User Development and the World Wide Web

Tanya McGill
Chris Klisc

School of Information Technology
Murdoch University
Western Australia
e-mail: t.mcgill@murdoch.edu.au
e-mail: c.klisc@murdoch.edu.au

Abstract

The development of organisational applications by end users has been widely researched in recent years. It has been established that there are both benefits and risks associated with end user development, particularly in the areas of spreadsheets and databases. Web development tools are enabling a new kind of end user development. The fact that web page creation may impact not only locally but also globally significantly raises the importance of this type of end user application development. This paper reports on the extent of web page development amongst end users and investigates the benefits and risks of end user web development as perceived by end users

Keywords

End user computing, user development, World Wide Web, benefits and risks

INTRODUCTION

End user development of applications is an important source for the provision of organisational information systems. Applications developed by end users support a wide range of decision making activities and contribute to business processing in a wide range of tasks (Rittenberg, Senn, & Bariff, 1990). The major tool used for end user development has been spreadsheets followed by database management systems (Taylor, Moynihan, & Wood-Harper, 1998). Recently web development tools have started to be used by end user developers (Nelson & Todd, 1999; O'Brien, 2002; Ouellette, 1999), and it is anticipated that this use will increase rapidly (Goupil, 2000). However, to date the extent of end user web development has not been reported in the literature.

A substantial body of research has investigated the benefits and risks of development by end users and the factors that influence them (e.g. Alavi & Weiss, 1985-1986; Amoroso & Cheney, 1992; Benson, 1983; Brancheau & Brown, 1993; Davis, 1988; O'Donnell & March, 1987; Rivard & Huff, 1984, 1985). The benefits that have been claimed include improved decision making, improved productivity, and increased satisfaction of end users (Amoroso & Cheney, 1992). The risks that have been identified include mismatches between tools and applications (Alavi & Weiss, 1985-1986; Davis, 1988; O'Donnell & March, 1987), lack of testing (Alavi & Weiss, 1985-1986; Davis, 1988; O'Donnell & March, 1987), inability to identify correct and complete information requirements (Davis, 1988) and failure to back up data (Benson, 1983). The proposed benefits of user development of applications can be attributed to users having a better understanding of the problem to be solved by the application, and the proposed risks to users having less understanding of the process of system development than do information systems professionals.

Whilst problems with traditional end user developed applications can have a large impact on organisational decision making, it has largely been believed that the possible negative impacts are limited to local effects, for example, workgroup or department (Nelson & Todd, 1999). Web development tools are now enabling end users to develop applications that are accessible to vast numbers of people from all over the world (Nelson & Todd, 1999). This brings with it greater potential benefits and risks. These benefits and risks can affect business processes, customers, suppliers and other organisations more than ever before. The exploratory study described in this paper investigates both the extent of web page development amongst end users, and the benefits and risks of end user web development as perceived by end users.

In the past organisations have done little to address the risks of traditional end user development (Panko & Halverson, 1996). Nelson and Todd (1999) investigated what strategies organisations were using to reduce the risks of end user development on the web. They developed a survey reflecting a web-related environment that was structured around 18 activities identified by Alavi, Nelson and Weiss (1987-1988). Each of these activities was classified as being in one of three categories: standards setting, resource allocation, or management and

support of application development. They found that organisations placed most emphasis on setting standards, followed by resource allocation, and that support of development was the least used type of approach. They also noted that there were large gaps between the perceived importance of some approaches and the degree to which they were currently being used. The participants in the Nelson and Todd study were predominantly information technology staff (28 out of 34) with the remainder being senior management. The study described in this paper investigates the perceptions of end user developers as to the importance of various approaches to reducing the risks of end user web development and compares these perceptions to those reported by Nelson and Todd (1999).

THE PROJECT

Participants

The sample for this study consists of 60 end users who had previously participated in a study on end user spreadsheet development (details of the original study can be found in McGill, 2001). The target population for the original study was end users who develop their own applications using spreadsheets. In order to obtain a sample of end user developers with a wide range of backgrounds, participants in the original study were recruited in several ways. Firstly, a number of advertisements were placed in local newspapers calling for volunteers, these were followed by e-mails to three large organisations that had expressed interest in the study and finally word of mouth brought forth some additional participants. The criterion for inclusion in the original study was previous experience using Microsoft Excel. Whilst being essentially a convenience sample, the participants covered a broad spectrum of ages, spreadsheet experience and training.

In the current study of 60 participants, 35% were males and 65% were females. Ages ranged from 20 to 67 years with an average of 45 years. On average, they had been using computers for 14 years (ranging from 4 years to 30 years). Some participants had considerable experience as 30 years of use indicates adoption very early in the personal computing revolution.

Procedure

The results of the earlier spreadsheet study were mailed to all participants, along with a request to participate in the current study by completing an enclosed questionnaire. Some participants, for whom no postal address details were recorded, were initially contacted via e-mail and asked to participate in the current study before being mailed the questionnaire. Those who failed to return the questionnaire and for whom e-mail addresses were recorded were sent a reminder by e-mail after approximately 3 weeks. One hundred and sixty seven questionnaires were mailed out and 60 completed questionnaires were received, giving a response rate of 36%.

The Questionnaire

The questionnaire consisted of five sections. The first section asked questions about the participants and their previous training and experience with computers and the Internet. The second section asked specifically about web page development experience and training, and where relevant, explored reasons for non-development. Questions relating to both Internet and web development training asked about formal courses and self study separately and responses were measured on a 5 point scale from Igarria (1990) where (1) was labelled 'none' and (5) was labelled 'very intensive'. In order to determine which web development tools end users had used, a list of nine popular tools was created based on information from a recent review of authoring tools (Moore, 2002). Respondents were asked whether they had used each of them and also given provision to name any other tools used. Reasons for non-development were explored via three items that were developed for this study. Respondents were asked to rate the importance of each reason for non-development on a 5 point scale where (1) was labelled 'not important' and (5) was labelled 'very important'.

The third and fourth sections included questions to be answered by all respondents about the potential benefits and risks of web page development. A list of the major benefits and a list of the major risks were developed from the literature on benefits and risks of development by end users (Alavi & Weiss, 1985-1986; Amoroso & Cheney, 1992; Benson, 1983; Brancheau & Brown, 1993; Davis, 1988; O'Donnell & March, 1987; Rivard & Huff, 1984, 1985). Each potential benefit was rated for importance on a 5 point scale measured from (1) 'not important' to (5) 'very important'. Each potential risk was also rated for importance on a 5 point scale measured from (1) 'not important' to (5) 'very important'. Twelve questions addressed potential benefits of end user web development and 12 questions addressed potential risks.

The final section addressed approaches to reducing the risks of end user web development. The questionnaire included 14 items to measure the perceived importance of the major activities that can be undertaken to reduce the risks of end user development on the web. These items are from the Nelson and Todd (1999) instrument.

Each approach was rated for importance on a 5 point scale measured from (1) 'not important' to (5) 'very important'.

RESULTS AND DISCUSSION

Background

Table 1 summarises the background characteristics of respondents including their previous experience and training with the Internet. Respondents had been using the Internet for an average of around 6 years (ranging from not having used it at all to 12 years). Considering the WWW came into practical existence around 1994, some of the respondents were obviously at the forefront of online communications, having used the Internet prior to the emergence of the WWW. However, most respondents appear to have used the Internet for between three and nine years, indicating Internet use as being dependent upon the emergence of the WWW.

Table 1: Background characteristics of respondents

	<i>Mean</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard Deviation</i>
Age (years)	44.68	20	67	10.32
Computing experience (years)	14.22	4	30	6.66
Internet experience (years)	6.19	0	12	2.79
Internet training - formal (/5)	1.63	1	4	0.80
Internet training - self study (/5)	2.61	1	5	1.08

Reasons for Internet use were also investigated and the results are reported in Table 2. Respondents used the Internet heavily for both work and personal reasons (91.7% and 93.3% respectively). It is worth noting that of the 60 respondents, only one reported not having used the Internet at all. Respondents had had little training in Internet use. The average level of formal training was 1.63 (out of 5), and the average level of self study training was 2.61 (out of 5), so self study was the main source of Internet training. Over half (55%) had received no formal training and almost half (47%) indicated that they had either not undertaken any self study or had done very little. It appears that on the whole Internet learning has been achieved via personal pursuits, and this is not perceived as training. No respondents rated their formal Internet training as extremely intensive and only two (3.3%) rated their self study as extremely intensive, again indicating very strong personal reasons for using the Internet, and reinforcing the popular image that 'people enjoy surfing the web'.

Table 2: Internet use

	<i>Number</i>	<i>Percentage</i>
Work use	55	91.7
Personal use	56	93.3

WEB PAGE DEVELOPMENT

Almost half (27 or 45.0%) of the sample of 60 spreadsheet end user developers surveyed had previously engaged in web page development (see Table 3). Of these, 55.5% (15 people) had created web pages for work use and 66.7% (18 people) had done so for personal interests.

Table 3: Web page creation

	<i>Number</i>	<i>Percentage</i>
<i>Web page creation</i>		
Yes	27	45.0
Work use	15	55.5
Personal use	18	66.7
No	33	55.0
Total	60	100.0

Those respondents who had developed web pages were asked to indicate their prior web page development training. As can be seen from Table 4, levels of web development training were relatively low with an average of 1.96 out of 5 for formal training and 2.58 out of 5 for self study. Self study was again the predominant method of training. Forty percent of those who had developed web pages had received no formal training. The emphasis on self training is consistent with other forms of end user development such as spreadsheet development (Chan & Storey, 1996; Hall, 1996), but may also indicate the 'fun' aspect of engaging in what is

currently seen as ‘hot’. The role of self training in end user web page development could be investigated in further research.

Table 4: Level of web page development training

	<i>Number</i>	<i>Mean</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard Deviation</i>
Formal courses	27	1.96	1	4	0.98
Self study	26	2.58	1	5	1.03

As can be seen in Table 5, the most common tool used by the 27 respondents who had developed web pages was Microsoft FrontPage (55.6%). This is consistent with the case study discussed in Ouellette (1999), where Microsoft Frontpage was used by 108 end users who contribute to an intranet. The second most commonly used tool was Microsoft Word (48.1%). The third most frequently used tool was Notepad (46.2%), which suggests some measure of familiarity with HTML code, and may indicate a desire on the part of users to ‘understand’ and have more control over web page development, not just create the pages. The final tool of significance is Macromedia Dreamweaver which had been used by 40.7% of users. As Dreamweaver is a rather expensive program for home use, perhaps it would be fair to say that this tool is primarily used in the workplace. No other tools were used by more than two respondents.

Table 5: Web development tools used

	<i>Number</i>	<i>Percentage</i>
Microsoft Frontpage	15	55.6
Microsoft Word	13	48.1
Notepad	12	46.2
Macromedia Dreamweaver	11	40.7
HotDog Pro	2	7.4
Adobe GoLive	1	3.7
Macromedia Homesite	1	3.7
CoffeeCup HTML Editor	1	3.7
HotMetal Pro	0	0.0

The reasons why the sample of spreadsheet developers had not yet developed web pages were also explored. Thirty three respondents (55.0%) reported not having created a web page and their reasons are listed in Table 6. The most important reason for not creating web pages was lack of knowledge despite wishing to do so (with an average importance of 2.50 out of 5), while lack of professional need and lack of personal need were rated as less important on average (1.45 and 1.58 respectively out of 5). It is worth noting that not one person strongly disagreed with ‘no personal need for creating a web page’, indicating a recognition of the role that web page development plays in many people’s personal lives and possibly acknowledging the potential for it to enter their own. This subset of respondents was also asked if they anticipated developing web pages in the future. Eleven people (33%) indicated that they didn’t anticipate developing web pages in the future, five (15%) indicated that they would create a web page in the future, while 19 (58%) acknowledged the possibility of doing so. As it is very difficult to predict future needs, the high percentage in the ‘possibly’ category reflects acceptance of the rate of change that is associated with the Internet (Burn & Loch, 2001).

Table 6: Reasons for not developing web pages

	<i>Mean</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Standard Deviation</i>
No professional need (/5)	1.45	1	5	1.00
No personal need (/5)	1.58	1	4	0.89
Would like to, but do not know how (/5)	2.50	1	5	1.42

BENEFITS OF END USER WEB PAGE DEVELOPMENT

The benefits of end user web page development are ranked by perceived importance in Table 7. The most important benefits relate to accessing and disseminating information. Improved accessibility of information was ranked most highly and was followed closely by improved communication of information. Faster response to information requests and direct control over information and applications were ranked third and fourth respectively. End users recognise that web page development provides them with a unique opportunity to both provide and access information. Whilst increasing access to the Internet and the availability of user-friendly

browsers has made accessing sites developed by information technology professionals a valuable information gathering approach, the development of user-friendly web development tools has enabled end users to participate in information dissemination to a degree never before possible.

Table 7: Potential web page development benefits ranked by importance

Rank	Benefit of End User Web Page Development	Mean	Standard Deviation
1	Improved accessibility of information	4.25	1.07
2	Improved communication of information	4.12	1.08
3	Faster response to information requests	3.82	1.15
4	Direct control over information and applications	3.66	1.28
5	Better use of limited resources	3.54	1.24
6	Improved user computer literacy	3.30	1.25
7	Encourages experimentation and innovation	3.27	1.10
8	Reduction in development backlog	3.20	1.24
9	Increased user satisfaction	3.18	1.10
10	Improved productivity	3.12	1.31
11	Improved decision making effectiveness	3.02	1.26
12	Improved relationships with information technology staff	2.46	1.19

The middle ranked benefits appear to reflect personal benefits from end user development. Better use of limited resources was ranked fifth followed by improved user computer literacy and encouragement of experimentation and innovation. End user developers appear to place moderate value on what they learn and gain from development beyond their specific task oriented information needs. These results for end user web development are consistent with the literature on other kinds of end user computing (Agarwal, 2000; Amoroso & Cheney, 1992; Davis, 1988; Pentland, 1989).

Reduction in development backlog was ranked eighth in importance. This implies that end users are not developing applications that would otherwise be developed by information technology professionals. Their web pages are in addition to those deemed necessary by their organisations and hence their development effort may not impact significantly on development backlogs.

Increased user satisfaction, improved productivity and improved decision making effectiveness were ranked ninth, tenth and eleventh in importance respectively. The relatively low ranking of user satisfaction suggests that whilst web development tools have become more user-friendly, web development is not yet a straightforward and satisfying experience. End users perceived the experience as one of learning and self-improvement rather than one that satisfies and/or results in applications that improve user satisfaction. Web page development is not perceived as an important source of productivity or decision making effectiveness. Web page development leads to information dissemination for the developer, but the participants in this study did not see this as improving their own productivity or decision making effectiveness, nor that accessing information provided from web pages developed by other end users would play an important role in improving their own productivity. This raises questions about the purposes of user developed web pages. Future research should explore more closely the reasons for which web pages are developed by end users.

The lowest ranked potential benefit was improved relationships with information technology staff. The low ranking reinforces the idea that end user web development is an activity that is removed from organisational system development. End users do not perceive it as supporting organisational development. The low ranking may possibly reflect the introduction of additional tensions in relationships with information technology staff, brought about by the risks of end user development.

No significant differences were found in the importance ratings of any benefits between those who had and those who hadn't previously developed web pages.

Risks of End User Web Development

The risks of end user web page development are ranked by perceived importance in Table 8. All potential risks were rated fairly high with averages above the midpoint of the scale, which implies a good awareness of the problems that can plague end user development. Unreliable systems were perceived as being the most important risk, with lack of data security ranked closely behind. The potential for development of unreliable and insecure systems has long been recognised as one of the major problems with end user development (Benson, 1983; Brancheau & Brown, 1993). Despite this recognition, organisations have done little to protect against it (Panko McGill, Klisc (Paper #16)

& Halverson, 1996). The high ranking of this risk with respect to end user web development reflects the increased level of importance of the problem due to the global accessibility of web-based systems. The potential for damage to the reputation of an organisation has increased as applications have become accessible by vast numbers of people from all over the world (Nelson & Todd, 1999).

Table 8: Potential web page development risks ranked by importance

Rank	Risks of End User Web Page Development	Mean	Standard Deviation
1	Unreliable systems	4.24	1.03
2	Lack of data security	4.19	1.10
3	Incompatible end user tools preventing sharing of applications and information	4.19	0.93
4	Inability to identify correct and complete information requirements	4.00	1.08
5	Lack of testing	3.96	1.04
6	Lack of documentation for applications	3.93	1.11
7	Mismatch between development tools and applications	3.87	1.10
8	Use of private systems when organisational systems would be more appropriate	3.83	1.10
9	Failure to backup data	3.81	1.16
10	Inefficient use of personnel time	3.79	1.04
11	Solving the wrong problem	3.51	1.28
12	Redundant development effort	3.41	1.17

Incompatible end user tools preventing sharing was ranked equal second in terms of importance as a risk. The last decade has been marked by great improvements in the compatibility of end user software, hence this result was unanticipated and requires further research.

The midranked group of risks all focus on the ability of the end user developer to undertake specific necessary development tasks such as identifying requirements, testing, documenting and choosing appropriate development tools. The respondents appeared to recognise the importance of each of the activities and the risks that can result from lack of skills in these areas.

Use of private systems when organisational systems would be more appropriate was ranked as the eighth most important risk, and failure to backup data as the ninth. Both of these risks relate to use of user developed applications rather than the actual development process and their lower ranking suggests that the respondents recognise that the major risks result from development practices rather than from use of applications.

The lowest ranked risks were inefficient use of personnel time, followed by solving the wrong problem and lastly redundant development effort. However, none of these risks was discounted, with averages that indicate that the majority of respondents recognised them as risks of relative importance. Not one respondent rated inefficient use of personnel time as 'not important'; five (9.4%) rated solving the wrong problem as 'not important' and one (1.9%) rated redundant development effort as 'not important'.

It was interesting to note that the average importance of each risk was lower for the group who had previously developed web pages than for the group who hadn't, although the differences were only significant for four risks (inability to identify correct and complete requirements ($t(52)=2.36$, $p=0.022$), use of private systems when organisational systems would be more appropriate ($t(52)=2.19$, $p=0.033$), solving the wrong problem ($t(51)=2.54$, $p=0.014$), and redundant development effort ($t(52)=2.70$, $p=0.009$)). Reasons for this difference could be that the development process has given them insight that allows them to discount the risks; however this seems unlikely given the prevalence of problems with end user developed applications. It would seem more likely that the satisfaction they derive from their own web development allows an overshadowing of the perceptions of risks. This should be explored further in future research.

Future research should differentiate between different types of web applications that might have different risks and benefits. For example, the risks associated with end user developed web pages that merely display information could be considered substantially less than those associated with applications that process information.

Approaches to Reducing the Risks of End User Web Development

The approaches to reducing the risks of end user web page development are ranked by perceived importance in Table 9. All of the approaches were rated fairly high with averages above the midpoint of the scale. The highest ranked approach was training. As discussed above, previous studies have found that end user developers receive very little training and what they do get tends to be self-training rather than formal training (Chan & Storey, 1996; Hall, 1996). The results in this study about training for web development are consistent with other forms of end user development such as spreadsheet development. The acknowledgement of the importance of training is quite interesting, as despite having received little training themselves, the respondents considered training to be the most important approach to reducing the risks of end user web development. Nelson (1991) suggested that training is perhaps the most effective tool for minimising the risks associated with end user development and the results of this study suggest that end users agree.

Table 9: Approaches to reducing the risks of end user web development

Rank	Approaches to Reducing the Risks of End User Web Page Development	Mean	Standard Deviation	Nelson & Todd (1999) Study
1	Training	4.39	0.81	3.48
2	Policies on data management	4.39	0.71	4.25
3	Coordination across organisational boundaries	4.31	0.75	4.00
4	Assignment of roles and responsibilities	4.28	0.81	3.61
5	Standards for purchases of hardware and software	4.19	0.83	3.76
6	Data access	4.17	0.86	3.85
7	Planning for equipment, capacity, and manpower	4.17	0.77	3.97
8	Scope of web-related activities	4.15	1.02	3.03
9	Systems integration	4.11	0.86	3.36
10	Consulting	4.06	0.90	3.58
11	Audit and review	3.98	1.04	3.47
12	Standards for end user development	3.98	0.84	3.73
13	Setting priorities	3.89	0.90	3.88
14	Documentation	3.83	1.00	3.18

Policies for data management was considered to be the second most important approach. This was unexpected because end user developers have traditionally been dissatisfied with approaches to the management of end user computing that involved control rather than support (Bergeron & Berube, 1988; Bowman, 1988). However, this ranking is promising as it suggests that end user web developers recognise that Internet applications are particularly vulnerable to data security risks and that these therefore must be addressed.

The middle grouping consisted of a number of approaches of similar importance that include assignment of roles and responsibilities, standards for purchases of hardware and software, and scope of web-related activities (i.e. clear distinctions between applications that are developed by end users and by information technology professionals) among others. The very consistent levels of importance given to these suggests that end users recognise that a variety of approaches is necessary and that approaches are complimentary.

Audit and review, standards for end user development and a requirement for documentation of web applications were ranked towards the bottom of the possible approaches. This is consistent with previous research that suggests that users are less satisfied when subject to greater application development control (Bergeron & Berube, 1988; Bowman, 1988). Nevertheless, a need for setting and enforcing organisational development standards for end users has been widely recognised (Cragg & King, 1993; Guimaraes, Gupta, & Rainer, 1999).

Setting priorities was also not given a high importance ranking. This suggests that, as might be expected, end user developers consider the web development they do as an individual activity designed to support their own work rather than part of an organisational information technology strategy. It is interesting to note that setting priorities is the only approach that was not more highly rated by the respondents in this study than the respondents in the Nelson and Todd (1999) study from which the items were derived.

As can be seen in Table 9, the end user developers who responded to this survey rated every approach to reducing the risks of end user web development (except setting of priorities) higher than did the information technology and senior management who participated in Nelson and Todd's (1999) study. The approaches on which opinion differed the most were training and scope of web-related activities. Information technology staff involved in managing end user development should recognise the importance to end users of appropriate training to support their development activities and of the need for clear distinctions to be made to enable the confidence of end users in determining which projects are appropriate for them. Guidelines on the kinds of applications that are suitable for end user development can help with this. Several authors have proposed guidelines recommending what kinds of applications are appropriate for end user development (Salchenberger, McGill, Klisc (Paper #16)

1993), and what kinds are not (Bowman, 1990). These types of guidelines need to be researched further so that more detailed assistance can be provided to prospective end user developers. In particular, the ability to tailor recommendations on what types of applications are appropriate to individual end users' backgrounds would be very valuable.

Nelson and Todd (1999) found that organisations placed most emphasis on setting standards, followed by resource allocation, and that support of development was the least used type of approach. They noted that most firms in their study appeared to be relying on a monopolistic control strategy (as described by Gerrity and Rockart (1986) and Alavi et al. (1987-1988)) and then concluded that while such a strategy may be the best approach given the relative infancy of web technology, it could prove to be an unstable strategy in the future. The results of the study reported in this paper, suggest that end user developers would support a change to the strategies used to manage end user web development with greater emphasis being placed on support of development via such mechanisms as training and clear definition of roles and responsibilities.

Those who had and those who hadn't previously developed web pages were compared with respect to their perceptions of the importance of the approaches to reducing the risks of web development. As with perceptions of risks, those who had previously developed web pages tended to rate the importance of the approaches lower than did the end users who hadn't, although the differences were only significant for two approaches: standards for purchases of hardware and software activities ($t(52)=2.80$, $p=0.007$), and scope of web-related activities ($t(52)=2.22$, $p=0.031$).

CONCLUSION

Despite early concerns about its risks (e.g. Alavi & Weiss, 1985-1986; Davis, 1988), end user development has become an integral part of organisational information provision (McLean, Kappelman, & Thompson, 1993; Shayo, Guthrie, & Igbaria, 1999). End user developers may now take advantage of user-friendly web development tools to create web applications and the prevalence of these applications will only increase (Ouellette, 1999). The study reported on in this paper investigated the extent of web page development amongst end users and investigated the benefits and risks of end user web development as perceived by end users. Almost half of the sample of spreadsheet users studied had created web pages, yet they had received little prior training in web development. Microsoft Frontpage was the most common tool used for web development, however almost half had previously used Notepad indicating some familiarity with HTML code. This suggests a desire to 'understand' and have more control over web page development. The most important reason for not creating web pages was lack of knowledge, and the majority of those who had not yet created web pages acknowledged the possibility of doing so.

As no distinction was made in this study between simple web page development and the creation of web applications, further research in this area would explore this distinction in order to gain a more comprehensive insight into the types of web development end users are undertaking and into how this influences their perceptions of risks and benefits.

It seems that end user web development is here to stay and that management of its risks will be of increasing importance to organisations. The results of this study have practical implications for the management of end user web development in organisations. End user developers are aware of both the benefits and risks of end user web development and it will be essential to ensure their involvement in the development of approaches to control risks. Previous research suggests that end user developers respond better to approaches that emphasise support for development of high quality and appropriate applications rather than control of development (Bergeron & Berube, 1988; Bowman, 1988). The results of this study support this, with training being seen as the most important approach to the reduction of the risks of end user web development.

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