
IS THERE A CORRELATION BETWEEN ICT INTEGRATION LEVELS AND LEARNING ORGANISATION MATURITY

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Abstract The use of technology by academics in teaching learning and assessing in higher education has become increasingly important in the early part of the 21st century. In this study 10 institutes of technology in higher education in Ireland are examined to investigate whether learning organisation maturity may be interpreted as a predictor of ICT integration levels. Two tools were used for this study. These tools are the learning organisation profile (LOP) tool adapted from [1] and the teaching learning and assessing tool (TLA) developed for this study. Some positive correlation between LOP & TLA were established for the institutes as a group and at individual institute level.

Keywords Learning Organisation Profile, Institute of Technology

1. Introduction

"Everything has changed but our ways of thinking, and if these do not change we drift toward unparalleled catastrophe." [2] Information and Communications Technology (ICT) is now a mainstream component of how higher education institutes conduct their business in Western Europe. The interest in investigating this topic arises from such work as that described by [3] where respondents listed ICT as a top three change driver in higher education. This makes ICT the third most significant change driver in higher education presently.

Many major studies, such as those by [4] and [5] in Europe, [6] in the US and [7], which has a global perspective, have examined the effectiveness of the integration of ICT into higher education organizational processes in detail. Overall these analyses provide a mixed picture of the effects on educational outcomes of the integration of ICT into teaching, learning and assessing (TLA). Many of these reports point to the requirement for continued research into this area. Researchers such as [4] found a disjoint between perceptions of policy and strategy makers and those employing ICT in delivery of higher education at the chalk face. The perception from students particularly from [4] was that there was little or no ICT skills development in their programs of study.

In the literature there are some radical approaches mentioned in relation to the integration of ICT into TLA. [8] for example, describes the scenario from Carnegie Mellon University where it was suggested that the traditional academic would be replaced by electronic tutors in the future. However, most reports agree that in the main a blended approach to the use of ICT in TLA will prevail. In the exploration of the integration of ICT into TLA, evidence of best practice will be sought both from the policy / strategy and the levels of integration perspectives. First, the paper will give a brief outline as to the development of the institute of technology (IOT) sector and where it sits within the higher education landscape of Ireland currently, in order to set the context for this study.

1.2. Irish Context

The higher education sector in Ireland is made up of in the main two types of higher education institutes i.e. universities and IOTs. In more recent times some private third level institutes have emerged mainly in the Dublin region. The Higher Education Authority (HEA) has traditionally been the funding body for universities and recently has become the funding body for the IOTs. This study is focused on the IOT sector. However it is important as a preamble to explore some of the current thinking into what the writer understands an IOT to be in the context of this study. Fundamentally the IOTs are coming from a base where [9] would describe them as teaching institutes i.e. institutes where the primary role is teaching where little or no research activity existed in the early days of their existence. In recent years there has been a greater emphasis on applied research in the IOTs.

Ireland has a binary higher education system, which developed over time to meet the needs of the various academic attainments of those student cohorts completing second level education and to serve the needs of the economy transforming from a mainly agricultural to a more industrialized base. Within the sector universities are mainly concerned with undergraduate and postgraduate programs to PhD level and beyond together with basic and applied research. The IOTs are mainly concerned with undergraduate programs, together with some post-graduate programs. IOTs are mainly involved with applied research and have strong regional links with industry in their locales. The IOTs were founded in the early nineteen seventies, whereas the university sector in Ireland has been in existence for a number of centuries.

IOTs were initially called Regional Technical Colleges. They were ten such colleges established at first in the early nineteen seventies. This number has increased to thirteen IOTs recently, with a number of new institutes opening in the Dublin metropolitan area towards the end of the twentieth century. The IOTs vary in size from 1,000 to 8,000 students. These are strategically located geographically throughout the country.

This study is set in an era when higher education institutions, similar to private business organisations are required to adapt and change at an increasingly frenetic rate to ever more intrusive environmental stimuli which require rapid cultural shifts. These adaptations are being driven by factors such as globalization, increasing competition, ubiquitous technology and communications and the emergence of the post-industrial society where the expected graduate is a knowledge worker [10]

required for the knowledge economy [11]. This is particularly true of Ireland a small open economy on the periphery of Europe which is currently hemorrhaging its traditional manufacturing base to less costly eastern European and Asian states. The current mantra of the Irish Government and all its agencies is to transform Ireland to a leading knowledge economy [12] as soon as possible.

1.3. Higher Education Institutions as Learning Organisations

Therefore, the question is what type of higher education institution is required to produce new knowledge workers and / or transform traditional workers to knowledge workers? The answer suggests a higher education institution which, somehow itself operates similarly to what is expected of any new knowledge economy entity. [1], [13] and others advise that knowledge economy entities are ones that embrace the learning organisation phenomenon. While the learning organisation phenomenon is supported by many in the literature the writer acknowledges that it has its detractors also such as, for example, [14]. There is a lack of empirical evidence of successful deployments of the learning organisation concept in many studies. This fact must also contribute to the view that the phenomenon, like many other yet to be proven management theories, will inevitably be embraced with a certain amount of scepticism. [15] suggests that the learning organization approach ought not be adopted in higher education as it is too close to management theories pertaining to private sector for profit organisations. The writer would disagree with these views however from both a theory and a praxis dimension. From the theory perspective the writer believes that the learning organisation approach is suitable as a model for the higher education setting as supported in literature such as [16] and [17]. The study described in this article is an example of investigation of learning organization theory in a higher education setting.

Higher education institutions are required to respond in ever shorter life cycles in adapting to new pedagogical cultures, driven by environmental change. In this climate there is a need to at least investigate business frameworks such as those espoused in learning organisation theory. Examples such as the [18] COVARM project in the UK represent efforts to streamline and normalize the course validation process using business models and software engineering tools. It is salutary in exploratory research in this area to look at a model like the learning organisation in that a limited amount of research exists in a higher education setting using such a model and thus further investigation is opportune at this juncture..

In essence a brief exploratory study undertaken by the writer fits into this drive towards the knowledge economy currently the strategic focus of Ireland Inc., in that it examines in a small way two important building blocks of the knowledge economy i.e. learning organisation maturity and efficacy in ICT deployment in organizations specifically in a higher education setting here. In a wider context, this study can also be viewed as contributing to the European Union objectives around the development of knowledge economies in its setting of agendas in areas such as life-long learning and e-learning. These aims originated from Lisbon in 2000 when the EU declared that it wished to become "*the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion*".

While a lot has been written about learning organisations and organisational learning ([13], [14], [19]) in the literature, there appears to be a dearth of work which links the theory to the application or practice.

2. Methodology & Literature Review

The study set out initially to identify strategies and / or strategic frameworks around the integration of ICT into TLA in higher education. During the examination of the literature a lack of specific frameworks became evident. Various assessment tools have been developed for measuring learning organization capability. In the main these tools adopt a normative perspective based on learning organization attributes arising from the literature. This study will adopt a similar approach in line with its coherence to social research in this domain. To the fore in these normative approaches is the self-assessment likert type scale method such as those developed by [26], [27], [28] and [1].

[26] developed a self assessment likert based tool. In the case of [27] they developed likert type questionnaires concerned with measuring areas such as the quality of the learning environment and the organization toxicity index (OTI). These measures allow an estimate of how amenable organizations are to allow their employees opportunities to learn. In the case of [28] they developed a likert type tool called the learning organization survey which consisted of 21 questions comprising five sections covering areas such as clarity of mission and vision, leadership commitment and empowerment, experimentation and rewards, effective transfer of knowledge and teamwork and group problem solving. [28] developed this tool in order to measure an organization's learning capability. This tool has been used in many case study analysis e.g. [29] and was adapted for a study in higher education by [30] in a paper on organizational learning maturity in higher education institutes.

However, despite the limited amount of frameworks, the writer was still determined to somehow examine institutes organisational strategic awareness. In this study the writer endeavoured to identify if there was any correlation between the level of integration of ICT into TLA and the level of learning organisation maturity in the IOTs.

2.1. Learning Organisation Maturity

Learning organisation maturity for an entity may be viewed, analogously, as continuous professional development or life

long learning for an individual. The learning organisation approach seemed to fit well with what the writer sought as a framework for strategic thinking, given its currency. The next hurdle to be crossed was to ascertain, whether it was possible to establish a measure of this 'learning organisation maturity' in relation to higher education institutes under examination. This led the writer to the work of [1] who along with others such as [19] had explored and applied in practice learning organisation maturity theories in many case studies. The tool developed by [1] for this purpose was called the learning organisation profile (LOP). The LOP tool made up of five subsystems namely, learning dynamics, organisational transformation, people empowerment, knowledge management and technology application. These subsystems seemed to have the elements required for the idea of a measure of learning organisation maturity, which was necessary to address the strategic focus of the study. The tool in praxis had been applied in over 500 case studies consisting mostly of business type organisations. The writer, by employing this tool, was if you like continuing the practice [20] of applying strategic methodologies first used in business organisations subsequently in a higher education setting. A number of small adjustments were made to the LOP tool in order to adapt it for this study within a higher education setting. Firstly some of the statements were slightly amended to allow a better fit to a higher education environment. Next some of the all positive statements in the questionnaire were changed to negative statements in order to mitigate against bias [24], [25] in the data.

Having found and adapted the tool to address the strategic focus of the study, the writer next sought a tool that might assist in establishing the level of integration of ICT into TLA in the subject higher education institutions. Again during the literature review tools developed around this theme such as [21] 'diffusion of innovations' and [22] 'technology acceptance model' (TAM) were examined. While acknowledging that the ideal way to make a measure of ICT integration is to monitor behaviours of use over time, this is not always feasible. So, given the cross-sectional nature of the study and having anchored the strategic focus in a well tried tool, the writer decided to develop a new tool to measure ICT integration levels. In order to mitigate in some way the risks presented by the new tool called TLA, (teaching learning and assessing), the tool was developed in a similar fashion to the already well accepted LOP tool, in that it used a likert type questionnaire, a well established methodology in social research. The TLA tool consisted of three subsystems with likert type questions around the use of ICT in lecture preparation, delivery and assessment. The tool was devised to provide a snapshot of ICT integration into TLA in the subject higher education institutions. The TLA tool, having been modelled on the LOP tool, could also follow the argument around aggregation [23] of data from individual to organisational level, which was necessary for this study. The TLA tool was tested statistically for validity and reliability, similarly to the LOP tool, and proved well within the norms required for social research.

2.2. Study Question

The main question posed by this study was:

Is it possible to correlate, the identification of learning organization' maturity, with the level of integration of ICT into TLA in the Institute Of Technology sector in Ireland?

First off it was imperative for the writer to identify a suitable means for gathering data given the limited resources available. Having looked at various options such as mailing surveys and online surveys, the online route was chosen because of administrative efficiency. Within the online area the next decision to take was whether the writer would outsource or manage himself the technical aspects of the survey. The latter was chosen, as the writer felt confident enough technically to do so. The main benefit, here, was the cost-neutral aspect of this approach. Having examined many open source survey tools PHPSurveyor was chosen as it showed best fit for what was required by the study. The adapted LOP and TLA tools were loaded onto the online PHPSurveyor tool. This tool is open source and uses the PHP scripting language and has the MYSQL database system as a back end. It catered for all the types of survey questions required in this study. Another useful feature of PHPSurveyor was that survey data could be easily extracted from it into an excel or CSV spread sheet format. This would greatly help in preparing data for analysis. The writer downloaded this open source product from www.phpsurveyor.org and installed it on a LINUX web server based within Athlone Institute of Technology. To summarize, the reasons an online publishing method was chosen were the following:

- Fast delivery of survey to targeted cohorts
- Easier administration of gathered data
- The predication of limited time and resource of the writer
- It was felt that participants would be more predisposed to completing a survey about ICT in Teaching Learning and Assessment in this fashion.

3. Findings

The survey was launched and data was gathered between June and July 2007. There were thirteen subject higher education institutions targeted and data from both tools was successfully gathered from ten of them. When the survey was closed the data was exported from PHPSurveyor and imported into SPSS for codification and analysis. Tables 1 to 5 give a summation of the preliminary findings.

The two tests chosen for this analysis were correlation of LOP subsystems with TLA subsystem results and multivariate

analysis between LOP subsystems as independent variables and TLA subsystems results as dependent variables. Table 1 applies a correlation analysis of LOP subsystems against TLA subsystems to ascertain trends here around the research question against the subject higher education institutions as a group. Table 1. shows significance in all cross-tabulations with, in general, a positive weak to moderate correlative effect between subsystems. In Table 1 the most significant correlations returned from cross tabulation are in the people empowerment subsystem, first and technology application subsystem, secondly. The other subsystems of learning, organisation and knowledge showed no significant correlations from cross tabulation.

The analysis in Table 2 tells us that the independent variables of people and technology can reliably predict the dependent variable preparation. This again underpins findings in Table 1. Table 2 indicates that for every unit increase in the independent variable, the dependent variable preparation is increased / decreased. For example with the people on its own in the model every unit increase in the independent variable people there is a predicted .21 increase in dependent variable preparation.

The analysis in Table 3 tells us that the independent variable of people can reliably predict the dependent variable delivery. This again underpins findings in table 1. Table 3 indicates that for every unit increase in the independent variable, the dependent variable delivery is increased / decreased. For example with the people on its own in the model every unit increase in the independent variable people there is a predicted .20 increase in dependent variable delivery.

Table 1. Correlation of LOP subsystems all institutes

		Correlations		
All Institutes		Preparation	Delivery	Assessment
Learning	Pearson Correlation	0.186	0.240	0.211
	Sig. (2-tailed)	0.000	0.000	0.000
Organisation	Pearson Correlation	0.227	0.267	0.268
	Sig. (2-tailed)	0.000	0.000	0.000
People	Pearson Correlation	0.275	0.289	0.221
	Sig. (2-tailed)	0.000	0.000	0.000
Knowledge	Pearson Correlation	0.222	0.231	0.235
	Sig. (2-tailed)	0.000	0.000	0.000
Technology	Pearson Correlation	0.253	0.256	0.258
	Sig. (2-tailed)	0.000	0.000	0.000
N		366	366	366

Table 2. People V Preparation independent – dependent variable comparison

		Coefficients(a)				
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1.00	(Constant)	19.94	0.96		20.66	0.00
	People	0.21	0.04	0.27	5.45	0.00
2.00	(Constant)	18.87	1.10		17.22	0.00
	People	0.15	0.05	0.19	2.93	0.00
	Technology	0.10	0.05	0.13	2.04	0.04
a	Dependent Variable: Preparation					

Table 3. People V Delivery independent – dependent variable comparison

		Coefficients(a)				
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1.00	(Constant)	17.37	0.84		20.57	0.00
	People	0.20	0.03	0.29	5.77	0.00
a	Dependent Variable: Delivery					

Table 4. People V Assessment independent – dependent variable comparison

Model		Coefficients(a)					
		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta	B		
1.00	(Constant)	15.42	1.03			15.03	0.00
	Organisation	0.22	0.04	0.27		5.31	0.00
2.00	(Constant)	13.72	1.25			10.97	0.00
	Organisation	0.15	0.05	0.18		2.76	0.01
	Technology	0.14	0.06	0.15		2.35	0.02
a	Dependent Variable: Assessment						

Table 5. People V TLA independent – dependent variable comparison

Model		Coefficients(a)					
		Unstandardized Coefficients		Standardized Coefficients		T	Sig.
		B	Std. Error	Beta	B		
1.00	(Constant)	53.17	2.38			22.38	0.00
	People	0.61	0.10	0.32		6.36	0.00
2.00	(Constant)	49.35	2.68			18.41	0.00
	People	0.38	0.12	0.20		3.08	0.00
	Technology	0.36	0.12	0.19		2.97	0.00
a	Dependent Variable: TLA						

The analysis in Table 4 tells us that the independent variables of organisation and technology can reliably predict the dependent variable assessment. This again underpins findings in Table 1. Table 4 indicates that for every unit increase in the independent variable, the dependent variable assessment is increased / decreased. For example with the organisation on its own in the model every unit increase in the independent variable organisation there is a predicted .22 increase in dependent variable assessment.

The analysis in Table 5 tells us that the independent variables of people and technology can reliably predict the dependent variable TLA. This again underpins findings in Table 1. Table 5 indicates that for every unit increase in the independent variable, the dependent variable TLA is increased / decreased. For example with the people on its own in the model every unit increase in the independent variable people there is a predicted .61 increase in dependent variable TLA.

4. Conclusions

While this study employed a learning organisation maturity model, adapted from [1], as a strategic framework measure for comparison with ICT integration in higher education institutions, the writer acknowledges that the learning organisation discourse is large and complex and requires further exploration to decide whether it may be a suitable strategic framework for higher education institutions. However, given the need for speed required by higher education institutions in adoption new strategies for transformation where the idea that competition in the space is emerging in Ireland in the early part of the 21st century, against a backdrop of scarcer resources, an approach such as that of the learning organization framework, which embraces a holistic view of organisational health in that it attempts to marry the desires of the individual and the organisation while acknowledging the tensions between culture and structure, may prove worthwhile. Preliminary findings here would indicate that in this study, a learning organization maturity model may be interpreted as being useful as a predictor of ICT integration levels in higher education institutions.

A discussion around the reason why the people empowerment subsystem emerged as the lead predictor raised the conundrum of a possible symbiotic relationship between learning organization maturity and ICT integration levels in the IOT sector in Ireland. To adjudicate more clinically on this symbiotic relationship a follow up longitudinal study might well prove worthwhile. In the context of a transformative environment in which the IOT sector in higher education in Ireland finds itself the engagement with strategic frameworks such as the learning organization model may benefit the embedding of the idea of continuous change and adaptation into the mindsets and theories in use of the protagonist stakeholders for the benefit of both themselves and their institutes into the future.

REFERENCES

1. Marquardt, M.J. (2002) *Building the Learning Organisation*, Davis-Black Publishing, Palo Alto CA
2. Einstein, A.
3. Goldstein, P.J. (2007) *The Future of Higher Education: A View from CHEMA*. Washington, DC: Council of Higher Education Management Associations. Available: www.appa.org
4. Collis, B.; van der Wende, M.; (2002) *Models of Technology and Change in Higher Education. An international comparative survey on the current and future use of ICT in Higher Education*. Twente, NL: CHEPS, Centre for Higher Education Policy Studies
5. The Seusiss Report (2003). *The Seusiss Report*. Brussels: Socrates-Minerva Programme of the Directorate for Education and Culture, European Commission.
6. Hawkins, B.L.; Rudy, J.A.; Wallace, W.H.:(2005) *Technology Everywhere A Campus Agenda for Educating and Managing Workers in the Digital Age*. Boulder, CO: Educause
7. Kearns, P.(2002) *Towards the Connected Learning Society An International Overview of Trends in Policy for Information and Communication Technology in Education*. Kambah, Australia: Global Learning Services 2002.
8. Scott, T.(2000) *The Wired Campus*, Business Weekly, p. 102.
9. Oswald, A.(2002) *A victim of vocabulary*. The Times Higher Education Supplement
10. Drucker, P. (2002) *Managing in the next society*. New York: St. Martin's
11. Kok, W.(2004) *Facing the Challenge*. Belgium, EU Communities
12. Building Ireland's Knowledge Economy Report to the Inter Departmental Committee on Science, Technology and Innovation (2010)
13. Senge, P.M.(1990) *The fifth discipline: The art and practice of the learning organization*. London: Century Business
14. Brown, A.; Keep, E.:(1999) *Competing perspectives on workplace learning and the learning organisation*, TSER Network Forum for European research in vocational education and training (FORUM)
15. Sennett, R. (1998) *The Corrosion of Character – The Personal Consequences of Working the New Capitalism*, W.W. Norton and Company, New York, NY
16. Hyland, A.(2004) *Univesrity College Cork as a Learning Organization*. Available: www.ucc.ie
17. Friedman, H.H.; Friedman, L.W.; Pollack, S.; (2005) Transforming a university from a teaching organization to a learning organization. Review of Business. St. John's University, New York
18. COVARM (2011) project <http://covarm.tvu.ac.uk/covarm>
19. Marquardt, M.J.; Schwandt, D.R.; (2000) *Organizational Learning, From World-Class Theories to Global Best Practices*, St. Lucie Press
20. Meek, V.L.(2003) *Governance and Management of Australian Higher Education: Enemies Within and Without*. In A. Amaral, A.; Meek, V.L.; Larsen, I.M.(2003) *The Higher Education managerial revolution?* Dordrecht, NL: Kluwer
21. Rogers, E.M. (1995) *Diffusion of Innovations*. The Free Press. New York. 4th Edition
22. Davis, F.D.; Bagozzi, R.P.; Warshaw, P.R.:(1989) *User Acceptance of Computer technology: A comparison of two theoretical models*. Management Science, 35 (8), 982-1003
23. Beal, D.J.; Dawson, J.F.:(2007) *On the Use of Likert-Type Scales in Multilevel Data : Influence on Aggregate Variables*. Organizational Research Methods 10(4), 657-672.
24. Messick, S.(1962) *Response style and content measures from personality inventories*. Educational and Psychological Measurement, 22, 41-56,
25. Friedman, H.H.(1988) *The Effects of Positive and Negative Wording on Responses to a Likert Scale*. Applied Marketing Research, 28(Fall), 17-22,
26. Watkins, K.E.; Marsick, V.J.(1997) *Dimensions of Learning Organization (DLOQ)*. Warwick: Partners for the Learning Organization,
27. Pedler, M.; Burgoyne, J.; Boydell, T.:(1997) *The Learning Company: a strategy for sustainable development*. Maidenhead: McGraw-Hill
28. Richards, G.; Goh, S.:(1995) *Implementing Organizational Learning: Toward a Systematic Approach*. Optimum, 26(2), 25-31
29. Goh, S.(2003) *Improving Organizational Learning Capability : Lessons from two case studies*. The Learning Organization, 10(4), 216-227
30. Neefe, D.(2001) *Comparing Levels of Organizational Learning Maturity of Colleges and Universities Participating in Traditional and Non-Traditional (Academic Quality Improvement Project) Accreditation Processes*. University of Wisconsin, The Graduate College. Web site: www.uwstout.edu