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Evaluating Cultural and Technical Obstacles in School-Based ICT Programs: An Analysis of Two Case Studies

Miriam Judge
Department of Communications, Dublin City University, Dublin, Ireland
Email: Miriam.judge@dcu.ie

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The emergence of a knowledge-based economy has been identified as a central trend in modern economies as a result of the increasingly important role of information technology and learning in economic performance. In recognition of this most governments throughout the developed world have responded with a series of policy initiatives since the late 1990's to either introduce or significantly increase information technology provision in schools to prepare students for life in the twenty first century. Ireland, with its growing reliance on the knowledge economy sector for employment and continued economic prosperity, developed its own policy initiative for computerizing the nations' schools known as "Schools IT 2000: A Policy Framework for the New Millennium". It was an ambitious programme with high expectations for the integration of ICT (Information and Communications Technology) in education. This paper examines two longitudinal educational ICT projects in Ireland in the first decade of the new millennium to query how far schools have travelled along the information superhighway and to ponder how well the catalytic capabilities of ICT have become embedded in the realities of classroom life and teachers pedagogic practices, with attendant implications for Ireland's economic development.

Keywords: Knowledge Economy; ICT Infrastructure; ICT Integration; Change in Schools; Thin Clients

Introduction

During the 1980's the term "Information Society" replaced the long established and familiar term "industrial society" as the more common descriptor of the Age. Popularised by theorists such as Daniel Bell (1974), Peter Drucker (1969) and Alvin Toffler (1980), the information society thesis argued that new technology, *i.e*. the computer, was the key driver behind the shift from an industrial to an information society which in many ways paralleled the change from an agricultural to an industrial society during the eighteenth and nineteenth centuries in Europe and North America. It was envisaged that this paradigm shift from an industrial to an information society would have lasting and far reaching implications for all sectors of society in particular economic activity and the global economy.

These early information society theorists, foresaw that new information technologies would give rise to a new kind of economy, the knowledge economy, in which a growing number of people would be involved in an unprecedented variety of information related to jobs and services. The emergence of a knowledge-based economy has been identified as a central trend in modern economies, in recognition of the increasingly important role of information, technology and learning in economic performance (OECD 1996, cited in Flew, 2002). The complexity and increasing sophistication of this new knowledge economy has altered not only the type of work which people are engaged in but the means and methods by which work is achieved. It has also led to a rethinking of the nature of knowledge where "know-how" and "know-where" has replaced "know that" (Tuomi, 2005) as a core skill. This has also been accompanied by a growing recognition of the need for long term investment in people who lie at the heart of the knowledge economy where intangibles such as ideas, creativity and new ways of doing things, as opposed to the production of material goods (Romer, 1995), has taken centre stage.

This rethinking of the nature of knowledge and the role of "people talent", facilitated by new information and communication technologies, as a key driver of the global knowledge economy, has profound implications for educational institutions across the primary, secondary and tertiary sectors. In recognition of this most governments throughout the developed world responded with a series of policy initiatives throughout the 1990's to either introduce or significantly increase information technology provision in schools to prepare students for life in the twenty first century. Ireland, with its growing reliance on the knowledge economy sector for employment and continued economic prosperity, developed its own policy initiative for computerising the nations' schools. Launched in 1997 "Schools IT 2000: A Policy Framework for the New Millennium", was an ambitious programme with high expectations for the integration of ICT (Information and Communications Technology) in education. The rhetoric of the knowledge economy imperative is clearly discernible on the opening page of this policy document which states that "the need to integrate technology into teaching and learning right across the curriculum is a major challenge which must be met in the interests of Ireland's future economic wellbeing". This theme is further developed by the catalytic rationale for increased ICT deployment in schools which saw ICT integration as a way of reducing the traditional emphasis on the memorising of facts, as information handling and problem solving skills became more central to the learning process. It was also envisaged that increased use of ICT would lead to more collaborative work environments in schools for students and teachers alike.

With the passage of time it is perhaps timely to pause and reflect on what has been achieved in terms of ICT integration in schools since the launch of "Schools IT 2000"; to query how far schools have travelled along the information superhighway and to ponder how well the catalytic capabilities of ICT have become embedded in the realities of classroom life and teachers pedagogic practices. The remainder of this paper will explore some of these issues through an examination of two key school based technology projects which the author has been involved in evaluating and researching over a number of years, namely The Wired for Learning Project which lasted for four years from the early to mid 2000's and The Hermes Project which commenced in the mid 2000's and ran for five years. The longitudinal nature of these projects which has enabled the researcher to engage with teachers and schools over a prolonged period has yielded some valuable and interesting insights into the process of ICT integration and the many challenges faced by schools at the infrastructural, organisational culture and change management levels when it comes to ICT deployment. More often than not it is these "soft" issues and not just the "hard" technology issues themselves which act as barriers in implementing technology based initiatives in schools. Unfortunately it is the "soft" issues, so frequently ignored by policy makers and techno-enthusiasts alike, which are often the hardest nuts to crack.

Research and Data Collection

The pre-dominant research orientation and background training of the author is as a qualitative researcher. Because both the topic and the research paradigm influence the design of any research study, the research methodology employed is fundamentally qualitative in nature, although a significant amount of quantitative data has also been gathered as part of the Hermes Project research process.

One of the hallmarks of qualitative research is that it is conducted in natural settings. The natural setting is the place where the researcher is most likely to discover, or uncover, what is to be known about the phenomenon of interest (Maykut & Morehouse, 1994). Through prolonged engagement in the field of study, the researcher comes to understand the experience of people in context. Driven by its philosophical underpinning, phenomenology, qualitative research attempts to get to the truth of matters by describing phenomena as it manifests itself to the consciousness of the experiencer. Researchers using the phenomenological approach are concerned about how individuals and groups perceive their worlds (Stevens *et al*., 1993) and therefore a key research tool is the in-depth ethnographic interview which enables the researcher to "focus on exploring how human beings make sense of experience and transform experience into consciousness, both individually and as shared meaning" (Patton, 2002: p. 27).

As formulated by Spradley (1979) the ethnographic interview is a way of getting people to talk about what they know, a way of getting inside people's heads, so that we can "enter into the other person's perspective" (Patton, ibid.: p. 341). It is also a means through which we can come to grasp what Schein (1992) calls those "basic assumptions", which guide peoples' culturally determined thoughts and actions. In all the author has conducted interviews with almost 140 mainstream teachers, ICT Co-ordinators and School Principals across both the primary and second level sectors in both the WFL and Hermes projects.

The ethnographic interview was by no means the only research gathering instrument deployed in these studies. Other "human to human" and "artifactual" (Lincoln, 1992) data gathering tools were also used such as observation studies, examination of project documentation material, surveys, focus groups and researcher attendance at project strategy meetings and staff ICT training courses. In this way the interview data has been "triangulated" (Cohen & Manion, 2000) to ensure the "authenticity" (sic. reliability), "trustworthiness" (sic. validity) and robustness of the research studies (Erlanderson *et al*., 1993; Lincoln & Guba, 1985).

In each study the author has focussed the bulk of the research attention on teachers and how they react to and engage with innovative technology initiatives through their adoption, adaptation, use and non-use of new technological tools to support their professional practices and pedagogy. Traditionally, as Knupfer (1993) reminds us, proponents of instructional computing have given "short thrift to the role of teachers" (p. 173), focussing their attention primarily on student benefits, while paying scant attention to the teacher's role in the acceptance, implementation and outcome of educational computing. This is despite compelling evidence of the centrality of teachers in the implementation of educational innovation. Furthermore as far back as 1995 the American Office or Technology (OTA, 1995) called for a change of focus in the research agenda for educational technology so that research attention is directed as the "chief agents of change", the teachers, and how they view the technology and the learner. It is this spirit of enquiry which informs the author's research agenda and the remainder of this paper will now focus on some of the key issues which have emerged from the author's empirically based studies on the deployment of technology innovations in schools participating in both the WFL and Hermes projects in Ireland.

The Wired for Learning Project

The Wired for Learning Project (WFL) began as part of the SIP (Schools Integration Project) strand of 'Schools IT 2000'. This partnership project between IBM and the Department of Education and Science (DES) initially comprised five pilot schools, three primary and two post primary [sic secondary] schools in the cities of Dublin and Cork. A second phase of the project known as the Dundalk Learning Network (DLN) WFL Project commenced in March 2000, involving a total of seventeen schools. From 1999 to 2003 the author conducted a longitudinal study of the five pilot WFL schools initially as part of a PhD programme of research (Judge, 2002) and subsequently as a final programme evaluation on behalf of the National Centre for Technology in Education (NCTE)/DES and IBM (Judge, 2003).

The overarching aim of Wired for Learning was to improve Ireland's education system through the use of new technologies. The project's name was derived from the Wired for Learning application itself, a web based communications and collaboration system, developed by IBM as part of its global IBM Reinventing Education programme. The aim of this programme was to promote school reform and improve education achievement by increasing parental involvement and information flow between the home, school and community. Made up of a suite of applications that support communications, collaboration and learning for the entire community, *i.e*. teachers, students, par-

ents and mentors, WFL is one of the earliest examples of a VLE/LMS (Virtual Learning Environment/Learning Management System) specifically targeted at schools.

While participation in WFL brought many benefits to schools, which have been documented elsewhere (Judge, 2003, 2004), the project also highlighted a number of more problematic and challenging issues concerning educational technology, change and the school and teaching culture.

Technology, School Culture and Change

Educational technology and change are intricately linked. Just as the introduction of new technology has brought about changes in society and in the workplace, the introduction of computers to schools is also laden with change implications, although this relationship is rarely acknowledged. Knupfer (1993) makes two important points about the relationship between computers, schools and change. Firstly she argues that the successful implementation of computers into education requires an understanding of the process of educational change and that this understanding must precede the actual implementation of the innovation itself. Secondly the teacher's role must be seen as central to any change because successful educational change depends on what teachers do and think (Sarason, 1982). Ultimately it is the teacher who must adopt computers and then adapt them to curriculum goals and classroom needs (Cuban, 1986; Fullan, 1991).

Because the Wired for Learning project was designed to promote school change using technology as a medium to facilitate the change process, both schools and their teachers faced many challenges as they strove to come to terms with both the vehicle of change, *i.e*. the WFL platform and change itself. While different change writers have proposed different theoretical models to explain the change process as it affects schools and organisations (Hall & Hord, 1987; Herriot & Gross, 1979; Leavitt, 1965) one of the most comprehensive theories of change as it applies to schools was provided by Fullan (1982) and subsequently refined by him in 1991. Fullan defines change as a "multi-dimensional" process in which at least three components are at stake: (1) changes in teaching materials such as the introduction of new curriculum materials or new technologies, (2) changes in teaching approaches such as new teaching strategies or activities, and (3) changes in teacher's beliefs (*i.e*. what people do and think).

For change to be successfully implemented it must be implemented at all three levels and in the process take account of both the "objective reality of the innovation and the subjective reality of individuals". Fullan maintains that many change efforts in schools fail because there is an overemphasis on the objective realities of the innovation without due acknowledgement of the subjective realities for teachers caught up in the change process. As a result new programs are frequently introduced and described in terms of program goals and supposed benefits rather than in terms of how the changes will affect teachers personally when it comes to their classroom activities and the amount of extra work that will be required of them outside of class. In other words "change is not usually introduced in a way which takes into account the subjective reality of teachers", (Fullan, 1991: p. 29) resulting in at best, superficial change, and at worst, no change.

The crucial issue of the time required to do extra work outside of class loomed large in the WFL project and was frequently cited by teachers in the course of the research as a reason why they were not engaging with some of WFL's tools core tools such as the "Instructional Planner" and "Private Conferencing" on a regular basis:

> "*Very few of us have put in lesson plans. I don't think teachers will be willing to input them into a computer themselves in their own time. Teachers get into routines very easily. I don't think they would be willing to come in earlier or stay later or work through their lunchtime. I think the perception is that this is good for the government. It's good for the kids. Why should it be costing teachers time and effort*?"
> *Post-Primary teacher*
> "*I think time is the big problem People wouldn't be happy with having to do lesson plans in the evening time from* 2.30 *till* 5.30."
> *Primary teacher*

The experience of the WFL participants as illustrated through the above comments indicates the extent to which the subjective reality of individuals impinges on the implementation of innovative projects. Furthermore even though the research study revealed that teachers were using some of WFL's other tools such as Home Page Designer, Team Projects and to a limited extent, Teacher's Lounge, to support their teaching, very few teachers reported that this usage was changing their teaching style or approach to teaching. This is consistent with Fullan's theory of the conception of an innovation "as a set of materials and resources as the most visible aspect of change, and the easiest to employ. Changes in beliefs are much more difficult to achieve because they challenge the core values held by individuals regarding the purpose of education" (Fullan, 1991: p. 23). We know from cultural theory that beliefs are culturally conditioned and therefore difficult to change because they are buried at the level of unstated basic assumptions (Schein, 1992). Unlocking this bolt is the key to meaningful change and the most difficult to achieve because it involves some very deep changes that challenge both the culture of teaching and the structure of schools.

Nowhere was this more evident than in teachers' reactions to the instructional planner application in WFL. By and large, teachers were uncomfortable with the instructional planner which facilitated the preparation and sharing of structured lesson plans. A deep analysis of much of the data emanating from discussions around this core WFL application revealed that the instructional planner confronted teachers' professional practices in terms of how they planned, managed and organised their teaching as well as challenging some deeply held beliefs about the craft of teaching as an art form rather than a science. Apart from the time required to produce their lesson plans in electronic format, many teachers had philosophical objections to, and deep-rooted fears about making lessons and the process of lesson planning available online. A frequent response was "lesson plans are such a personal thing, they are unique to each teacher, so you couldn't possibly share them with someone else", or, "After 20 years of teaching I am not going to change to writing out lesson plans… I know in my head what I am going to teach".

Issues also emerged in relation to the absence of a culture of sharing in schools, fear of peer criticism and accountability:

> *"I've heard it said I'm not willing to do that—why should*

I put hours of work in for it to be shared out. That seems to be the attitude. I don't know what it would take to change that attitude. How do you change the way people think. A lot of teachers are in the system and teaching a very long time. Maybe with newer and younger teachers it might change".
Post Primary Teacher

There was a deep suspicion in some quarters that the introduction of WFL was an attempt to bring in greater teacher accountability through the back door. Some teachers were quite defensive on this issue, arguing that the public examination system is the norm through which their professional accountability is maintained, and by which they are judged, and they wanted to keep it that way. There was a reluctance to accept a widening of the concept of accountability to include other areas of their professional life in areas such as lesson planning and communicating with parents, principals and their peers. As one vice-principal commented:

"*I feel that it is actually in some kind of deep down way a system of making teachers accountable. It's a way of getting at teachers. A form of public accountability if you like. But I think that is coming anyway, whether teachers like it or not. Things are changing and it's all about transparency, openness, accountability and new education acts. So WFL would fall into all of that.*"
Primary School (*Vice-Principal*)

It has long been acknowledged that teaching can be quite an isolated profession (Lynch & Lodge, 2002; Maeroff, 1988) and that the nature of teaching means that teachers do not have the same opportunities for interacting with their peers as is the norm in most other adult occupations. Unlike most other organisations operating within the knowledge economy framework, where teamwork and daily—almost hourly professional communication mediated by information technology is the norm, teachers traditionally do not operate in this way. The predominant organisational form in schools tends to be individualistic where teachers work in isolation from their colleagues with little opportunity to work together or exchange ideas on a sustained basis. Consequently when new technologies, particularly something as ideologically sophisticated as WFL comes along, which facilitates and almost demands professional cooperation, collaboration and communication, it creates a certain amount of dissonance because it challenges many deeply held beliefs about what teachers do and how the school and teaching culture operates. Changing this culture is a long and complex process which technology alone cannot address. This largely explains why teachers involved in the WFL project struggled to identify with the instructional planner from the outset although all schools tried very hard to get their teachers to use it, particularly during the project's initial operation phase. However it encountered too much opposition from teachers and consequently by the end of the project it was no longer being actively used as a vehicle for lesson planning in the WFL pilot schools.

Infrastructural and Technical Constraints as Revealed though the Hermes Project Lens

If Wired for Learning revealed some of the more culturally embedded and deeply held beliefs about the nature of teaching and learning, and how these can impede the widespread adoption of ICT in schools, research conducted for the Hermes project illustrated some of the more basic infrastructural and technical issues that have affected ICT usage in many Irish schools. This section will concentrate on discussing what the early research data from the Hermes project revealed about the state of computer facilities in Irish schools, almost six years after "Schools IT 2000" had finished.

The Hermes project involved a cluster of nine primary schools based in North County Dublin who agreed to work together to trial and test bed thin client technology using a broadband wireless network. The project was managed by a full time central co-ordinator, a seconded teacher who had successfully installed and managed a single site thin client platform in his own school from 1999-2001 (which will be referred to from here on out as the original thin client school). Encouraged by the success of this initiative, which brought a robust, reliable infrastructure to one school in which technical issues were minimal, many local schools were keen to adopt a similar model and the schools came together to investigate how this might be achieved. As a result the Hermes project got underway.

The Hermes project was a combination of two technologies, made up of (1) thin clients and (2) a broadband wireless network. Thin client technology is basically a network based server solution in which Network Computers (NC's) act as terminals providing access to applications and data held on servers. Approximately 30 NC's were installed mainly in computer laboratories in each Hermes school, supplemented by at least one NC installation in every classroom. Using a broadband wireless connection to facilitate connectivity all the machines across all participating schools were remotely attached to a server farm based in the central co-ordinator's school. This sever farm hosted all core system resources for the project including educational software, broadband Internet access, desktop applications and administrative resources. The major advantage of this system was that it removed all major housekeeping and administrative tasks from the local schools, thereby freeing up ICT coordinators from the drudgery of technical support to concentrate their efforts on developing and encouraging ICT pedagogy in their respective schools.

Immediately prior to the installation of the thin client network in schools a baseline data survey was administered to the participating schools. The survey was designed to capture, among other things, core data about the existing ICT infrastructure and ICT integration levels in schools prior to Hermes' commencement. Of the 120 questionnaires delivered to teachers, ICT coordinators and Principals, 119 questionnaires were returned, representing an almost 100% response rate. Furthermore during the project's first year of implementation a number of in-depth interviews were conducted with a representative sample of teachers, and each of the nine ICT Co-ordinators and school Principals (n = 60). The survey data was analysed using SPSS while all interviews were transcribed in full and thematically analysed. Both the qualitative and quantitative data provide some interesting insights into infrastructural and technical barriers affecting ICT integration.

Technical Facilities and Support

To benchmark the quality of the schools' IT infrastructure prior to the commencement of Hermes the Central Co-ordinator performed an inventory of each schools computer set-up. This

revealed that the computer infrastructure in the majority of schools was very basic and in some cases, completely inadequate. While most schools had a dedicated computer room, six of the nine schools had an unacceptable student computer ratio (SCR) of 15 or more with just two schools with an SCR of 5. Furthermore when teachers were asked to rate the existing IT set-up on a four part likert scale the only school which did not give any form of negative rating to its computer facilities was the original thin client school where the IT set-up as rated by teachers ranged from excellent or good. The responses from the remaining eight schools were varied with the majority of staff in three schools in particular, giving a complete negative rating to their facilities. Interviews conducted with a representative sample of teachers within the first year of Hermes' operational phase reveal quite clearly how compromised their IT facilities were, as these comments illustrate:

> "*We got involved in the project because we have had a computer room for years but because of a total lack of technical support it never functioned properly. You'd go over there with your class and only some computers would be working or some would crash while you were there and it was a disaster—a real headache and really the feeling among the staff was that when you were there you would waste more time than you'd gain. So when Hermes came along with the promise of this complete package—new computers, tech support, training etc. we were more than willing to embrace it*".
> *Teacher, School C*
> "*With the old system I must have been called upon twenty times a day because this machine wouldn't start, this machine wouldn't close, this machine wouldn't save—oh it was dreadful. Actually it literally got to the stage where we just closed down the computer room completely and said we are not coming up here anymore. So we just closed it down and said to the staff don't come up here anymore it's pointless. As a result for six months the computer room was closed down until the Hermes system came along. So this is bliss by comparison*".
> *Principal, School E*
> "*Oh yes, the Hermes system is a lot more reliable. I frequently remember the old computers either the mouse or just something would be wrong or the machines would just freeze and then for a long time while it looked great because we had plenty of computers most were broken so we couldn't use them and those that were working weren't connected to the printer and the children couldn't print off stuff which was frustrating for them. So it's a huge improvement now*".
> *Teacher, School B*

While the survey data revealed that 55% of teachers used the computer room once a week it also revealed that 40% of teachers used it in a more ad-hoc manner, if at all. This high level of ad-hoc usage was largely attributable to the poor state of computer facilities as revealed though the interview data as well as inadequate levels of technical support. Prior to Hermes the provision of technical support was a major headache for most schools as ICT co-ordinators were also full time class teachers which made it very difficult for them to provide technical support in an efficient and timely manner. For teachers this acted as a deterrent in terms of using the school computer room as they felt they had no immediate help available to them if things went wrong. For ICT co-ordinators it was a source of frustration as most of them felt that 'keeping things running smoothly was a job that could never be done properly':

> "*Before Hermes the idea of a computer room didn't appeal to me at all and even though I was timetabled to come down I never did because there was no backup if something went wrong, so there was no way I'd go down. But this year with the new system I said I'll give it a go and I've been delighted with it, absolutely delighted with it. So where there's a back-up, a sever farm thing, I think it's fantastic, you can't do anything wrong*".
> *Teacher* 4, *School E*
> "*There used to be a huge amount of work fixing things which meant staying late most evenings trying to fix machines and sort out problems but since Hermes that's all stopped. It's great that it has taken the technical end of things away from us because now if there is a problem you can just contact the central co-ordinator and he sorts it out as usually it's a server issue which means the problem lies elsewhere rather than in the school, which is great*".
> *ICT Co-ordinator, School F*

Given the server centric nature of the Hermes thin client system which meant that all system resources and applications were installed on the server farm located in the central hub school, all system administration and housekeeping tasks were performed centrally rather than locally. This was a huge change for most schools as effectively it removed responsibility for day to day running of school networks away from individual schools, a development which was welcomed wholeheartedly by everyone. This change was best summed up by one teacher who said:

> "*Before Hermes if something went wrong, everything collapsed and we had to wait until we could get somebody to come along and look at the system and fix it and that could take a week, even two weeks. Nowadays we tend to make a phone call and things are fixed straight away and that has made a huge difference, it has made using the computer room so much easier.*"
> *Teacher* 8, *School H*

Given the poor state of schools computer facilities and the absence of adequate technical support and backup, it is hardly surprising that teachers gave themselves very low scores on ICT integration with the majority (51%) indicating that they did not integrate technology well into their teaching and a further 35% indicating that they integrated ICT only "fairly well".

Conclusion

The Hermes project provides an interesting insight into the state of ICT provision in Irish schools. From the research data it can be seen that most of the participating schools were struggling with many basic and fundamental issues in relation to ICT infrastructure which in many ways illustrates much of what is currently amiss with IT provision in Irish schools and the attendant implications for ICT integration.

When these findings are combined with those from the WFL project it is easy to see how both at a systemic and more prac-

tical level there are a number of barriers operating on both the technical and organisational culture fronts, which have slowed down the assimilation of ICT into the daily routines and norms of the teaching day thereby thwarting the ambitions of "Schools IT 2000". Ad-hoc exposure to IC*T*—maybe for one hour a week if you are one of the lucky students attending a school which has a fully working and well maintained computer facility, and where the school culture is supportive of ICT, is hardly the ideal preparation for life in an increasingly "global, networked and informational" (Castells, 1996) knowledge society.

While not intended as a representative study nonetheless the Hermes schools illustrate the infrastructural and technical barriers to ICT integration which many Irish schools have to struggle with on a daily basis. As discussed earlier only one school (the original thin client school) had a well run, well managed and well supported infrastructure in place prior to the project's commencement. Five schools had at best mediocre facilities which acted as a constraint on ICT usage, while in three schools facilities were very poor resulting in a somewhat problematic and patchy engagement with ICT. I think anyone familiar with how ICT in Irish schools has evolved since 'Schools IT 2000' would recognise this scenario as pretty typical. The question therefore that must be asked is why? Why does the ICT landscape in Irish Schools resemble a patch work quilt?

The answer in many ways is quite simple—Ireland does not have a coherent policy in relation to ICT in schools. Since the launch of "Schools IT 2000", which at the time was recognised as a fine policy initiative that was leading the way forward in Europe, Ireland appears to have lost its way. Significantly since then only one further ICT policy initiative entitled "A blueprint for the future of ICT in Irish education" has been initiated and that was launched way back in 2001. Consequently many countries such as Britain, Northern Ireland, Finland and even former Eastern bloc nations such as Estonia have leapfrogged ahead of Ireland in this critical arena as they continue to develop new policies in relation to educational ICT every three to four years to take account of new developments in technology and educational thinking. Given this scenario it is hardly surprising that the "OECD Education at a Glance Report" (2006), observed that a lack of sustained investment in ICT infrastructure has resulted in Irish schools falling far behind their European peers. In the globalised knowledge economy of the 21st century this has to be a cause for concern.

If Ireland as a nation is serious about moving up the food chain of the knowledge economy, and attracting higher value added jobs in order to sustain and further develop national well-being, it cannot allow ICT provision in schools to develop in the ad-hoc manner as has happened to date. This ad-hoc approach has resulted in a situation where pupils in some schools benefit more than others because the school culture is favourably disposed to the integration of ICT, or a school is lucky enough to have an innovator on staff who can galvanise support for ICT development, or happens to be located in a well off community who can be relied on to fund additional equipment, technical maintenance and support.

As the second decade of the new millennium reaches its midpoint, perhaps the time is now right to launch a new and invigorated "Schools IT 2020" which will map out a visionary ICT Education policy for the next decade in Ireland. Despite the patchy nature of the overall development of ICT in Irish schools to date, many worthwhile and innovative ICT projects have been supported by the DES, the NCTE and industry partners such as Microsoft, IBM, Intel, HP, Citibank and Diageo, among others. While too numerous to individually mention here, each of these projects in their own way has thrown a different light on the process of ICT integration and what hurdles and obstacles need to be overcome in order to move the ICT agenda in education forward. There is an urgent need for joined up thinking, to use the lessons learned from these projects as the backbone upon which to build a new, forward looking, yet grounded ICT policy framework. There are many exciting developments and changes currently underway in the Irish education system as a result of programmes such as Whole School Development, (www.spds.ie/) the Schools Leadership Development Programme (http://primary.lds21.com/) and the reform of the Junior Certificate Curriculum. Any new ICT policy framework will need to be linked to these initiatives so that ICT policy is seen not as a stand-alone, isolated programme, but rather as something that is centrally affiliated to the whole process of transformation and reform in schools over the longer term. Ireland's economic future and well being depend on it.

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