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"ICT's role in Next Generation Universities: What will IT look like in a New Campus?"

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1. ABSTRACT

The University of Ulster, one of two in Northern Ireland and of seven on the island of Ireland has a student population of some 26,000 with 4 campuses (Belfast, Jordanstown, Coleraine and Magee) dispersed throughout the county. It has created an ambitious estates development strategy that includes the development of a new urban campus in Belfast city centre, the capital city, with the initial phase due occupancy in 2015 and the complete campus by October 2018. The decision to develop the new campus, which will eventually be home to 15,000 students, was taken following a Government commissioned review, in 2006, of the higher education estate in Northern Ireland. A review by the University considered various options to redress the situation, with the most cost-effective option being to relocate around 13,000 students from its Jordanstown campus to a new city centre development.The new campus will play a significant role in the academic, cultural, social and economic regeneration of the city of Belfast and will be co-located and integrated with its existing modern campus where approximately 1,800 students currently study.

The development will serve as a substantial boost to the regeneration of the city centre, integrating with other developments including, on its doorstep, the city's cultural Cathedral Quarter, the Gaeltacht Quarter and the nearby Titanic Quarter located in the docklands.

Plans include the development of three new inter-connected buildings, providing 73,000 square meters of accommodation to serve all 6 faculties. The project is known as the Greater Belfast Development (GBD) Project (2012). Significant attention is being given to ensuring the project delivers a contemporary environment for learning and teaching as well as being attentive to 'smart' or 'intelligent' design elements that aid in its operation. The JISC, in its publication "Designing Spaces for Effective Learning: A guide to 21st century Learning Space Design" (2006), states that "

Increasing investment in estate and learning technologies,combined with the need for more cost-effective space utilisation,is making it increasingly important for senior managers anddecision-makers to keep abreast of new thinking about the designof technology-rich learning spaces."

The paper outlines the information and communications technology (ICT) aspect associated with learning and teaching, based on a journey through the various Royal Institute of British Architects Plan of Work (RIBA, 2013), the definitive model, used in the United Kingdom and which has international influence, for building design and construction. Whilst the project has not yet commenced the construction stage, nevertheless substantial detailed planning and multi-disciplinary consultations have taken place. Key landmark activities and milestones relating to ICT as it impacts upon teaching, learning and research functional requirements are discussed.

2. THE JOURNEY TO DATE

In February 2009, the journey commenced (Belfast Telegraph, 2009) with the formal public announcement and unveiling of plans for a new campus, with an associated expenditure of £250M (approximately €300M). Consultations were instigated with myriad stakeholder and focus groups from September 2009. ICT formed a major feature of many consultations, with user aspirations and requirements captured. A Space Strategy consultation (Ryder, 2009 and Performance Consultancy, 2012) formed a basis for much of the consultation work, with the period to early 2010 focussing on the production of a detailed brief defining client requirements and articulating the educational visionfor the project; RIBA Stages A and B, explained later. This work led to the production of a

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portfolio of User Requirement Specifications (URS), including one for Information and Communications Technologies (Arup, 2012). ICT aspects of the development continue to be refined with focussed consultation and reviews. The infrastructural aspects in terms of data and power are now well defined and represented on the architectural plans. End point ICT hardware considerations, whilst not defined in detail given the rapidly changing nature of device, have been superimposed on a range of space categorisations and detail is rapidly reaching a stage where it can be incorporated into the formal tender invitation to be issued for bids from interested contractors. Planning approval is anticipated by March 2013, with demolition works commencing shortly thereafter. Phase I is anticipated to be operational in fall 2015 and the full campus by fall 2018.

3. RIBA STAGES: ICT-RELATED ASPECTS

The RIBA Stages, as they are commonly known, are:

- *Preparation*: Stage A: Appraisal and Stage B: Design Brief
- *Design*: Stage C: Concept, Stage D: Design Development and Stage E: Technical Design
- *Pre-construction*: Stage F: Production Information, Stage G: Tender Documentation and Stage H: Tender Action
- *Construction*: Stage J: Mobilisation and Stage K: Construction to Practical Completion
- *Use*: Stage L: Post Practical Completion.

Today Internet Protocol (IP) centric building design is commonplace as architects rethink their approach, acknowledging the concept of a smart or intelligent building design. Many business and building functions centre on IT as the operation and management of building systems become IP-based, therefore early consideration of IT is of paramount importance (Manivannan, 2012). Retro-fitting IT within modern and complex buildings is unimaginable and expensive. The importance of incorporating key ICT considerations relating to learning and teaching requirements in the above Stages is considered a critical success factor for the entire project. Several other equally important ICT-related aspects also exist but these are outside the scope of the paper; for example sustainability and performance of the building. Our aim is to achieve "excellent" status, using the Building Research Establishment's Environmental Assessment Method (BREEAM), which is of particular importance from an ICT perspective.

In outlining the Stages, an ICT-only perspective is given, though within the overall broad context of what a Stage entails. For example, Stage A accommodates, as part of the *client's requirements*,the integration of ICT into the *design brief*; hence sustainability considerations and use case concepts are of relevance at this early point in the project lifecycle."Focus group" consultations with staff identified space requirements for teaching, learning and research and with students, their aspirations for ICT in social spaces and student areas. These consultations captured information for inclusion in the Space Plan. As an illustration "*Create spaces that enable the growth of technology and embrace new ways of learning*" was a technology requirement identified by the student focus group. The associated Space Plan statement is "*All spaces are considered as IT rich zones which are capable of future development in tandem with technological advances. Mechanical and Electrical service considerations will provide suitable opportunities to explore learning options*."

Moving to Stage B, where an architect will now have been appointed to the project, facilitates very high-level concept thinking around ICT. The University seeks to develop a "smart" building incorporating contemporary spaces within which learning, teaching and research is conducted. The Stage B output, the *strategic brief* will encapsulate user requirements and sketch design briefs. Critical at this stage is the identification of physical space to accommodate digital cable installations; building risers, cable routes and positions for major network hardware installations.

Stage C is deemed a critical milestone as its output, the *outline design proposals* emerge, which, if subsequently substantially changed, may introduce extra costs and extend project timelines. From an ICT perspective, Stage C develops detail around the content of the preceding Stage; for example,positioning of cabling infrastructures and the initial assessment of costs. Clearly, cost estimates are 'ballpark' at such an early stage; in the case of the GBD project, 5-6 years premature. Our Information and Communications Technologies URS (ICT URS) was created at this Stage.

By Stage D the *detail of the design* has been established and associated costs refined. The transition from Stage C to Stage D, in our case, involved significant collaborative work with the architects and with the mechanical and electrical engineering consultants. The architectural

drawings matured to the extent of incorporating the data and electrical services infrastructures, with a 'layer' of plan created to incorporate specific ICT requirements, for example within all learning and teaching spaces as well as social learning environments. A space categorisation schedule was compiled in collaboration with the architects; this document established a common nomenclature to describe the various space types within the proposed building; for example social learning spaces, classrooms, lecture theatres, research offices, and spaces designated as 'specialist', the latter category being the responsibility of discipline areas to determine associated ICT requirements. A spread-sheet model was developed to facilitate cost estimation for ICT fit-outs, where typically 3 options were used within each space category. Also, the decision for ICT end-point equipment (e.g. display devices and other technologies in support of learning and teaching) procurement is taken. In our case, the University is establishing a 5-year "select supplier" agreement with the purchase of equipment its responsibility, but with delivery, commissioning and acceptance tests being vested in the contractor. Further detail is provided later on the approach to collaborative working with the consultants.

Technical design is identified as Stage E of the Plan of Works, and involves the incorporation of relevant technical detail to adequately describe requirements to facilitate ICT-related installation and fit-out requirements. Considerable liaison with the team of architects coupled with successive refinements to the plans is critical. Appreciations of nomenclature and of physical aspects of the building's construction come sharply into focus as final designs are achieved. A 'design freeze' occurs at this Stage and the provision of all documents for tenders commence; the latter activity initiating Stages F (Production Information), G (Tender Documentation) and H (Tender Action).

Building construction is contained within RIBA Stages J (Mobilisation) and K (Construction to Practical Completion). *Detail on all infrastructural ICT aspects* (data cabling, wireless node locations, cable routes, end-point technologies, for example) are in effect finalised apart from "latest decision date" items as this project spans a multi-year lifecycle.*Contract documents* including relevant drawings and schedules and arrangements of handing over the site, for example for 'in work' inspections throughout the construction period to completion apply to ICT aspects. Typically, *visual inspections* to confirm quality of installations and positioning of power and data points, as well as *test results* for wireless, wired and optic infrastructures are key considerations.

Once the building complex has been constructed and available for occupancy, Stage L facilitates the *post practical completion activities*. For ICT these activities will include *all acceptance tests* for installed technologies, ensuring formal sign-off and availability of documentation and manuals as well as any 'agreed within contract' training. Since the University's ICT Strategy is being implemented across its 4 campuses including the new development, it is anticipated that Stage L will be primarily associated with hardware acceptance tests.

4. LEARNING AND TEACHING REQUIREMENTS

Mobility and flexibility are adjectives frequently used when describing contemporary learning environments, with pervasive and reliable wireless data networks and myriad examples of student-owned handheld devices being the technology of choice for social communications and for access to online content and learning environments. Whilst the shift towards location and time independent learning in a virtual world is acknowledged, nevertheless the role of physical learning environments remains relevant. Over the past decade or more, many UK Universities have built new real estate or substantially modified existing buildings where emphasis has been on creating modern learning environments. The JISC publication "Designing Spaces for Effective Learning: A guide to 21st century learning space design" (2006) includes short case studies that serve to illustrate some of these initiatives.

Our press release, "*Future learning at the Belfast campus" outlines future learning as "Dedicated high quality generic, discipline specific and social learning spaces will be provided to foster innovative and effective teaching and learning throughout the campus. …..campus will be designed to support formal and informal, individual and collaborative learning. It will facilitate the use of new and emergent technologies and pedagogies and will be sufficiently flexible to adapt to the ever changing external teaching and learning environment*". The current IT Strategy encompasses statements that are aligned to the above vision, with their progressive implementation applying to each campus on a year-by-year roll out basis. By 2015, and again by 2018, the ICT provision at each of the 4 campus will be aligned. So what do future learning spaces look like; what do students seek

and how effective will they be? The internet-based Slideshare Forum provides a number of interpretations through presentations under the heading “Designing Spaces for Effective Learning”.

At Ulster, the central IT department is responsible for the fit-out and support of ICT in centrally-managed spaces, with faculties responsible for spaces hosting specialist facilities and services. Centrally-managed provision supporting learning and teaching activities include meeting areas, social spaces or student hubs, teaching rooms and lecture theatres, IT laboratories and open spaces within libraries. Today’s ICT provision includes an increasingly pervasive wireless footprint, wired data services to all classrooms, video-conference services in meeting venues, IT laboratories as well as wired and wireless data services to teaching accommodation. A limited provision of formal social spaces exist as the University embarked upon a multi-year project to convert 2 libraries to Learning Resource Centres (LRCs) as well as to build 2 new purpose designed LRCs; these spaces provided the social areas where wireless services were initially concentrated alongside several hundred wired desktops for open access and to support independent and group-based learning.

Concurrent with the GBD project, are a series of other campus-based projects to establish social learning spaces, known as “hubs”, as well as a plan to build a new teaching block, for occupation in Fall 2015, on the Coleraine campus. A plan is at concept stage for a new teaching block at the Magee campus. These initiatives will act as pre-GBD project test bed opportunities to evaluate new technologies and to observe current and future trends in learning and teaching practices.

The new campus will feature several student hubs where informal teaching and learning will take place, supported by wireless services. All teaching spaces will have a purpose designed “learning wall” hosting ICT facilities for delivery of formal teaching. These locations will have a wired data service as well as acting as wireless hotspots for students. We anticipate a mix of conventional projection systems, wall-mounted flat-screen displays and interactive white boards depending on the size and intended uses of each classroom. The concept of “latest decision date” will be used to determine the actual technology to be fitted, hence allowing for new solutions and for changes to learning and teaching practices to be considered. This date will be around 12 to 9 months ahead of the building commissioning and handover date in summer 2015, for Phase 1 and summer 2018 for Phase 2. Alternatives to didactic teaching are included in the design decision making process, however the extent to which additional ICT hardware will be required has yet to be determined. The installation of wired data and power services has been identified as part of a future-proofing consideration. Spatial designs, especially for furniture layouts and the choice of furniture, whilst important are not ICT consideration, yet they do influence ICT aspects of the design.

5. “JOINED UP” PLANNING AND DESIGN: STAKEHOLDER ENGAGEMENT

Stakeholder Engagement: It is a truism to state that stakeholder management associated with the establishment of a new campus within the tertiary sector is complex; myriad interests exist, compounded by myriad opinions. One of the earliest engagements saw the production of the Space Strategy (Ryder, 2009 and Performance Consultancy, 2012). In programme management parlance this comprehensive high-level statement approximates to a Vision Statement and also to a Blueprint. The associated work involved extensive consultations involving the full management hierarchy of the University as well as representatives from the student, teaching and support staff.

The equivalent of a Mandate was provided by the senior management team, hence the plan and associated financial implications were approved and the project commenced.

Early work, as with the approach traditionally adopted with large building projects, saw the requirement to establish a portfolio of consultancies being initiated. Once the formal tendering processes were completed and the team of consultancy organisations appointed, then there was the communications interface with the University to be established. A Project Office was formed and lead by the appointment of a Project Director. The office comprised estates department staff working on secondment, temporary specialists appointed from within industry, as University-appointed consultants, and other long-term yet fixed-term, staff including those with project management experience.

The alliances between the members of the University community, the external stakeholders (for example government bodies, local council, neighbourhood representatives, the local community) were overseen by the Project Office. The Office is also responsible for the strategic interface between University members (staff, students) and the various consultancy teams. For example, IT

staff has a strong working relationship with the team of architects and it also liaises with the mechanical and electrical, BREEAM, Health and Safety and other consultancies.

Workshops, Focus Groups, Round Table discussions and a series of informal consultations have been the core aspects of verbal communications between the various consultants and members of the IT department. A similar approach has been adopted, by the consultants, when undertaking stakeholder engagements, whether with students, staff, alumni or other relevant parties.

As stated, the focus of the paper is on learning and teaching aspects of the overall design, hence comments are necessarily restricted in terms of paper length. The role of Focus Groups is important as their membership comprises individuals with domain expertise and who are tasked with taking key decisions. Typically, a Focus Group associated with teaching and learning provisioning comprises the Pro Vice-Chancellor whose portfolio is "learning and teaching", the Faculty Teaching and Learning Co-ordinators and representatives of the IT department with domain expertise in the design and provision of ICT within physical spaces. This Group is, for example, tasked with approving the architect's final plans for classroom and lecture theatre fit-outs. The preparatory work will have involved "round table" informal technical design team meetings, during which the detail is articulated and translated into schematics, 3-D concept images, detailed plans and accompanying tables of quantities of the associated end-point technologies.

In parallel to these forums, whose roles are focussed at the operational and tactical levels, the various and relevant University committees engage in strategic decision making. The approach adopted is analogous to the Anthony Triangle hierarchical view of management structure in terms of where the various tiers of decision making are invested. The Change Management Group, established to steer fundamental changes to the business of the University as it moves towards the new campus, is responsible for addressing the requirements associated with a transition from a pedagogic model of teaching to a student-centred learning model. Clearly this remit has profound implications for academic staff practice as well as for spatial requirements and hence the associated ICT provisioning. Similarly, the Learning and Teaching Committee, with responsibility for the institution's learning and teaching strategy, the Estates Committee and the Information and Information Technology committees, with their corresponding responsibilities for the strategies encompassing their portfolios of responsibility, have close synergistic relationships with the Change Management team and with the Project Office.

Outputs: To-date the key features of written communications associated with the above stakeholder activities are:

- The compilation of the ICT User Requirements Specification (ICT URS)
- An agreed nomenclature to describe the various space types
- A "Guiding Principles" document, which along with the ICT URS, articulates the ICT attributes for inclusion in the architect's plans, and
- A cost modelling spread sheet, developed using Microsoft Excel.

These documents aid in the weaving of all relevant ICT requirements into the design processes. A definitive statement is then available to the contractors who are ultimately responsible for construction, fit-out and commissioning of the completed complex.

User Requirements Specification: The purpose of the ICT URS is "*to capture the University's high level ICT requirements … and will be a means of enabling technical assurance and governance during the project timeline for building design that is impacted by ICT*". Two important aspects of the URS are a focus on:

- ICT infrastructure elements on the architecture-engineer facing designs
- Need to plan ahead of time and with knowledge of near-term foresight, thus facilitating a "last responsible moment" decision on state-of-the-art technology fit-out equipment.

The document is comprehensive in terms of its scope of ICT considerations, covering all space categories, ICT infrastructure, Building Information Systems, relationships with key RIBA Stages and implications of ICT advancements on working practices e.g. document management solutions, way finding systems and unified communications facilities.

The URS provides for opportunity to integrate aspects of the University's IT Strategy within the architectural design stages of the project beyond RIBA Stage D, thus ensuring the integration of ICT design solutions with building infrastructure during Stages E and F. The alignment of ICT designs with both construction and system facing considerations will accommodate design consistency and

continuity within these latter two stages to be carried forward to those Stages associated with tendering and construction (Stages G onwards).

Space Types Nomenclature: This document is a tabulation that defines all the major space types and identifies whether the ICT fit-out responsibility resides with the IT department or with a faculty. Its purpose is to ensure clarity of communications between IT staff and the various consultants with whom they engage.

Guiding Principles: Clarity of communication of requirements is considered important if the ICT requirements are to be appropriately represented on architect's drawings, hence onwards into construction. The Guiding Principles document builds detail unto various elements of the URS so that the plans portray information relevant to tender costs and to construction. For example, the relationship between natural light sources and the 'learning' wall; the orientation of light sources and the arrangement for its switching (on and off); the physical dimensions and positioning of display screens relative to room dimensions ("floor to ceiling" height, length, width and access routes) and other similar spatial-fit-out-ICT considerations are captured by the document. Detail, where appropriate is classified according to the space types to which it refers. The fundamentally important detail refers to actual physical positioning of, for example:

- Data panels on walls
- (Electrical)power plates (quantities and positions)
- Other cable requirements (audio, control unit, video etc.)
- Attachments (e.g. for ceiling mounted projectors, audio speakers etc.).

The architect and mechanical and electrical consultants, in particular, receive iterations of this document as our mutual understanding and interpretation of ICT requirements are progressively refined. They translate the requirement into planning details and then into Data Sheets. Stages F and G are the particular areas to benefit from this document's content. The IT department identifies the ICT equipment schedule (projectors, screens, control system software etc.) and derives a 'Bill of Quantities" type model from which cost estimates can be derived.

ICT Fit-out Cost Modelling: The University is responsible for the cost of ICT fit-out which is viewed as a continuum of the implementation of its IT Strategy, whether in the new campus or existing campuses. The relocation of the Jordanstown campus, the largest of the four, will influence equipment lifecycle planning as we get closer to the 2015 and 2018 opening dates. This influence is accounted for in terms of possible delayed replacement plans so that the finances are available for the new development. On the other hand, the sheer size of the new development and a decision not to decommission and relocate existing ICT equipment (as Jordanstown will deliver all its courses until June 2018) means early cost planning of equipment is essential. Furthermore, the principle of "latest responsible moment", allows for an element of cost modelling to be performed, typically with alternative degrees of sophistication in choice of end devices. A simple Excel-based "Bills of Quantities" model has been developed to facilitate these activities.

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8. ABOUT THE AUTHOR

In 1972, the author was a student in the then new Jordanstown campus, in its first year of operation as Ulster College, later to become the Northern Ireland Polytechnic, established as a result of the Lockwood Report (1965) on Higher Education in Northern Ireland. In 1984, following the Chilver Report (1982), the erstwhile New University of Ulster and the Ulster Polytechnic, as it had then become known as, merged to form the University of Ulster. From 1973 to 1976, he was employed in the IT department, and again in 1977 where he has remained since. His career has focussed on IT support services with emphasis on teaching and learning, which in 2005, the University acknowledged with one of its first Distinguished Learning Support Fellowships and the first to be granted to a non-academic staff member. The paper highlights aspects of the author's involvement and responsibilities in the planning of ICT provision for the new campus.