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Directing the South African ICT labour force towards growth sectors: a case for non-institutional scarce skills transition and reskilling courses

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Abstract:

South African universities offering Information and Communication Technology (ICT) graduate courses are under pressure from (i) an existing and well-documented ICT skills shortage in South Africa, and (ii) the rising demand for skilled labour from within the business analysis, software development and mobile application development sectors.

Contributing to a stimulation of a sufficient, sustained supply of correctly skilled, industry-ready ICT graduates to meet this growing demand for entrepreneurial ICT labour within the core ICT industry [and hence to stimulate growth in the developing South African economy through growth in capacity and entrepreneurial potential] is the underlying goal of this study. To achieve this goal, this article describes ways of stimulating the needed growth in the quality and quantity of ICT graduates who are suitably skilled for core ICT industries in South Africa. This growth can be achieved through short courses focussed on innovation and entrepreneurship within the mobile industry and other key scarce skills sectors.

This article presents two case studies describing how mobile application development short courses, as examples of successful ICT education projects in South Africa that have an impact on core ICT labour supply, can be used to (i) stimulate growth in the overall industry-ready ICT graduate supply in South Africa, and (ii) grow the entrepreneurial potential within the ICT labour supply.

Suggestions are made regarding the non-institutional nature and maturity of the proposed short and the importance of flexibility and industry focus when implementing such courses at tertiary education institutions and in other non-institutional contexts in South Africa.

Keywords: Mobile Application Development, Information and Communication Technology, Labour market, Innovation, ICT Skills

1. Introduction and problem statement

The documented ICT skills shortage in South Africa (Lotriet, Matthee, & Alexander, 2010) is an indication that the local ICT industry, including the core ICT industry, is expanding (Breytenbach & De Villiers, 2012). ICT skills supply can match an accelerating demand through education-stimulated growth (Breytenbach & De Villiers, 2012). This growth in ICT labour supply logically will only result in industry growth if educators can match their curricula with the skills needed for core ICT industry growth, by continually re-aiming their courses towards the moving ICT skills demand target. The skills needs of the ICT industry changes in nature as technologies and their creative application domains

develop, and recent ICT labour market research has done well to identify current scarce skills trends (ITWeb, 2011; MICT SETA, 2011), while acknowledging the uncertain and changing nature of the demand side of the South African labour market. Scarce ICT skills currently include software development skills combined with database design, manipulation, administration and Structured Query Language (SQL) knowledge, business analysis skills, and new skills such as mobile application development skills (ITWeb, 2011). The debate on the ICT graduate shortage did not end with the recognition of the size and nature of the skills shortage (Lotriet, Matthee, & Alexander, 2010), even though this was an important first step. Further research identified skills shortages and gaps in the ICT graduate “supply chain”, and solutions have been suggested (Breytenbach & De Villiers, 2012; Calitz, Greyling, & Cullen, 2010).

The South African government, guided by the National Development Plan (NPC, 2012) and the National e-Skill Plan of Action (NeSPA, 2010; NeSPA, 2012), has invested substantial resources in infrastructure and institutions – particularly in the form of the National e-Skills Institute initiative – to address the growing ICT labour supply concerns. This expenditure has been validated, as research shows the core ICT and related creative industries to be some of the faster growing segments in economies that are under strain as a result of global economic turmoil (Bridgstock, 2011).

In 2013 many of the South African government’s skilling initiatives - including the e-Skills Institute project - were stifled before reaching the point of sustainability: changing government priorities had redirected funding before new academic and e-Skills initiatives had achieved the needed momentum to stimulate real growth within the ICT graduate supply chain. This paper proposes an education based solution to this stalemate position reached within the e-Skilling discourse in South Africa in 2013.

This paper is structured as follows. First we pose the research question and discuss the methodology followed. Then we present a short overview of literature pertaining to skills development courses/projects and their context(s) within the South African ICT labour deficiency. This includes a look at the maturity and the non-institutional nature of such courses. Second, we supply two case studies that support our argument that mobile application development courses will increase the supply of ICT graduates and accelerate the South African e-skills initiative towards maturity. Third, we discuss our findings from the two case studies, followed by the knowledge contribution of this article and a conclusion.

2. Research question

It is from the position discussed in the introduction in which ICT education, including education focussed on mobile and creative industry domains, had been commissioned by governing authorities in 2010 [whose priorities have since changed] but had not been implemented sustainably by 2013, that we pose the research problem of this article:

Can short courses in scarce ICT skills serve the dual purpose of

- (i) accelerating current institutionalised e-skilling projects towards sustainability – becoming a flexible yet sustainable education-driven tool for increasing the supply of ICT graduates, while [simultaneously]:
- (ii) driving non-institutionalised growth in innovation and creative entrepreneurship within the South African ICT labour market?

We found early signs indicating that scarce-skill short courses can serve this dual purpose, and present two case studies both following an interpretive case study research approach, to support this argument. Each case study is presented in such a way as to highlight how each project benefited the ICT labour supply chain and increased entrepreneurial potential within the domain of mobile application development.

3. Research Methodology

This research study was designed to revolve around the development and implementation of two mobile application development short courses as examples of scarce ICT skills courses, at two universities in South Africa. The first course was structured as a transition course that guided secondary school learners towards tertiary ICT study, while the second formed part of a postgraduate diploma in software development that reskilled unemployed graduates for entry into the ICT labour market.

The research question required a research design and methodology that focussed on the capture of data that would indicate clearly whether or not a secondary school learner or a graduate student would become part of the ICT labour supply after the short courses. Two questionnaires were designed for each course – a pre-course registration questionnaire and a post-course feedback questionnaire. These questionnaires were used prior to each course and again on completion of each course to capture the data required to present each course as an interpretive case study. The questionnaires were designed to indicate any changes in study/career choices resulting from participation in the short courses. Summarised views of the data are available in the case study sections of this article, followed by an interpretive discussion of our findings.

4. Literature review – the South African ICT labour market in context

In this section we present six themes in the literature that together guide the reader towards an understanding of the two case studies to follow. The six are:

- (1) ICT graduate supply can be seen as a labour supply chain with evident gaps and opportunities for improvement
- (2) ICT development can be classified according to their maturity, and maturity is an indicator of sustainability

- (3) the ICT skills shortage in South Africa can be seen as a symptom of a healthy, growing core, however the education-driven ICT labour supply must be designed to accommodate changing industry needs,
- (4) there is a real danger of missing the opportunity to rectify mistakes in a fast-changing supply chain when proposed solutions become over-institutionalised
- (5) mobile application development is a suitably flexible field of study and teaching platform for the education delivery required to stimulate the needed growth in the ICT labour supply and its entrepreneurial potential
- (6) a differentiation between two types of short courses: transition courses and reskilling courses.

4.1 Defining core ICT fields

We define core ICT fields according to the list of skills required in the South African ICT labour market (MICT SETA, 2011). These fields include, but are not limited to, software development, database management, business and systems analysis, web development, and mobile application development.

Sadabash (2012) provides a comprehensive definition of the ICT industry and its sectors, and a detailed, standardised ICT occupation taxonomy that includes the occupations mentioned above. We use this definition, together with the MICT SETA list of scarce skills, to define the core ICT industry. Mobile application development, as an ICT labour occupation grouping, is not a traditional ICT or Information Systems (IS) speciality, and is not clearly defined in ICT occupation taxonomies in the literature (Sadabash, 2012). Mobile application development, however, can be seen as a subsection of software development, and we therefore include it in our definition of core ICT labour.

4.2 The ICT graduate supply chain

The supply side of the ICT labour market can be seen as a supply chain starting at secondary school level, progressing through tertiary education to graduate level (Calitz *et al.*, 2010). Recently it was suggested (Breytenbach & De Villiers, 2012) that there are mismatches between the skills supplied by this chain – the educational offering - and the skills needed by the South African ICT industry. This finding is supported by the Department of Higher Education and Training suggesting that accurate provisioning of scarce ICT skills is made difficult by a lack of information regarding industry skills needs (DHET, 2012: 14). We refer to such skills mismatches as “skills gaps” or “skills shortages” resulting from the supply chain. These gaps must be addressed simultaneously at all levels of the supply chain for overall supply to increase and for the quality of this supply to improve.

We need to find ways using scarce-skills short courses, of increasing the ICT graduate supply produced by academic institutions in South Africa. Our focus is therefore *institutional*. When we refer to the ICT supply chain, we are referring to the collection of *institutions* generating new ICT graduates in South Africa. One of our concerns is that education within the ICT labour supply chain has become over-institutionalised, and too inflexible to handle the changing nature of ICT demand.

We agree with the view that ICT graduate supply results from an academic, institutionalised supply chain, and our two case studies target two different parts of this chain – secondary school level and tertiary education level. We argue for making this supply chain more flexible through non-institutionalised short courses.

4.3 Viewing graduate-increasing projects from a maturity perspective

Breytenbach, De Villiers, and Jordaan (2012) critiqued the lack of maturity of education-driven and infrastructure-driven ICT development projects in South Africa. They found that education development projects are sustainable after reaching a maturity level categorised by *diffusion*. Diffusion is a term used to describe development projects that have a broader developmental impact than their original intention. An example of such diffusion would be a student who turns knowledge gained through education into an entrepreneurial business concept and then moves to further business development (*diffused* financial growth as a result of the initial knowledge growth). The concept of diffusion is based on Sen (1999) and his work on diffused increases in economic freedom.

If the “diffusion” maturity level is not reached by projects that aim to increase ICT graduate supply by the time that the project budget is spent, does this lack of maturity mean that the education project will fail? Not always (Breytenbach *et al.*, 2012), but it would mean that the project is not yet sustainable, has only a marginal chance of success if resources are withdrawn at such an early stage. There is a direct link between diffusion maturity and project sustainability (citation?).

We theorise that the South African e-Skills Institute initiative is starting to show signs of struggling with diffusion maturity due to the immature lessening of government as a result of a change in government priorities. For a comprehensive review, see Breytenbach *et al.* (2012). For the purpose of this article we wanted to determine whether or not diffused development took place in our two case studies as a measure of the maturity, and hence sustainability, of these two projects.

4.4 The ICT skills shortage as a symptom of normal industry growth

Using a human capital labour market approach, Breytenbach and De Villiers (2012) present a positive view of the e-skills shortage as a symptom of growing core ICT labour demand. This view is followed, however, by a disclaimer. Even with indicators showing that ICT labour-consuming industries are growing, the ICT labour market is precariously positioned and currently in a non-competitive state (Breytenbach & De Villiers, 2012). Graduate supply can keep up with growing demand –or the institutions responsible for stimulating the supply chain can miss out on the development potential of the current (non-optimal, non-competitive) market position by focussing on skills and/or the implementation of skills that do not match the current industry and government needs.

4.5 Missing opportunities for corrective growth due to institutionalisation

In the same way as education/development projects fail due to a lack of maturity, such projects also risk failure if they become over-institutionalised. Placing too many institutional restrictions [or expectations] on immediate, flexible syllabus changes and/or education approach changes may cause the resulting courses to fail to reach their development goals. Quick courseware and syllabus changes are needed to strengthen all levels of the ICT labour supply chain in order to increase the quantity of ICT graduates, but also to change the type and quality of students graduating in ICT. Sen (2009) writes about institutionalism: “[*transcendental institutionalism*] tries to identify social characteristics [a set of institutions] that cannot be transcended in terms of justice [increasing freedom]”, and “in searching for perfection, transcendental institutionalism concentrates primarily on getting the institutions right”. Therefore education-driven development projects following a transcendental institutionalism approach [such as the e-Skills Institute initiative] view development as a clear growth path leading developing entities - students and community members - closer to being “perfectly” positioned for employment, fully developed, fully educated, ready for employment as productive labourers: a state that can be described clearly in terms of the institutions used to reach it. The primary goal of development projects becomes putting in place *institutions* (education centres, frameworks, rules, companies, workgroups, technology standards, IS tools, IS infrastructure, skills hubs, information centres, etc.) that will allow entities to reach a state of being perfectly developed - or in our context, immediately employable in a scarce skills ICT sector. Many education-focussed development projects buy into the transcendental institutionalism development philosophy because it lends itself so naturally to domains with institutionalised supply chains (citation, or is this speculation?).

Academic institutions must be wary of their own institutional nature and guard against over-institutionalising short courses aimed at alleviating the ICT skills shortage. Academic institutions erroneously over-institutionalise development opportunities by aiming to put in place a comprehensive set of institutions (rules, accreditations, and governing bodies) that will result in a one-size-fits-all cure for the already over-institutionalised ICT labour supply chain and move it towards an imagined transcendental state in which more than enough industry-ready ICT graduates are produced each year. Academic institutions must also guard against expecting industry to take ownership of the less institutionalised forms of training – flexible short courses, application-specific short courses, media-specific short courses, and so on. Taking too long to implement the syllabus changes in touch with industry dilutes the development potential of such courses and makes the entire ICT labour supply curve more price inelastic.

Sen (2009) suggests a way of steering clear of falling into a transcendental institutionalism trap – an approach of comparative realisation. We will call this (arguably better) development philosophy the “comparative” approach, and not “realisation-focussed comparison”, as Sen (2009) called his theory. ICT development projects following the comparative approach view development as a flexible path without a fixed [near perfect] end-point, and without a perfect technology- or education-driven solution, that is aimed at when entities are developed. Development within this approach is viewed as an on-going, *continual evaluation of actual possibilities* for increasing the economic and social

freedoms of people; a comparison and ranking of each possible development opportunity. The actions that will maximise development are then implemented, using the ICT tools and other resources needed to manifest the envisioned development. This allows for changes when they are needed, even if this means that all future project goals must be changed accordingly. In an ICT labour market context, this approach suggests that each group of students must be measured, that realistic development opportunities must be identified, and that the opportunity that will result in the greatest development must be focussed on first, using a flexible education approach to transfer the most-needed skills as quickly as possible.

This might seem an overly theoretical distinction between institutionalism and the comparative realisation approach to ICT development projects, but it makes a significant difference to the way we look at proposed solutions to the ICT labour shortage. We understand from Sen (2009) that we can lose out on development potential if the institutional changes [the institutional burden to be carried] required by a proposed solution [education-driven project] are too great. A moving development target requires a moving solution.

Scarce skills short courses, are one viable solution to the major skills deficiencies in the ICT field, but can lose most of their potential if strangled with institutional requirements and aspirations.

4.6 Mobile application development – a suitable starting point

According to Marshall (2013), predictors indicate that by 2017 there will be some 850 million mobile devices in Africa and the Middle East, of which 500 million will be smart devices. He predicts additionally that market forces in Africa will cause 65% of mobile applications to be open-source, cloud and HTML5/SMS/voice based for maximum, cost-effective reaching of consumers and communities. The complexity of vendors in the “Mobile App Development” market is increasing, and agility is key. This supports our contention that mobile application development should be included in ICT occupation taxonomies, as suggested in section 4.1.

With most of this article focussing on mobile application development as a scarce skill and as subject matter for the case study short courses, we note that the majority of mobile learning (m-learning) literature focuses on mobile technology as an education delivery platform, and that the number of publications in this field is on the rise (Gomez, Baron, & Fiore-Silvast, 2012). We agree that mobile devices can serve a dual purpose, as education medium and subject, in ICT projects aiming towards increasing ICT graduates and the entrepreneurial potential of ICT labour. Therefore we provide a very brief mention of mobile devices as education medium as part of this literature review.

As an example of relevant, existing m-learning literature, Chen and Wei (2012) identify two challenges in mobile learning: (1) the lack of generalisation – one solution only targets one mobile technology such as Android, BlackBerry, or iPhone, and (2) challenges surrounding the creation of optimised e-lesson (m-lesson) content that displays and interacts correctly on different mobile devices. These authors suggest a solution based on e-LML (e-Learning Markup Language), a way of setting out lesson plans in a popular XML format. We suggest looking at similar solutions for mobile technology

as a platform, such as using free mobile blogging solutions to resolve display issues, and new porting tools to translate applications between platforms¹.

With a high level of mobile penetration and a growing level of mobile internet usage In South Africa², the potential for mobile devices to be used as a cost-effective (and in many ways innovative) education platform is obvious.

The short course nature of mobile application development is a good match for the kind of tool we need to quickly and flexibly stimulate more learners into the ICT labour supply chain and reskill existing ICT workers towards industry readiness. ITWeb (2011) indicates non-institutionalised training in the form of short courses as the preferred training method for IT companies

4.7 Defining transition courses and reskilling courses

We end our literature review by defining two kinds of short courses, (i) transition courses and (ii) reskilling courses.

We loosely define a transition course as a short course that helps the learner/student to progress smoothly from one phase of the supply chain to the next phase in the same supply chain, for example from secondary school ICT study to tertiary-level ICT study. Such courses are typically used to even out the technical learning curve related to scarce skills-related fields of study, such as computer science or mobile application development, giving students a greater chance of success. The first case study presented in this article describes a short course that can be classified as a transition course.

Other short courses fall into a category we call reskilling courses. A reskilling course moves the student from one labour supply chain to another. Stated differently, the student is made ready to take part in an industry other than the one his/her primary studies aim towards. For example, a short course that teaches an econometrics student how to develop mobile applications is a reskilling course.

We discuss early indications that both transition and reskilling courses in mobile application development provide workable solutions for filling the skills gaps in the ICT labour supply chain, while keeping up with current ICT industry skills needs – solutions that are mature and non-institutional in nature.

¹ See, as an example of such a porting tool, the BlackBerry Apps Generator:

<http://www.blackberryappgenerator.com/blackberry/>

² News article: <http://www.iol.co.za/business/business-news/cellphones-boost-sa-s-internet-penetration-1.1294151#.UKvfIldkyAg>

5. Case study 1: Mobile application development as motivation for further ICT study – a transition course

One ICT labour supply chain gap mentioned in the literature is secondary school learners' lack of understanding of ICT as a career while deciding what to study or pursue as a career (Breytenbach & De Villiers, 2012; Calitz, 2011; Granger, Dick, Jacobson, & Van Slyke, 2007). In South Africa, a secondary school learner must choose his/her preferred secondary school subjects after completing two out of five years of secondary school – reaching this career path choice at the age of 14 or 15, when ICT industry knowledge is usually limited.

The project described in this case study – the Mobile Application Development (MAD) Challenge – was aimed at secondary school learners aged 16 and older – learners who had already made their final subject choices at secondary school level. The goal of the MAD Challenge was so see how school learners who have indicated an interest in ICT by choosing IT or CAT (Computer Application Technology) as a secondary school subject compared with learners who did not choose IT or CAT as a subject when participating in a mobile application development short course with a strong entrepreneurial focus [conceptualising and writing applications that could potentially make money].

Table 1: Summary – MAD project 2012

Number of learners accepted for course	60
Number of learners who completed the course	30
Entrepreneurial ideas/creative applications generated	16
Course-finishing learners who indicated an interest in ICT jobs prior to course	18/30 = 60%
Course-finishing learners who indicated an interest in ICT jobs after the course	25/30 = 83%
Number of non-ICT-studying learners indicating ICT as a career preference after the course	3
Number of learners who changed their career choice to ICT as a direct result of the course	7

Table 2: Summary – MAD project 2013

Number of learners accepted for course	54
Number of learners who completed the course	22
Entrepreneurial ideas/creative applications generated	14

Course-finishing learners who indicated an interest in ICT jobs prior to course	14/22 = 63%
Course-finishing learners who indicated an interest in ICT jobs after the course	18/22 = 81%
Non-ICT-studying learners indicating ICT as a career preference after the course	4
Learners who changed their career choice to ICT as a direct result of the course	4

Students were measured before and after their participation in the course regarding their interest in ICT as a possible career choice, their primary motivations when making study/career choices, and their basic understanding of the ICT industry. The MAD project was set up with the underlying hypothesis that short courses of this nature could potentially stimulate growth in the group of secondary school learners who choose to become part of the ICT industry by giving learners a feel for the new and exciting entrepreneurial opportunities and the job satisfaction to be found in ICT. A summary of basic measures for the 2012 and 2013 MAD project groups are presented in Table 1 and Table 2.

All MAD participants indicated an interest in ICT at a young age prior to the course, but not all learners had IT or ICT as secondary school subject. Of the thirty students who finished the challenge in 2012, seven did not have IT or CAT as a school subject. Of these seven learners, two changed their minds about studying ICT at a tertiary level as a result of the course, and indicated a need for more information regarding available courses, especially ICT courses related to software development. One learner indicated a 50% possibility of changing her mind from studying medicine towards studying ICT, and this student's mobile application reflected a keen dual interest in both medicine and technology – potentially an embedded ICT professional within the medical field? The other four non-IT learners who finished the course indicated no clear choice for or against further ICT study, with all four indicating that they needed more information about occupations within the ICT industry before making further study choices. The 2013 MAD challenge resulted in similar results, with four non-ICT studying students indicating an interest in studying ICT. In total eleven A-grade learners changed their minds regarding their dream jobs and possible career choices towards ICT as a direct result of this short transition course in mobile application development.

This short course was non-institutional in nature, and took the form of a ten-week boot camp, structured as six informal [yet intensive] tutorial sessions, followed by four weeks of unstructured laboratory work in groups or as individuals. The non-institutional nature of the course allowed participants the freedom to work at their own pace and on their own topics of interest, which, in turn, had a direct effect on the level of creativity and entrepreneurship that manifested as a result of this course.

This short course showed early signs of reaching diffusion maturity, both within the academic institution that facilitated the course and in the applications developed by the participants. The course has had a positive impact on the marketing approach followed by the academic departments in question [as an example of direct diffusion] and has resulted in several mobile applications that could

generate income for course participants after course completion. The observable diffusion was confirmed when the project was approved to run again, on a bigger scale, in 2013 – the project had reached diffusion maturity.

The competition was set up with particular sensitivity towards social maturity variables, as discussed in Breytenbach *et al.* (2012), and variables that could increase the ICT labour supply chain price elasticity, as discussed in Breytenbach and De Villiers (2012).

6. Case study 2: Reskilling graduates to meet industry needs

Whereas the first case study can be classified as a transition course – preparing students for a higher level of study in the near future – the second case study describes a reskilling short course.

This reskilling course was structured as a postgraduate diploma, with fourteen weeks of structured lectures in 2012. The course content, taking participating students through (i) programming fundamentals, (ii) web fundamentals, and finally (iii) mobile application development using Java, was structured into seven two-week sections, each presented as a postgraduate subject. The seven subjects then made up the postgraduate diploma. Table 3 displays basic information regarding this course.

Table 3: Summary – postgraduate diploma project

Number of learners accepted for course	32
Number of learners who completed the course	14
Entrepreneurial ideas/creative applications generated	3
Non-ICT-studying learners indicating ICT as a career preference after the course	12
Number of learners entering directly into the ICT labour market	14

This course, although slightly more institutionalised in nature, was still flexible enough to align with changing industry needs. The advantages of this flexibility became clearer as the 14 weeks of lectures progressed, with the focus moving towards mobile development as the need for such skills were expressed by companies offering internships to participating students. The coursework was adjusted mid-stream – a good working example of Sen's comparative realisation approach to development (Sen, 2009). The slightly more institutional nature of this project had an additional side benefit of giving participants an accredited reference when applying for work in the ICT industry – an industry new to all of them.

Fourteen non-ICT graduates were successfully reskilled through this flexible, minimally institutionalised software and mobile development course, and have already entered the ICT labour supply chain at the graduate level. Three of these students are now working for the companies that offered them internships for the duration of the course, which hints [again] at the importance of preparing students for industry through practical exposure [increasing industry readiness]. There is an epistemological overlap between this project, being industry and internship driven, and the work of

Araya and Peters (2010), which discusses the preparation of graduates for employment in the technical and creative industries by focusing on their level of embeddedness in the industry.

7. Findings and discussion: The dual purpose of scarce skills short courses

Diffusion maturity was reached within a year in the transition course project described in the first case study, and by the reskilling course discussed in the second case study; both short courses running successfully for a second year in 2013. The early indicators of success shown by the second project have motivated the e-Skills Institute coordinators to investigate the facilitation of similar courses within the Institute which, if implemented, would be a measurable diffused increase in freedom resulting from the project in question. Indications are that these reskilling courses would be open to industry workers in need of being reskilled towards industry readiness.

From the summary in Table 3 it would seem that the increases in (i) ICT labour supply and (ii) entrepreneurial potential in the ICT labour supply chain were less for the second case study than for the first case study (see Table 1 and Table 2), but the authors argue against such a conclusion. The diploma short course, focussing on reskilling *non-ICT* graduates into industry-ready ICT graduates within 14 weeks, had a much harder task at hand than persuading secondary school learners to indicate that they would potentially study ICT. Having fourteen previously unemployed non-ICT students with confirmed permanent employment within core ICT companies after only 14 weeks of reskilling is an exceptional result.

The two case studies discussed above confirm some positive characteristics of scarce skills short courses. Short courses, both transition and reskilling courses, (a) reach the desired “diffusion” level of project maturity relatively quickly, as they are cost effective, reasonably easy to facilitate, and have a measurable impact on the employability of participants (which makes these projects easier to embed in social structures); (b) seem to attract quality students into skills gaps – talented individuals who, through transition or reskilling, can be integrated into the ICT labour supply as high quality graduates; (c) not only guide students towards employment in the core ICT industry, but also perform the function of motivating students towards becoming ICT professionals embedded in the innovation and creative industries; and (d) work at all levels of the ICT labour supply chain. Our case studies provide evidence of these courses bridging information gaps at secondary school level and reskilling postgraduate students for ICT industry readiness. Finally, we found mobile application development to be a suitable subject for such transition and reskilling courses – it meets 2012 and 2013 industry needs and supports entrepreneurial career paths in core ICT industries.

8. Conclusions and further research

We started this article by questioning whether or not scarce skills short courses could (i) accelerate current institutionalised ICT projects such as the e-Skills Institute project towards sustainability, while (ii) driving non-institutionalised growth in innovation and creative entrepreneurship within the South African ICT labour market.

The first question can be answered with certainty, with two case studies we have provided evidence that short courses reach maturity quickly and can be delivered with minimal institutionalisation. Such short transition or reskilling courses can be used as agents of acceleration, stimulating new or existing education-driven projects towards sustainability and [later] project success – with the assumption that success is defined as filling skills gaps within the ICT labour supply chain and increasing the employability of course participants.

The second question, regarding short courses engineering an increase in the level of entrepreneurship within the ICT labour market, touches on a more complex discourse about the kind of labour [entrepreneurial in nature] that seems to be driving growth within core ICT industries and related fields. Both Flew (2011) and Bridgstock (2011) mention entrepreneurship as an important variable for industry growth and increases in labour employability within the creative industries. This suggestion, that entrepreneurship drives industry growth, especially through multidisciplinary applications, together with the level of innovation that we observed in the two case study projects, guides us towards an answer to our second research question.

Mobile application development as a subject encourages multidisciplinary applications – the use of technology in traditionally non-technical fields – and unlocks entrepreneurial ideas at all levels of the supply chain by giving non-technical thinkers and students with creative skillsets an entry point into the mobile [mass/global] market in a cost-effective way. Both case studies were characterised by high levels of feasible new business ideas and innovative applications of mobile technology outside of what would be classified as core ICT industry.

We acknowledge the need for more rigorous research regarding the relationship between (i) the evident entrepreneurial potential of ICT graduates having mobile development skills and (ii) ICT industry growth, as well as the relationship between (iii) entrepreneurship and (iv) growth in the demand for both core and embedded ICT labour.

We conclude this article with three practical suggestions for consideration by stakeholders involved with the e-Skills Institute project and similar education-driven initiatives in South Africa. First, scarce skills short courses should be considered as a tool with which to make up lost ground in the development of ICT labour. We suggest combining software development and mobile application development as subject with current m-Learning trends in South Africa³; mobile devices create an applicable vehicle for mobile application development education and other short transition and reskilling courses. We should consider options such as mobile applications that help the user to write his/her own mobile applications on popular platforms with greater ease – triggering further entrepreneurial innovation.

Second, we suggest delivering scarce skills development courses with the least possible institutional restriction. Quality, consistency and accreditation must be ensured, but both case studies indicate the

³ See, as an example, the work of IT Schools Innovation (<http://www.itschools.co.za>).

need for flexibility in approach when aiming towards filling fast-moving ICT skills gaps. South Africa is moving away from a “university focused solely on technology” approach, a concern mentioned by Lotriet *et al.* (2010), as this works against the principles of realisation-based comparison (Sen, 2009) by over-institutionalising the ICT labour supply chain.

Finally, we propose the creation of a network of educators who can move easily between academic institutions and industry and fill the ICT skills gaps in academic and industry parts of the ICT labour supply chain. The e-Skills Institute initiative has resulted in the creation of a strong network of educators with the common goal of increasing employability and innovation in the ICT labour market. This network can be used to facilitate short transition and reskilling courses in scarce skills areas countrywide.

Can scarce skills short courses be used to redirect the South African ICT labour supply chain towards meeting industry demand for higher levels of core and embedded ICT labourers with higher entrepreneurial potential? We believe it can.

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