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## 1 Executive Summary

The report maps the existing educational and training curricula in the consortium's countries to determine the expected skills supply of individuals entering the workforce of the mobile apps industry. Consideration was also extended to potential on-the-job training seminars and non-formal training. The identification involved desk research in educational and training provision and typical individual skill profiles across the EU. To validate the skills supply, CUE ran a survey on ICT enterprises and sector representatives' views on the actual skills of the mobile apps workforce. NAACE, AICA and ATI contributed to the collection of evidence, participating and promoting the survey to relevant organisations through their collaborative networks. AELP promoted the survey to the relevant target groups in UK.

This deliverable documents and analyses the business and technical skills required in mobile app creation to build a skill-related profile of mobile apps creators, either individual developers or enterprise IT developers. The research undertaken revealed a significant training provision in the participating countries and beyond in technical related modules. The business related modules, appeared sporadically, as part of App development courses in only few countries. The survey results relieved similar results to the desk based survey. Most of the developers possess skills related to the technical content of their jobs while their employers indicated that non-technical competences are required too.

## 2 Introduction

### 2.1 Project Objectives<sup>1</sup>

The project aims to form an ICT Sector Skills Alliance focused on the mobile apps field, setting the basis for the establishment of a European ICT Sector Skills Council. The AppSkill Alliance responds to the call for enhancing the responsiveness of initial and continuing VET systems to sector-specific labour market needs and to the demand for improved skills by: a) Acting as a collaboration platform that will connect VET providers, sector representatives, and VET authorities, b) identifying skills needs & mismatches, and c) developing and delivering an appropriate training programme connected with qualification frameworks.

#### Objectives

AppSkill sets out to:

- Design a European learning outcomes approach curriculum for mobile apps creators to improve business and design skills.
- Link the designed curriculum with ESCO, EQF, NQFs, and quality assurance principles to facilitate recognition and make it transferable across EU.
- Gather and systemize evidence of skills shortage at EU level to fine-tune and optimize vocational learning content and approach.

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<sup>1</sup> Application form , 2014, VET open course for mobile apps creators



- Coordinate the sector in terms of skills anticipation and act as a cornerstone for a long-term European collaboration.
- Introduce innovative training delivery methods in the form of MOOC.
- Validate the training approach so as to offer operationally mature open educational resources and approaches.
- Provide replicable training to mobile apps creators.

## 2.2 Deliverable Structure and aims

This deliverable aimed to examine the existing educational/training curricula in the consortium's countries, in order to determine the expected skills supply of individuals entering the workforce of mobile apps industry

The identification involved desk research in educational/training activities accompanied by a survey in the four participating countries.

The report provides information on the Mobile Apps industry on the whole including country specific information on employment rates and prospects. The results of desk based research on existing formal and non-formal training are presented along with the key findings of the questionnaire.

The main chapters of this report include:

- The methodology followed
- Existing Training curricular
- Industry and employment trends (country level)
- Formal training (country level)
- Non formal training
- Survey results
- Conclusion & recommendations

## 2.3 Desk Research

Through desk research CUE examined the existing educational and training curricula in the consortium's countries to determine the expected skills supply of individuals entering the workforce of the mobile apps industry. The desk research cumulated in typical individual skill profiles across the partner countries of the EU.

The main sources in the desk research are listed below:

- Scientific articles and journals on the industry's prospects
- CEDEFOP country reports on employment and skills
- European Commission reports on skills
- Industry reports (such as Vision Mobile , Delloite and Touch)
- Websites of training providers, non-formal training and various reports



Five countries were examined, UK, Italy, Belgium, Spain, and then “others” including USA and Australia. A total of 27 Universities and 18 companies were researched covering a total of 84 different courses.

## 2.4 Survey

To validate the skills supply identified through the desk research carried out, CUE ran a survey on ICT enterprises and sector representatives' views on the actual skills of the mobile apps workforce. NAACE, AICA, CUE and ATI contributed to the collection of evidence, participating and promoting the survey to relevant organisations through their collaborative networks. AELP also promoted the survey to the relevant target groups in UK.

The semi-structured design of the questionnaire was intended to give survey participants the opportunity to add their suggestions in relation to the future skills required for the sector, the role of academia, and the qualifications required by the industry.

A total of 75 responses from 9 countries were received.

## 3 General trends in Employment & Qualifications Levels

### 3.1 Belgium

The economic crisis reduced employment mainly in the primary, manufacturing, and distribution and transport sectors between 2008 and 2013. In contrast, employment in the construction, business and other services and non-marketed (mainly public sector) services sectors increased over the same period. Future employment growth in Belgium, up to 2025 will be concentrated in business and other services, with some increases in the distributing and transport sector and non-marketed (mainly public sector) services.<sup>2</sup> Most job opportunities, around 30%, will be for professionals (high level occupations in science, engineering healthcare, business and teaching). The proportion of job opportunities for professionals, in Belgium is significantly higher than the 24% forecast for the EU as a whole. Most job opportunities in Belgium will require high-level qualifications. However, replacement demand will also provide significant numbers of job opportunities requiring medium-level qualifications.<sup>3</sup>

In contrast to EU demographic trend the growth of Belgium's population is not expected to be concentrated solely among older age groups. Even though the largest increases are in the working age population aged over 55 years, by 2025, numbers of people in the working-age population aged between **25 and 39 years old are also forecast to rise**. Belgium's labour force is becoming more **highly qualified**. By 2025, the share of those with high-level qualifications should rise to 47.5% compared to 40.2% in 2013 and

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<sup>2</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Belgium, 2015 edition, p2

<sup>3</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Belgium, 2015 edition, p3

35.6% in 2005. People with medium-level qualifications in 2025 will be the same as in 2013, around 40.1% of the labour force.<sup>4</sup> In 2013, 11% of young people left the education and training system with low-level qualifications, above the national target of less than 9.5% by 2020. In the EU, the average, in 2013, was 11.9%, still higher than its benchmark of less than 10 % of young people leaving the education and training system with low-level qualifications by 2020.<sup>5</sup>

### 3.2 Italy

Despite creating new jobs, Italy's ageing workforce and occupational mobility means that, between now and 2025, replacement demand in Italy is forecast to provide almost six times more job opportunities than expansion demand. In Italy, most job opportunities, around 22% will be for professionals (high level occupations in science, engineering healthcare, business and teaching), followed by around 17% for technicians and associate professionals (occupations applying scientific or artistic concepts, operational methods and regulations in engineering, healthcare, business and the public sector).<sup>6</sup> Italy's working age population is projected to grow by about 6% between now and 2025. However, labour market participation is forecast to fall from 49.7 % in 2013 to 48.9 % in 2025, lower than the EU forecast average of 55.5%. The increase in working age population combined with the fall in participation rates means that the total labour force will grow by 4% between now and 2025.<sup>7</sup>

Following the EU demographic trend, Italy's population is getting older. Between now and 2025, although numbers of people aged 15 to 24 are expected to rise, the biggest increases in Italy's labour force are projected in the age groups of 50 years and above.<sup>8</sup> Numbers of people in the labour force aged between 30 and 49 are expected to fall substantially. Although older, Italy's labour force is becoming more highly qualified. This is explained by older less qualified people leaving and younger more highly-educated people entering the labour market. By 2025, the share of Italy's labour force with **high-level qualifications** is forecast **to rise** to 30.8% compared to 20.7% in 2013 and 15.6% in 2005. People with medium-level qualifications in 2025 will account for 46.7% of the labour force compared to 45.4 % in 2013. The share of the labour force with low-level or no qualifications is forecast to fall just below 22.5% in 2025. According to Cedefop's forecasts, by 2020, in Italy around 36% of 30 to 34 year olds will have high level qualifications. Although this is below the EU's educational attainment benchmark of 40% it is significantly higher than the national target of 26%. On current trends around 45% of 30 to 34 year olds in Italy will have high-level qualifications by 2025.<sup>9</sup>

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<sup>4</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Belgium, 2015 edition, p5

<sup>5</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Belgium, 2015 edition, p6

<sup>6</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Italy, 2015 edition p3

<sup>7</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Italy, 2015 edition p5

<sup>8</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Italy, 2015 edition p5

<sup>9</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Italy, 2015 edition p5

### 3.3 Spain

The economic crisis reduced jobs in all sectors, with employment in construction and manufacturing hit hardest between 2008 and 2013. Future employment growth in Spain up to 2025 will be in the distribution and transport sector, and business and other services. However, this growth is offset by job losses in manufacturing and non-marketed (mainly public sector) services.<sup>10</sup> Given the low employment growth, expected trends in occupational mobility and an ageing labour force, between now and 2025 replacement demand in Spain is forecast to provide about nine times more job opportunities than expansion demand. The share of job opportunities for professionals (high level occupations in science, engineering healthcare, business and teaching), around 13% in Spain is lower than the 24% forecast for these occupations in the EU as a whole. Most job opportunities in Spain will require high-level qualifications. However, there will also be significant numbers of job opportunities requiring medium-level qualifications.<sup>11</sup>

Eurostat's latest population projection (Europop 2013) for Spain reflects current trends in fertility rates and net migration flows. Spain's working-age population is projected to fall by around 1% between now and 2025. Labour market participation in Spain is also forecast to fall from 58.5% in 2013 to 54.4% in 2025, below the EU forecast average of 55.5%. Following the EU demographic trend, Spain's population is also getting older (Figure 5). Between now and 2025, although numbers of people aged 15 to 19 are expected to rise, the biggest increases of Spain's labour force are projected in the age groups of 45 years and above. Numbers of people in the labour force aged between 20 and 44 are expected to fall substantially.<sup>12</sup>

Although older and a little smaller, Spain's labour force is becoming more highly qualified. This is explained by older less qualified people leaving and younger more highly-educated people entering the labour market. By 2025, the share of Spain's labour force with high-level qualifications is forecast to rise to 37.8% compared to 35.5% in 2013 and 31.2% in 2005. People with medium level qualifications in 2025 will account for 31.1% of the labour force compared to 26.4% in 2013. The share of the labour force with **low-level or no qualifications** is forecast to fall from 38.1% in 2013 to 31.1% in 2025.<sup>13</sup> In 2013, in Spain, 23.6% of young people left the education and training system with low-level qualifications, above the national target of reducing this to 16% by 2020. In the EU, the average in 2013 was 11.9%, still above its benchmark of less than 10% of young people leaving the education and training system with low-level qualifications by 2020.<sup>14</sup>

<sup>10</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Spain, 2015 edition p2

<sup>11</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Spain, 2015 edition p3

<sup>12</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Spain, 2015 edition p5

<sup>13</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Spain, 2015 edition p5

<sup>14</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, Spain, 2015 edition p6





### 3.4 United Kingdom

The effects of the economic crisis on the employment in the UK were relatively mild compared to other EU Member States. Between 2008 and 2013 there were heavy job losses in construction and manufacturing but employment increased in the primary sector, business and other services and non-marketed (mainly public sector) services. The future job growth in the UK will be concentrated mainly in construction and the business and other services sectors. However, in the primary sector employment is forecast to fall.<sup>15</sup> Given its ageing labour force and relatively low unemployment rate between now and 2025, replacement demand in UK is forecast to provide more than eight times more job opportunities than expansion demand. In the UK, most job opportunities, around 25%, will be for professionals (high level occupations in science, engineering healthcare, business and teaching), followed by managers, around (20%). These shares of job opportunities are higher than the EU averages of 24% and 9% respectively for these occupations. The share of job opportunities for service and sales workers, around 18%, in the UK is also above the EU average of 16% for this occupational group. Most job opportunities in the UK will require medium-level qualifications. However, there will also be significant numbers of job opportunities requiring high-level qualifications.<sup>16</sup>

The UK's working-age population is forecast to grow by about 6.5 % between now and 2025. However, labour market participation in the UK is expected to fall from 55.2% to 53.7% below the EU forecast average of 55.5%. Following the EU demographic trend, the UK's population is getting older. Between now and 2025, there will be an increase in numbers of people in the labour force between 30 and 39 years-old, but a much larger increase of people aged over 55. Although older, the UK's labour force is becoming more **highly qualified**. This is explained by older less-qualified people leaving and younger more highly-educated people entering the labour market. By 2025, the share of labour force with high-level qualifications should rise to 39.9% compared to 36.3% in 2013 and 30.2% in 2005. People with medium-level qualifications in 2025 will account for 45.7% of the labour force, compared to 43.5% in 2013. The share with low-level or no qualifications is forecast to fall from 20.1% in 2013 to 14.4% in 2025.<sup>17</sup>

## 4 Mobile Apps Sector in Context

Global revenue for the total mobile application stores' market increased by 160.2 % and reached \$US 2.2 billion in 2010 (compared to \$US 828 million in 2009). The Apple App Store recorded annual revenue of \$US 1.8 billion at the end of 2010, maintaining its lead position on the market (with an 82.7 per cent share, which is a decrease from its more dominant position of 92.8 per cent in 2009). The Android market

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<sup>15</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, UK, 2015 edition p2

<sup>16</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, UK, 2015 edition p3

<sup>17</sup> CEDEFOP, Country Forecasts, Skills Supply and Demand up to 2025, UK, 2015 edition p5



increased its revenue by 861.5 percent in 2010. This suggests a 4.7 per cent share of global mobile application revenue in 2010 (an increase from 1.3 % in 2009).<sup>18</sup>

The EU app-developer workforce will grow from 1 million in 2013 to 2.8 million in 2018. Additional support and marketing staff result in total app economy jobs of 1.8 million in 2013, growing to 4.8 million in 2018. The EU workforce contains a broad range of roles and skill sets, including developers, testers, designers, and UI and UX experts.<sup>19</sup>

According to a survey conducted by Gigaom Research (2014) more than three-quarters of coders and scripters have college or advanced degrees.

A fast growing and youthful industry has resulted in a similarly young labour force. Rapidly evolving it is difficult to keep skills current yet this is not the reason for the youthful workforce. That comes from the industry's development. Consider that 40 years ago there were almost no software professionals globally. Home computers only started appearing in any serious numbers a little over 30 years ago. To learn software development of any kind before that it was generally necessary to be at a university. There were so few opportunities to get started in the industry for people now in their 50s and 60s that there obviously aren't many of them and most of the really experienced leaders are in their 40s. The first generation that really grew up with computers are only in their 30s. As such it's not at all surprising that the average age in the industry is just a little over 30. Computers were invented and personal computers commercialised first in English-speaking countries, so this probably explains why the average age in the industry is higher in those places. Most developers have come into the industry in fairly recent history, a large proportion of those have learned their computing at university. This creates a workforce with a very large number of junior developers for every experienced developer. Mobile is still fairly new and developers are still working out the best ways to build software in that environment; already though there is a massive interest in the Internet of Things (IoT).<sup>20</sup>

Development languages are still primarily driven by the target platform although many languages are now cross-platform, giving developers more freedom to choose.<sup>21</sup> Regional variations in the choice of development language can sometimes be related to the dominance of specific hardware platforms, factors which can more-easily be attributed to market conditions and economic realities, rather than dictums from platform owners. Java remains very popular in South Asia and India whilst support for scripted languages, and HTML5 is strong in North America where Hypertext is the primary platform for 47% of developers. Elsewhere developers remain with Objective C and C# (the primary platform for 38% of Asian developers). Americans are looking at cross-platform and rapid development solutions, a trend which is mirrored in

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<sup>18</sup> Deloitte Consulting, Citadel Consulting, Tech4i2, The Castlegate Consultancy, (2011) Pricing of Public Sector Information Study Apps market snapshot.

<sup>19</sup> Mark Mulligan and David Card (2014), 2014, Sizing the EU App Economy, GIGAOM research

<sup>20</sup> Vision Mobile

<sup>21</sup> VisionMobile



Western Europe and Israel. HTML5 development is easier with reliable connectivity, despite the addition of persistence APIs, web pages still work better when connected. Scripted solutions are also harder to optimise, so their popularity may reflect the greater processing power available to North American consumers. Scripting languages are generally faster to work with, and slower to execute, but if the end users have the latest hardware then the execution speed is less critical. North America also has a legacy population of web developers, highly skilled in HTML and JavaScript and keen to apply that experience into the mobile marketplace.<sup>22</sup>

The high-level view is that IoT market is not yet large enough to sustain many serious businesses, mobile apps are still not making any real money for more than half of those involved and desktop apps are only slightly better. Cloud services developers have the best odds of making money although 43% of those interested in revenues still fall below \$500 / month. This outperformance of cloud services developers is interesting because there must be some kind of client, be it mobile app, desktop app or IoT device. Since IoT developers are typically not making much money we can conclude that the mere presence of a cloud service connected to a mobile or desktop app is improving the odds of success.

- Common business models for the app sector are:
- freemium (free download with in-app purchases)
- paid (paid download with no in-app purchases)
- paidmium (paid download with in-app purchases)
- in-app advertising (contains ads like banners and videos)
- dynamic (business model shifts according to usage)
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Freemium and in-app advertising appeal “to a broader user base by eliminating up-front costs and create ongoing revenue streams for publishers,” while paid and paidmium revenue is declining, though they can still be successful for the right apps. Freemium app revenues grew by over 70 per cent, while paid and paidmium app revenues declined by 19 per cent and 24 per cent, respectively. The freemium model is very successful, even with a small proportion of users making in-app purchases, because “publishers can structure their apps to target the whales that make repeated purchases.” However, less than 15 per cent of publishers surveyed make \$10,000 per month or more from in-app advertising and “a well-executed approach to app discovery, user acquisition and user engagement” is important. The report also points out that geography matters and it’s not one-size-fits-all across countries: Revenue generated through app stores versus in-app ads varies widely across countries—India brings in 70 percent of its app revenues via in-app ads while Japan makes more money via app stores (81 percent). The US and Japan are the largest markets for mobile app revenue, but emerging markets such as Brazil, India and Russia are projected to quickly grow through 2018.<sup>23</sup>

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<sup>22</sup> Vision Mobile

<sup>23</sup> Mobile World Live, <http://www.mobileworldlive.com/apps/news-apps/mobile-app-advertising-revenue-rise/>, dated 8 Apr 2015, downloaded 23/11/2015



Research undertaken by IEEE found Analysis of the results revealed new challenges to market-driven software engineering related to packaging requirements, feature space, quality expectations, app store dependency, price sensitivity, and ecosystem effect. This work hypothesizes that there exist country differences in mobile app user behaviour and conducts one of the largest surveys to date of app users across the world, in order to identify the precise nature of those differences. The survey investigated user adoption of the app store concept, app needs, and rationale for selecting or abandoning an app. We collected data from more than 15 countries.<sup>24</sup>

In terms of skills, the literature suggests that the following are the most predominant existing competencies on global scale:

➤ **Technical Skills**

- 1) Cross-platform Development: In the mobile app industry, it's not enough to be skilled in developing apps for one platform – you have to be versatile and able to create any sort of app for any sort of device<sup>25</sup>
- 2) UX/UI Design Skills
- 3) Modern programming languages: PHP, Java, HTML5 and C#, as well as the likes of Adobe Flash Lite, Python and Objective C , Apple's own Xcode
- 4) Agile Methodologies
- 5) Computing/Computer Science Degree Or Equivalent
- 6) .NET : Although Microsoft's mobile platform represents only a small percentage of the mobile development market it is still an essential skill due to back-end integration solutions and cloud adoption<sup>26</sup>.
- 7) CSS : Cascading style sheets (CSS) are used on most websites today and are responsible for how Web pages appear in the browser

➤ **Non Technical Skills**

- 8) Business Expertise : Business expertise is a must to stand in the competition. An example of such a skill could be that a mobile application developer should know how to build an application for optimizing it's visibility in the list of the available applications of the same category<sup>27</sup>
- 9) Business Development
- 10) Intellectual property: For every application intellectual property is created which will serve as the basis of ownership and the value of your company as it grows<sup>28</sup>.
- 11) Project Management<sup>29</sup>

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<sup>24</sup> Soo Ling Lim, Peter J. Bentley, Natalie Kanakam, Fuyuki Ishikawa, Shinichi Honiden, "Investigating Country Differences in Mobile App User Behaviour and Challenges for Software Engineering", *IEEE Transactions on Software Engineering*, vol.41, no. 1, pp. 40-64, Jan. 2015, doi:10.1109/TSE.2014.2360674

<sup>25</sup> Lauren Riley, 2014, Top 5 Skills Employers Look In a Mobile App Developer, Business 2 Community

<sup>26</sup> Rich Hein ( 2013), 9 Hot Mobile Development Skills, computerword

<sup>27</sup> <https://www.urbanpro.com/a/skills-needed-mobile-application-developer>

<sup>28</sup> <http://www.bluecloudsolutions.com/articles/thieves-beware-intellectual-property-rights-iphone-app/#>



## 5 Formal Training in Partner Countries

As programming skills become ever more important and a core competency for all kinds of 21st Century workers, this is leading individuals to seek out new ways of learning to code. Many new initiatives are appearing where start-ups and non-profit organisations offer innovative and engaging training approaches to coding and many businesses are also searching for innovative approaches to finding the coders they urgently need.<sup>30</sup>

During July and August 2014 European Schoolnet launched a survey with its Ministries of Education. Their aim was to gain a more consistent view of countries which are changing their ICT curricula on developing student's computer programming and coding skill. The participating countries included amongst others Belgium, Italy, Spain and the UK. A significant number of countries had already decided to integrate coding as part of the curriculum activities. Other countries were supporting the development of coding activities to complement school activities without these being a formal part of the curriculum. The partner countries already either integrate coding/computing in their curriculum or plan to do so in the near future (Belgium Flanders and Spain).<sup>31</sup>

The 2014 national curriculum for computing was been developed to equip young people in England with the foundational skills, knowledge and understanding of computing they will need for the rest of their lives. Through the new programme of study for computing, they will learn how computers and computer systems work, design and build programs, develop ideas using technology and create a range of content.<sup>32</sup>

Developers are typically self-starters, and that is reflected in the predominance of self-teaching across all the languages. Around two thirds of developers claim some sort of self-education, though many have followed that up with degrees and post-graduate studies, and it is clear that some languages, Java, Objective C and C# for example, lend themselves to formal education. Strongest amongst the self-taught are the niche languages; Ruby, Lua and Python (average 28% self-taught), alongside Swift (27%) which is new enough that anyone using it will have to have taught themselves to some degree. Visual Development tools also show a high proportion of self-learners, demonstrating the advantages of having a low barrier to entry. Amongst alternative education routes on-the-job training dominates, with programmers expected to improve their skills through experience and collaboration. Classroom training courses are clearly popular with the higher-level languages, including scripting languages and HTML5, while Massively Open Online

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<sup>29</sup> Apperian Ic, 2011, 10 Tips for successfully managing for Apps project

<sup>30</sup> European Schoolnet, Computing our future Computer programming and coding - Priorities, school curricula and initiatives across Europe [http://www.eun.org/c/document\\_library/get\\_file?uuid=521cb928-6ec4-4a86-b522-9d8fd5cf60ce&groupId=43887](http://www.eun.org/c/document_library/get_file?uuid=521cb928-6ec4-4a86-b522-9d8fd5cf60ce&groupId=43887), October 2014, Downloaded 27/11/2015

<sup>31</sup> European Schoolnet, Computing our future Computer programming and coding - Priorities, school curricula and initiatives across Europe, [http://www.eun.org/c/document\\_library/get\\_file?uuid=521cb928-6ec4-4a86-b522-9d8fd5cf60ce&groupId=43887](http://www.eun.org/c/document_library/get_file?uuid=521cb928-6ec4-4a86-b522-9d8fd5cf60ce&groupId=43887), October 2014, Downloaded 27/11/2015

<sup>32</sup> Miles Berry, Computing at School., 2013



Courses are providing education to those studying Python and Objective C, but also Swift, showing that the provision of such courses is an important tool for platform owners hoping to attract developers.<sup>33</sup>

The training provision in the partner countries covers mainly the following areas:

## 5.1 Belgium

A total of two Universities and three Training Providers were investigated

### Technical Skills

The skills that mainly appeared in Belgium courses are the following:

NDK, 2D animations, Java Native Interface, tHTML, CSS, Android NDK Open GL, ES and API , CSS3, SQLite, Android widgets I and II, Phonegap API,

### Design

Introduction and Android Security Architecture appeared in one course with Android Architecture Overview appearing in a further. Camera, audio, video and graphics appeared in a further.

### Testing

Debugging and tools, deploying for testing and publishing appeared in one of the courses, with advanced debugging and analysis provided from the same provider. A few other providers also offered this. Designing the user interface appeared with one trainer, which could be compared to user testing.

### Maintenance

The user experience, feedback and technical report did not feature within the content of any provider researched.

### Business Skills

There was no reference to legal issues within the courses provided, similarly to the UK, in addition business skills and development did not feature, but could have been taught within another subject. Problem solving could have been taught under the testing subjects and debugging.

### Product/planning

Resource planning, communication, project management, risk management or financial management was not taught within the course provision that was researched.

### Marketing and Promotion

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<sup>33</sup> Vision Mobile



It was not evident from the research undertaken that implementation of social media was present in any course. Social functionalities and advance services featured with one supplier. There was no evidence that sales channel distribution, creativity, SEO/App Store Optimisation featured, neither did Product Tracking.

## 5.2 Italy

Two Training Providers and one University were researched. One of the training providers was also to be found in Spain, running the same courses, virtually in the language of that country. They also held courses in other countries.

### Technical Skills

Mentioned under the courses researched, the following technical components are listed as being taught: 2D animations, Java Fundamental for Advrois, HTML, CSS, CSS3, PhoneGap API, Android Webkit API, Android Widgets I and II.

### Design

It was not evident from the courses researched that architecture, human interaction, usability requirements collection, databases, graphic design or animation featured much in the courses taught in Italy, but we did find a provider teaching designing the user interface.

### Testing

Deploying and testing featured with one supplier here, but not any others, and one supplier featured Debugging and analysis within their course.

### Maintenance

The user experience, feedback and technical report did not feature within the content of any provider researched.

### Business Skills

There was no reference to legal issues within the courses provided, similarly to the UK, in addition business skills and development did not feature, but could have been taught within another subject. Problem solving could have been taught under the testing subjects and debugging.

### Product/project planning

There was no evidence of Resource planning, communication, project management, risk management or financial management being taught within the course provision that was researched.

### Marketing and Promotion

It was not evident from the research undertaken that implementation of social media was present in any course, Social Functionalities and Advance Services appeared within the same training provider that was in





Spain. Similarly for sales channel distribution, creativity, SEO/App Store Optimisation featured, and Product Tracking.

### 5.3 Spain

From the selection that was looked at, there were six Universities and seven Learning Establishments / Training Providers.

One of the training providers researched was also to be found in Italy, running the same courses, virtually in the language of that country. They also held courses in other countries.

#### Technical Skills

Listed within the courses are various technical subjects covered, Android widgets, 2d animations, Network, File I/O, Shared Prefe, SQLite,HTML, CSS, CSS3, Xcode Storyboarding.

#### Design

It was not evident from the courses researched that architecture, human interaction, usability design, requirements collection, databases, graphic design or animation featured much in the courses taught in Spain. There was only one provider that taught architecture.

#### Testing

It was not evident from the providers researched that use of analytical datya, user testing, quality assurance or bug fixing featured much, although some courses provided a level of bug fixing and researching and one provider taught troubleshooting as part of their learning package. This, however, could have been covered in the programming and design element of the course in addition to a separate subject.

#### Maintenance

In the area of maintenance, User experience did feature, with user experience design, interface, architecture featuring in the courses provided, but feedback and technical support did not.

#### Business Skills

There was no reference to legal issues within the courses provided, similarly to the UK. Digital business administration did feature with one provider,

#### Product/project planning

It was not evident from the course content researched, that resource planning, communication, project management, risk management or financial management were taught in any of the courses.

#### Marketing and Promotion





It was not evident from the research undertaken that implementation of social media was present in any course, although Social Functionalities and Advance Services did feature with one provider. There were no modules on sales channel distribution, creativity, SEO/App Store Optimisation featured, neither did Product Tracking.

## 5.4 United Kingdom

A selection of universities (14) and training providers (6) was researched.

Almost all the training provided featured mobile applications planning and development, with an element of designing interfaces, so would fall very much under Technical Skills. The training focussed on both Android and IOS functions and appliances. Nine of the training providers taught an element of HTML coding and apps within their courses. Eight of the training provides taught an element of JAVA / JAVASCRIPT subjects within their courses/subjects.

The courses are often more theoretical and gave an overview of the objective of the module to be studied rather than stating the actual tools or software to be used.

Universities have tried to address the interest in the area by offering short courses as well as longer 3/4 year undergrad and 1 year postgraduate courses.

Online and face to face training course vary widely in duration and subject matter.

Some of the courses also have business related skills: entrepreneurship, project management, marketing etc and some included an element of gaming and digital marketing.

### Technical Skills

Listed within the courses are various technical subjects covered, 3d Dynamic Modelling graphics and animation, splash screen, c#, Cloud and Web Design, HTML5, CSS3, WinJS, IOS development, Android Development, Java, Javascript, JQuery, AJAX, PHP, XML, PHP, Node.js.

### Design

Within Design, Usability Design features, as well as databases featured quite heavily. Animation was also a module that appeared in most of the courses. Teaching on Database driven websites, database system is also taught by a few providers along with usability, accessibility and sociability techniques.

### Testing

Mobile device testing featured within the courses provided from the ones researched. Some of the courses provided expected the trainee to already have a level of IOS programming or Android, and already be programming in languages such as Java, C++ or C#, so the basics were not included.



### Maintenance

With regards to Maintenance, specifically the user experience, feedback and technical support, some of the courses focused on these elements but there was not much evidence of technical support within the courses, nor feedback, however the user experience featured heavily.

### Business Skills

It was not evident from any of the course content listed, that Intellectual Property rights was taught in any of the courses. This could be under another subject though. One of the course providers listed Client-side development, but presentation skills, communication, or legal issues/requirements did not featured at all.

### Product/project planning

It was not evident from the course content researched, that resource planning, communication, project management, risk management or financial management were taught in any of the courses.

### Marketing and Promotion

One of the courses listed social interaction design. Sales channel distribution, creativity, SEO/APP Store Optimisation or product tracking was not evident from the courses researched.

## **5.5 Others**

In this section other countries were researched training supply at the USA and Australia

### Technical Skills

IDEs, FDT, IntelliJ IDEA, SDKs and Apache featured in the courses in America with Java and Java1 and XML also featuring in Australia.

### Design

Mobile Data Architecture appeared in a course in Australia, Web and Mobile Database Development appeared in America.

### Testing

Interface usability featured within a course in America, but quality assurance, use of analytical data and bug fixing and optimisation did not appear.

### Maintenance

The user experience, feedback and technical report did not feature within the content of any provider researched.

### Business Skills

Creative Presentation featured within a course in America.



### Product/project planning

There was no evidence of Resource planning, communication, project management, risk management or financial management being taught within the course provision that was researched.

### Marketing and Promotion

Marketing management and digital marketing featured in a course in Australia.

## **6 Non Formal Training**

There are a number of peer-to-peer platforms that allow for a targeted and immediate response that a course could not provide:

### **Dream.In.Code**

Dream.In.Code is a community of over half a million programmers, web developers who share a passion for learning and helping others learn. There are several comprehensive and very active Q&A areas including Programming Help, Web Development, and Computer Support areas.

In addition, there is a vibrant general discussion area which includes the Corner Cubicle (for professionals), Student Campus (for students), Caffeine Lounge (chit-chat), and other off-topic forums.

Dream.In.Code is primarily a place to ask questions and receive immediate and accurate answers

### **CNET**

<http://www.cnet.com/forums/mobile-apps/>

CNET is a forum, on these forums mobile apps developers can again ask questions and receive answers. The site also features a list of frequently asked questions to help users utilise these forums to their fullest potential.

### **AndroidForums.com**

This busy community is practically buzzing with posts. AndroidForums.com as a whole is intended for Android developers to ask one another questions when they're stumped. They have a whole sub-forum devoted to developers and creative discussions, one dedicated to app announcements, and even one for Alpha & Beta testing. One of the most appealing resources on the page linked above is entitled: Developer 101. This is a good place for beginning developers looking to collect tips & tutorials on how to get started and what sorts of tricks of the trade will work for them.

### **Making Money with Android**

Making Money with Android is a forum that is dedicated to exactly what it implies: making money. This is a great place to find bug-fixing & testing suggestions, answers to questions and of course, ideas for new apps and how to implement them. The forum places more of an emphasis of the monetization side of owning an app as opposed the technical issues one may encounter.



### **Anddev.org**

This developer's forum is home to android developers around the entire globe. The [Anddev.org](https://www.anddev.org) forums are full to bursting with up to date threads that tackle a veritable army of technical issues, problems, and code-ridden tutorials. Here programmers will not only find answers to questions involving coding and mapping, but also novice and advanced tutorials. The FAQ is extensive and the proverbial "think tank" is brimming with fresh ideas.

### **AndroidPIT**

This community is open to the public with a heavy focus on Smartphone-specific technology. Yet, true to form, the Android artists have taken over a corner of the [Android PIT](https://www.androidpit.com) forum for their own purposes, and it is here that like-minded developers will find a safe-haven to share promotional strategies. The community is not as active as others, but maintains a respectable level of activity while providing useful information, tips, tricks and suggestions of the trade.

### **Devshed**

[Devshed](https://www.devshed.com) has graciously provided an entire subforum to the denizens of the Android development community. Some of the more exciting topics for discussion include App Development Training Courses as well as insights into gaming development platforms. Overall the topics on this forum are more scattered with broad topics, but it's nice if you're new to the community and looking for something you don't want to be overwhelmed by.

## **7 Survey Results**

A copy of the survey can be found at Annex 1. The questionnaire was divided into four areas:

Section 1 - Looked for some basic company information, the number of staff in the following area:

- Business Development
- Marketing
- Business Management
- IT Staff
- Country business is based in
- Target market for the mobile apps developed
- Specific sectors/categories product aimed at

Section 2 reviews the level of technical skills individuals within the organisation:

- SWIFT
- JAVA
- SQL
- CSS
- Objective Oriented
- HTML 5



- PHP
- Reviews within the field of design - the extent of the skill individuals are expected to possess:
  - Architecture
  - Human Interaction
  - Usability Design
  - Requirements Collection
  - Databases
  - Graphic Design
  - Animation
- Reviews with the field of testing - the extent of the skill individuals are expected to possess:
  - Use of Analytical Data
  - User Testing
  - Quality Assurance
  - Bug Fixing & Optimisation
  - Reviews with the field of maintenance - the extent of the skill individuals are expected to possess:
    - User Experience
    - Feedback
    - Technical Support

Section 3 explored Business Skills levels present in the company - covering:

- Business Skills
- Business Development
- Legal Issues/Requirements
- Intellectual Property Rights
- Presentation Skills
- Communication
- Client Management
- Scoping & Estimation
- Problem Solving
- Reviews with the field of product/project planning - the extent of the skill individuals are expected to possess:
  - Resource Planning
  - Communication
  - Project Management
  - Risk Management
  - Financial Management
- Reviews with the field of marketing and promotion - the extent of the skill individuals are expected to possess:
  - Implementation of Social Media
  - Sales Channel Distribution

- Creativity
- SEO / App Store Optimisation
- Product Tracking

Section 4 - requests respondents to identify up to 3 future areas or skills that, in their opinion, will be essential in the future of mobile apps development

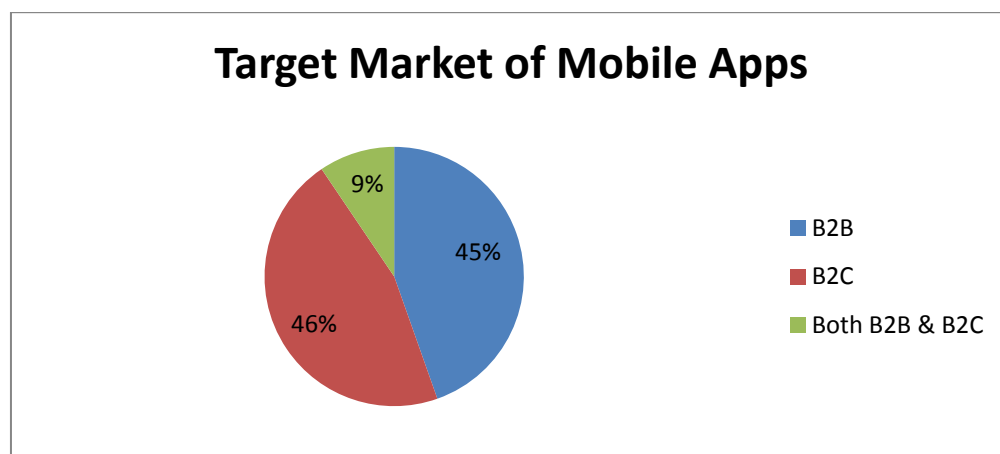
## Summary of the results

### Company information

The vast majority of the companies who participated in the survey were micro and small size enterprises; therefore, the employees normally work in more than one area. 0-5 people tend to be employed across the different departments (business development, marketing, business management and IT) while the IT department employees the largest part of the workforce. This can be explained from the fact that the questionnaire targeted IT companies, thus the IT department is the most predominant.

### Target Market

The target market of the survey participants was mainly Business to Customer as illustrated in the diagram below



*Figure 1-Target Market of Mobile Apps*

### Sectors that the Applications are aimed for

As shown on the diagram below most of the products are aimed for the educational, the communication and the business sectors. However, most of the developers stated that they work across sectors depending on the demand. Some of the 'other' sectors included transport (navigation related Apps), tourism and graphic design

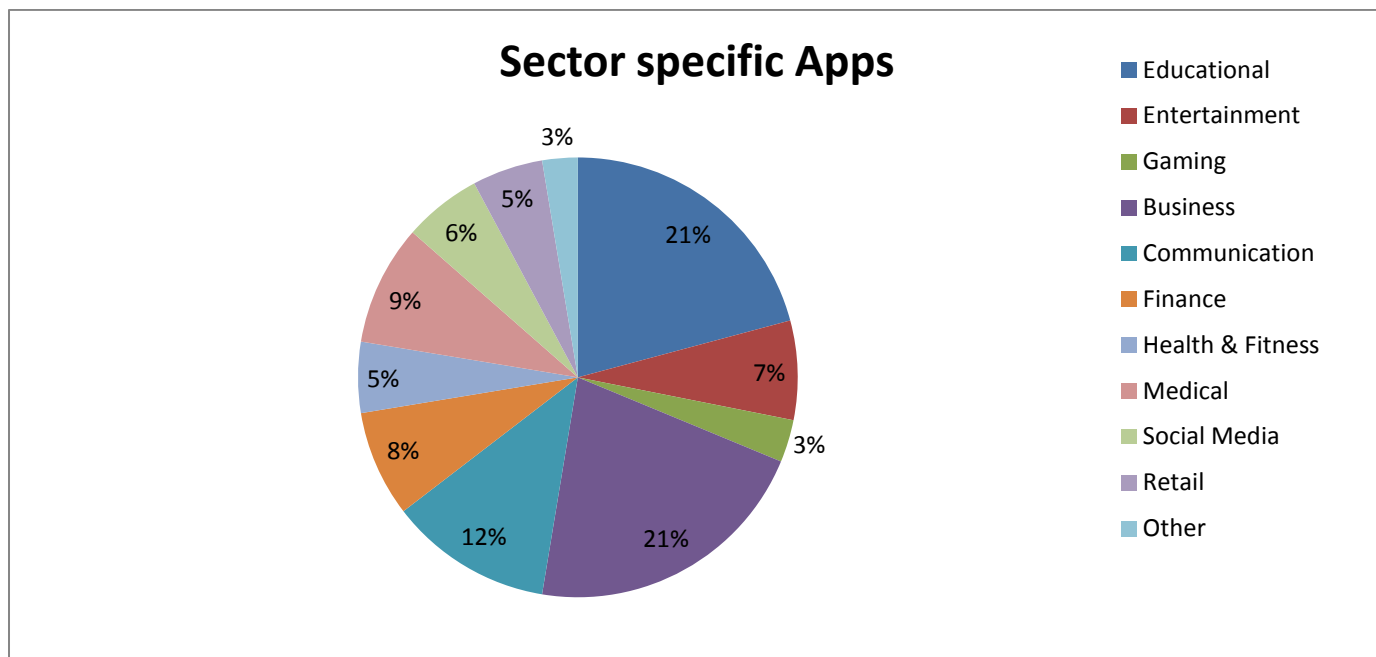
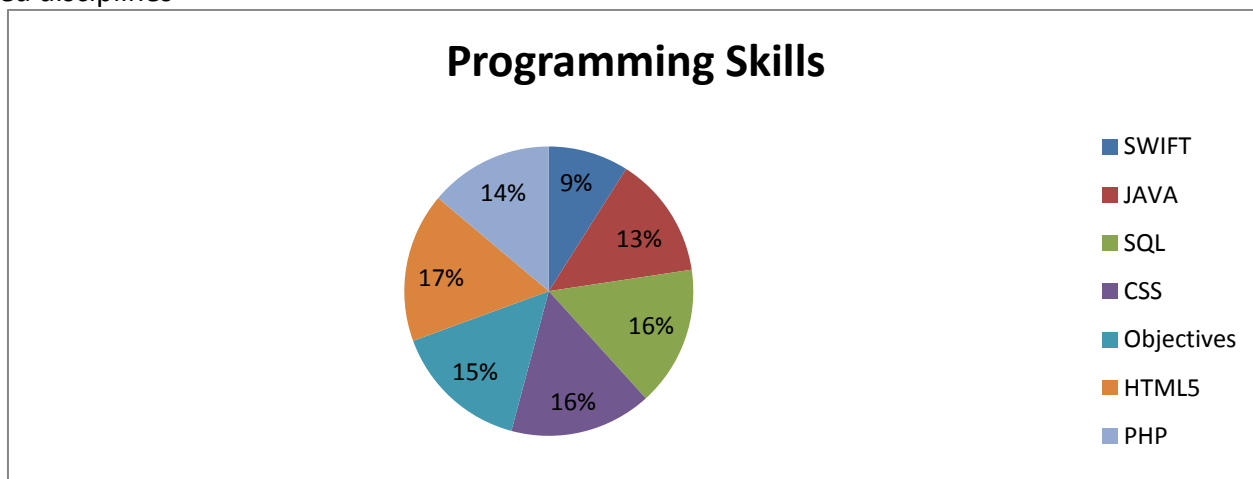


Figure 2: Sector specific Apps

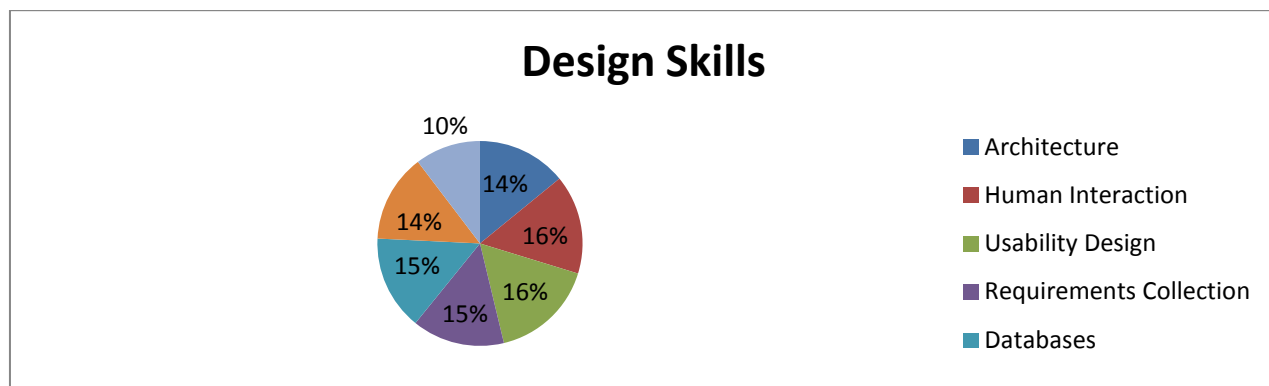
## Technical Skills

In terms of programming languages, as shown at the diagram below, HTML5 has been characterised as the most important. However, it is evident from the responses that developers have a good knowledge of all the programming languages as there is none that really stands out. Evidently, this underlines the importance of possessing non technical skills too in order to enhance marketability and create a competitive advantage

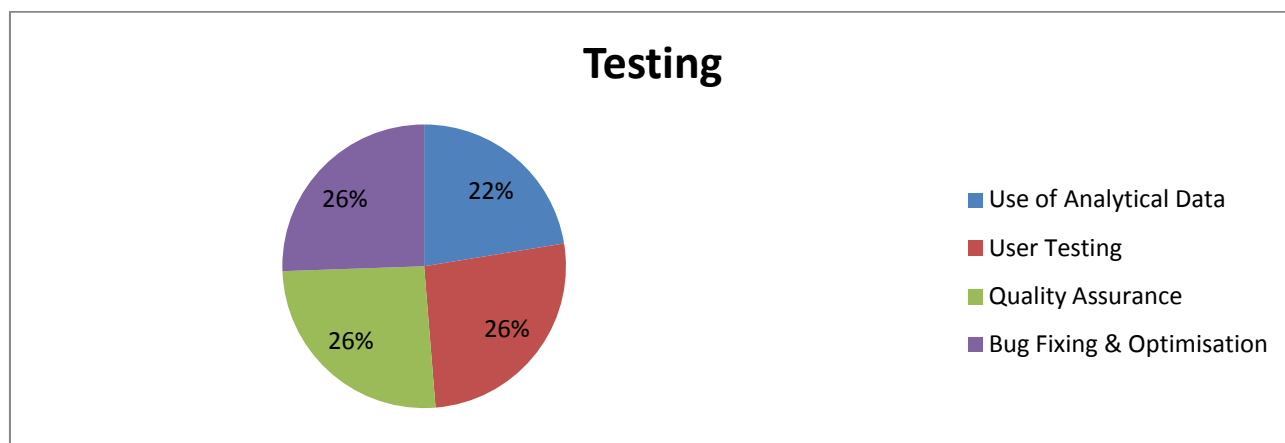
Similarly in Design, Testing and Maintenance, Apps developers already possess skills in all the design related disciplines



*Figure 3-Programming Skills*

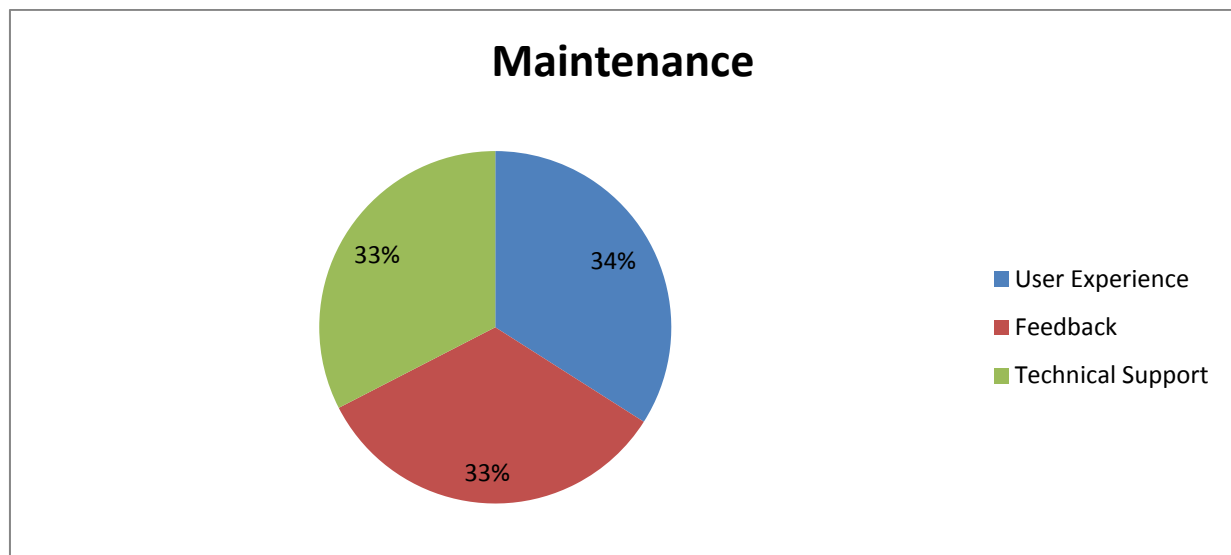


*Figure 4- Design Skills*



*Figure 5-Testing Skills*





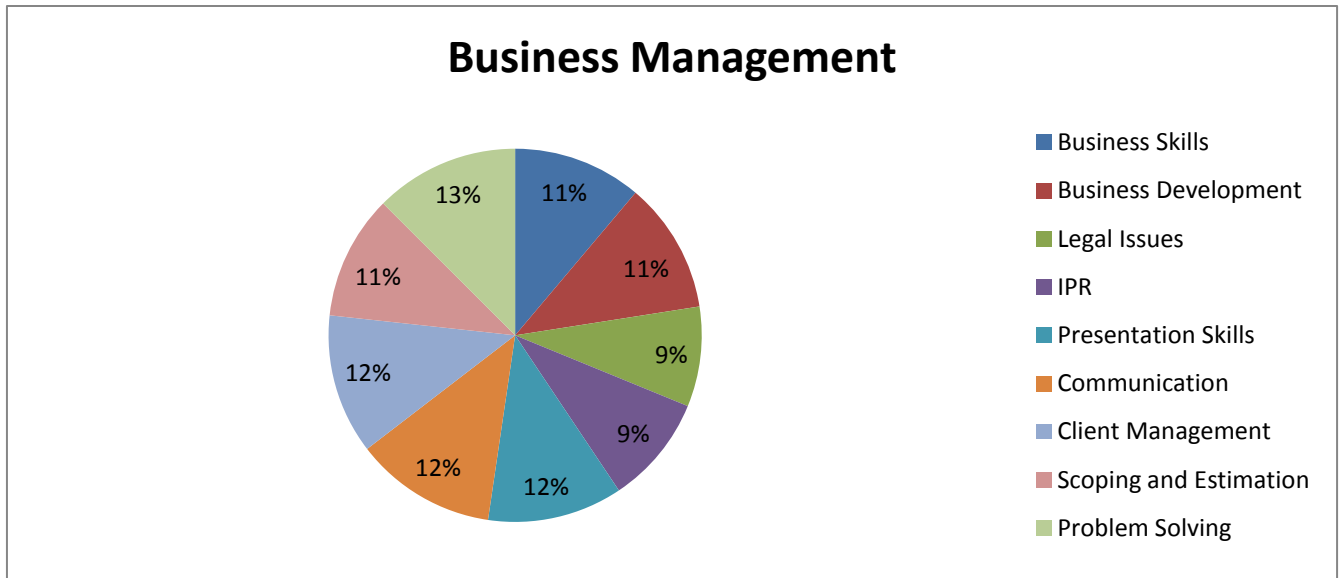
*Figure 6-Maintenance Skills*

## Business Skills

With regards to **Business Management**, the skill is mainly dominant relates to problem solving. Knowledge on IPR is underrepresented. This demonstrates that many software developers are unaware that patent protection may be available to them, particularly smaller companies, putting them at a disadvantage. European IPR authorities have concluded that, while software and business methods *per se* are excluded from patentability, they are not necessarily excluded if they introduce a technological innovation.

Effectively, software and its underlying code, which satisfy the requirements of being novel and inventive have the potential to be patented in the US and a few other non-EU states. Patenting requires a long and expensive registration process, as well as extensive checks, to check whether it is the subject of an existing patent or an application for a patent, and that it has not been described in publicly available literature prior to the application date for the patent. In the UK and other EU states, software “as such” cannot be patented. However, if that software is incorporated in some invention, then it can be patent-protected

Therefore, due to the above mentioned complications especially with regards to patents, most of the software developers do not posses knowledge and skills in this area.

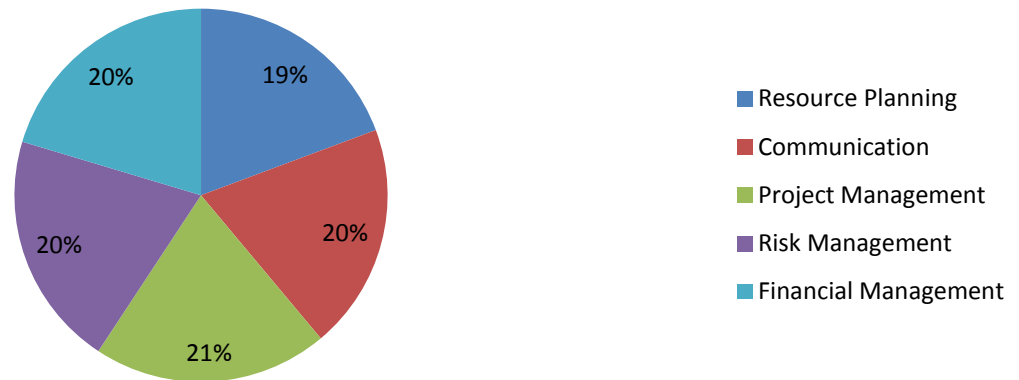


*Figure 7-Business Management Skills*

Project Management seems to appear as the most principal skill for App Developers. Resource planning has scored relatively low. This is not surprising, though as in fact, over 80% of projects are unsuccessful either because they are over budget, late, missing function, or a combination. Moreover, 30% of software projects are so poorly executed that they are cancelled before completion. Software projects using modern technologies such as Java, J2EE, XML, and Web Services are no exception to this rule<sup>34</sup>

<sup>34</sup> Mike Perks, 2006, Best Practices for software development projects, IBM

## Product /Project Planning



*Figure 8-Product/Project Planning*

In terms of Marketing and Promotion, Creativity is the most common skill. Software development activities are perceived as creative and autonomous<sup>35</sup>. Software developers prefer to work on those development activities which are perceived as creative<sup>36</sup>. Creativity is crucial in software development as it is the source to solve complex problems and innovate<sup>37</sup>. Therefore it is also linked with Business management and project management skills.

<sup>35</sup> Knobelsdorf, M., Romeike, R.: Creativity as a pathway to computer science. ACM SIGCSE Bulletin. 40, 3, 286 (2008)

<sup>36</sup> Gu, M., Tong, X.: Towards Hypotheses on Creativity in Software Development. 5th International Conference on Product Focused Software Process Improvement (PROFES). pp. 47–61 Springer Verlag (2004)

<sup>37</sup> Crawford, B. et al.: Agile software teams must be creatives. 5th International Workshop on Co-operative and Human Aspects of Software Engineering. pp. 20–26 IEEE (2012)

## Marketing & Promotion

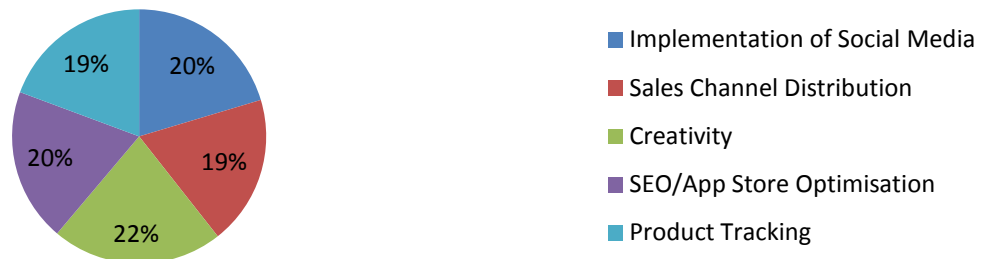


Figure 9-Marketing and Promotion Skills

## Further Learning

The most predominant answer on how the employees undertake further learning is through the application of continuous learning through the role. Structured on the job learning and further academic qualifications seem not to be what most employers prefer to adopt in their companies

## Further learning



Figure 10-Further Learning

## Essential Future Skills

In the last question, the participants were asked to identify up to 3 key skill areas which will be essential in the future of mobile Apps development. It is evident from the responses that the non technical skills are gaining ground over the technical skills. This can be explained from the fact that Mobile App developers are expected to acquire all the necessary technical skills while there is significant training supply both through official education or unofficial modes such as forums, job shadowing/in house training etc. Project Management and Market/Product related skills are on the top of the priority list of the most desired competences. The table below summarizes the most important skills as defined by the responders

Technical	Non Technical
Modern languages	Problem Solving
Graphics	Marketing
Cross platform programming	Creativity
Testing	Project Management
	Product development
	Market Analysis

## 8 Conclusions

This deliverable documented and analysed the business and design skills supply in mobile app creation sector. The provision of training in a total of six countries was mapped (Belgium, Italy, Spain, UK, USA and Australia). To draw reliable conclusions on training offer but also to study the demand side, a survey was conducted. The survey's objective was to capture the views of the industry on current and future desired skills for the App developers. The questionnaire consisted of six parts and was completed by 75 participants.

The results of the desk research demonstrated the remarkable potential of the industry: With over 10 billion mobile Internet devices expected to be in use by 2016, the mobile application industry will grow tremendously to match demand and keep up with ever-evolving technologies<sup>38</sup>. The official training offered in the countries examined covers all the necessary technical skills and modern languages that developers possess to develop mobile apps. Some countries (for example the UK and USA) have also identified the need to provide non-technical skills to enable trainees to develop demanding applications to distinct them from competition. The supply of training in Mobile App development mainly through HEIs has risen significantly the last years. Considering the socio-demographic trends: 1. tendency for official

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<sup>38</sup> <http://businessdegrees.uab.edu/resources/infographic/the-future-of-mobile-application/>



training and 2. In the case of Belgium- drop in the working age population, there is definitely space for further training in this area as the market (students) is expected to grow further.

The survey results clearly demonstrated that mobile app developers, in their majority, do possess almost all the necessary technical skills. In terms of non-technical skills, IPR, resource planning, social media and sales are amongst the less represented.

Lastly, the participants ranked the business related skills as very essential in the future of the mobile app development.

It is evident therefore that there is currently an enormous supply of technical related content and modules. On the other hand, the industry indicated that developers are expected to also have a good knowledge of business related matters. That creates a demand which currently is under-represented in terms of training provision.

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AndroidPIT

Devshed



## Annex 1 – Survey





## Annex 2-Desk based review matrix



### **Annex 3- List of training content**