

Global Market System for Software Development



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Abbreviations

CEE	Central and Eastern Europe
CMMI	Capability Maturity Model Integration
IAPCO	International Association of Outsourcing Professionals
IDC	International Data Corporation
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITO	IT outsourcing
PCT	Patent Cooperation Treaty
PYPL	Popularity of Programming Language
SaaS	Software as a Service
SQuaRE	Software Product Quality Requirements and Evaluation
UNCITRAL	United Nations Commission on International Trade Law
WIPO	World Intellectual Property Organization
XP	Extreme Programming

Introduction

The main aim of this study is to provide a brief overview of the most important actors, functions and rules that are needed to be considered in the global market system for software development. **Figure 1** depicts this system and provides the basic structure of this study. This study is geared towards companies that want to understand and enter the global market; it has a special emphasis on the European demand for software development and the chances for access by companies from the Western Balkan countries.

The first part of this study focuses on the global demand for software development. It starts with explaining the definition and main aspects of software. Although everybody uses it in the daily life, the real concept of software is quite unknown to the general public. The study then provides an overview on currently popular programming languages at global level and gives insight into a major global trend in software delivery. It also analyses the geographical location of software demand and supply in the European market, which may guide companies that want to find profitable markets.

In the second part, the study reviews several supporting functions that are important for accessing the global demand. This industry flies faster than light, so it is important to be prepared to change models and business plans as well as to delegate management tasks. The focus lies on software lifecycle models, market information and intermediation services, as well as project management aspects.

In the third part, rules and standards are analyzed that influence the access of software development companies to the global demand. These concern the quality of the software product before it is finished, its protection for commercial purposes and the new ways of dynamic contracting in the information society. The study concludes with a few recommendations.

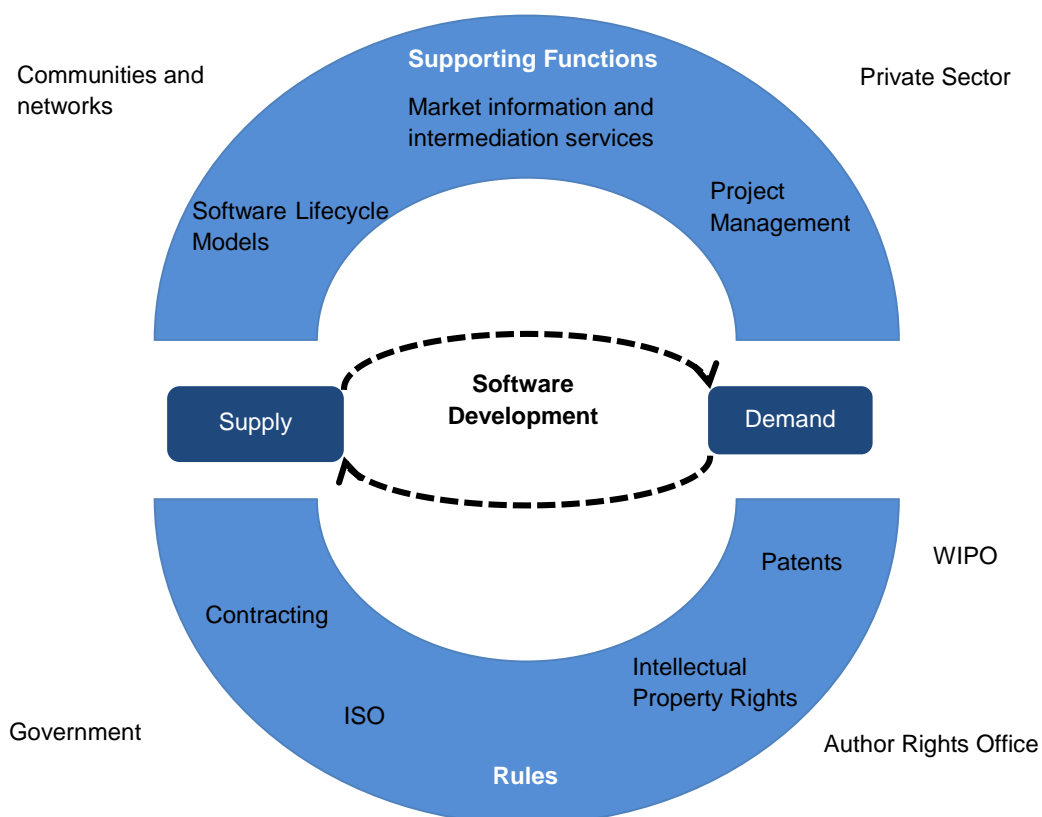


Figure 1: Global market system for software development

Part I: Global Demand

In this first part of the study, the reader can get to know the elements that compose software and find a short definition of each of these elements. It also provides a general idea of the most popular languages, which may not assess the value of any particular language, but can help to have an idea about the trends in coding. The study then proceeds to examine how business software delivery and hence demand is influenced by the internet. Finally, the geographical location of software demand and supply in the European market is analyzed.

1. What is Software?

The concept of software is not entirely understood in the general public. A common myth¹ is that software is only the program which interacts with the user. In general, people define software as the programs that they can use with their desktops, tablets or smartphones in comparison with hardware defined as the physical elements of any electronic device.

The reality is that software is composed of several elements:

- **Documentation:** The document of requirements is the first guide, normally written with the natural language, to know how the program will work. The second step is to make a design, which includes the functionalities and the user interface (if any) on a technical level written in a design document. With this document, programmers can write the source code with the comments explaining each function or procedure (needed for future changes and maintenance). The user instructions are also part of the documentation.
- **The program** can be an executable file that can be used in a particular device (for Windows, Apple, Android). On the other hand, the source code can be directly executed from a virtual machine (like JavaScript). Programs are what users normally know and interact with, but not always a user interface is provided.
- Another important aspect, which is not part of the software itself but part of the creating process, is the **testing**. The tests that review the functional level to guaranty the minimum errors possible are the verification tests and those that agree if the software complies with the initial requirements are the validation tests.

It is important for the buyer to know all these elements and consider the costs of the production of all of them. A source code without the documentation for instance is really hard to follow or review and could add future economic losses while upgrading the program.

2. Popular Programming Languages

As was explained before, one of the parts of the software is the coding for obtaining the program itself. For creating that code, a programming language is used. "A programming language is a formal constructed language designed to communicate instructions to a machine, particularly a computer. Programming languages can be used to create programs to control the behavior of a machine or to express algorithms."²

It is better to compare a programming language with a paintbrush than with a natural language. When a painter or a group of artists are trying to create a work of art, they will select different paintbrushes

¹ Pressman (1997) describes a number of common beliefs or myths that software managers, customers, and developers believe falsely.

² Wikipedia. http://en.wikipedia.org/wiki/Programming_language

depending on the surface, materials and techniques needed. Programmers work in similar situations; their needs in software development are diverse and the contexts are changing quickly. It is therefore important for programmers to have a range of programming language at their disposal.

For this reason, this study does not aim at providing a closed list of the most important languages. Nevertheless, for programmers who are interested to get a snapshot of programming languages that are currently popular on a global level, there are a few websites that can be useful. They present popularity indices based on different data available on the Internet. Four data sources were selected as particularly relevant:

- Search engine data analysis
- Activity in social networks for programmers
- Global jobs demand
- Surveys with programmers through social networks

In the following, the scope of each source is explained, together with some current results and the related links in order to find more and updated information.

a) Search engine data analysis

The PYPL PopularitY of Programming Language Index analyses data from Google. As explained on the related website³, the index is created by analysing how often programming language tutorials are searched on Google: the more a specific language tutorial is searched, the more popular the language is assumed to be. The raw data comes from Google Trends⁴. Hence, anyone can verify it, or make the analysis at a future moment, for his/her own country or in other languages. **Table 1** shows the ten most popular programming languages according to the PYPL Index by November 2014 and the trends in the ranking compared to November 2013.

Position Nov 2014	Position Nov 2013	Programming language	Share in Nov 2014	Twelve month trends
1	1	Java	26.2 %	-0.7 %
2	2	PHP	12.3 %	-1.7 %
3	3	Python	12.0 %	+1.1 %
4	4	C#	9.6 %	-0.3 %
5	5	C++	9.1 %	-0.4 %
6	6	C	8.1 %	+0.1 %
7	7	Javascript	7.2 %	-0.4 %
8	8	Objective-C	6.7 %	+0.0 %
9		Swift	2.7 %	+3.6 %
10	10	Ruby	2.5 %	+0.0 %

Table 1 The 10 most popular programming languages according to PYPL

b) Social networks for programmers

Redmonk⁵ ranking is based in the activity detected in the two biggest communities for programmers: GitHub⁶ (activity in terms of number of projects) and StackOverflow⁷ (activity in terms of number of

³ <https://sites.google.com/site/pydatalog/pypl/PyPL-PopularitY-of-Programming-Language>

⁴ <http://www.google.com/trends/explore#cmpt=q>

⁵ <http://redmonk.com/sogrady/2014/01/22/language-rankings-1-14>

⁶ <https://github.com>

⁷ <http://stackoverflow.com>

tags). As a critique to this source, it can be mentioned that other important communities are not included.

According to Redmonk, the ten most popular programming languages in the first quarter 2014 are almost identical as in **Table 1** above (although not in the same order).

c) Global jobs demand

The job site Indeed⁸ provides a search option to detect job trends based on the percentage of job postings that contain a given search term over time. While it does not provide a comparison across different popular programming languages, professionals may use this search option to inform themselves about the job trends concerning a particular language of their interest.

d) Surveys with programmers through social networks

One particular survey that is worth to mention is a Twitter survey from 2013⁹. Programmers were asked what languages they used during 2013. The data presented in **Figure 2** are the total mentions. The volume of data is not comparable with the search engines data analysis but the answers to the question can be proved clicking on each hashtag, seeing the users and tweets.

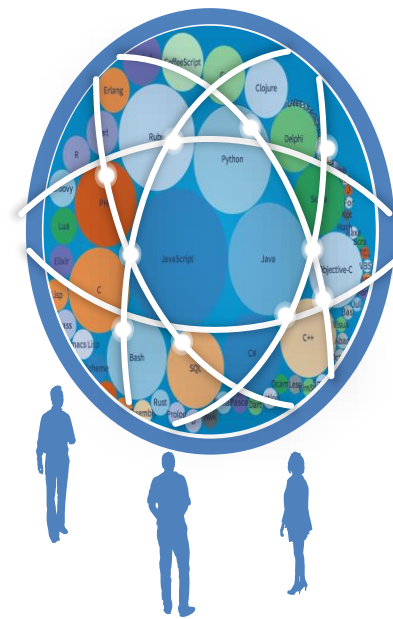


Figure 2: Twitter Survey 2013, figure adapted from code2013.herokuapp.com

In conclusion, it can be noted that the findings from the different sources are reasonably similar. Currently the most popular programming languages on global level include Java, JavaScript, Python, PHP, C++, C, C# and Ruby. Expertise in these languages can provide a certain advantage in accessing global demand. However, it is equally important to note that – firstly – this situation can change very quickly; secondly, expertise in a less popular language can be very profitable at the same time; and thirdly, mastering a range of programming languages that can be adapted to the client's needs promises a more sustainable access to the global demand.

3. Global software delivery trend

The traditional software industry was delivering complex and closed products to the market. However, the new consumers prefer to be able to adapt their needs with simple user-friendly applications that can add new functionalities as demanded. To solve that gap, software companies are changing the

⁸ <http://www.indeed.com/jobtrends>

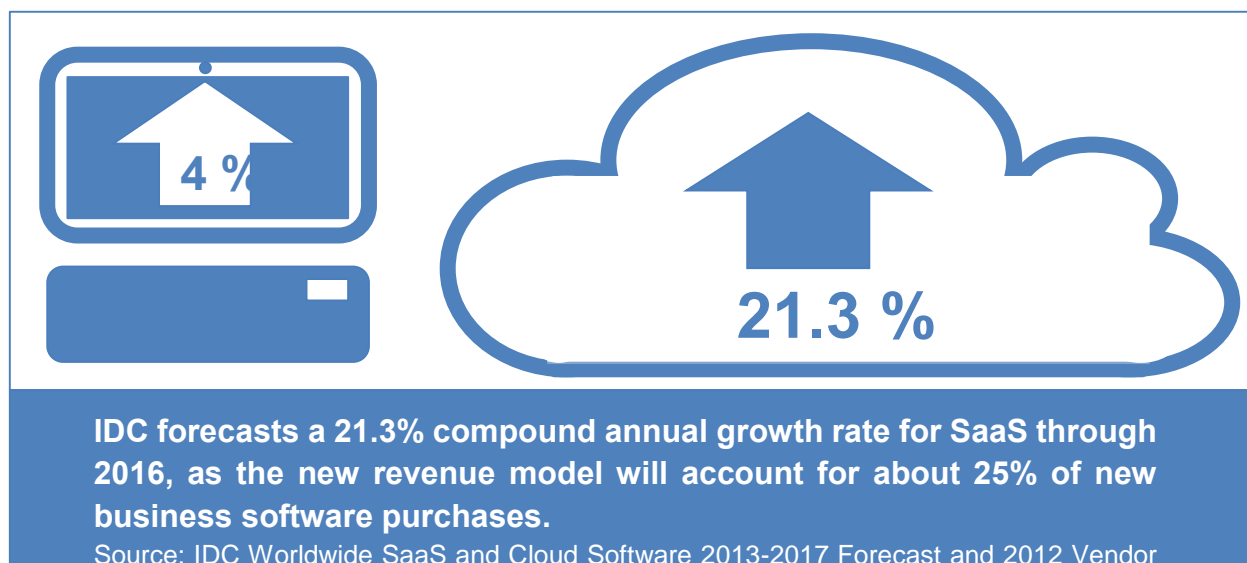
⁹ <http://code2013.herokuapp.com/>

way of delivering products to the market with a new vision called Software as a Service (SaaS) that enables small companies to reach bigger clients and to big companies to reach smaller customers.

The term SaaS is used to describe any application which is managed and hosted by a third party, and whose interface is accessed from the client side. Thanks to new technologies such as AJAX and HTML5, the vast majority of SaaS applications run directly from the web browser without requiring any additional downloads or installations from the client side. Common examples include Gmail, Salesforce and Youtube.

The vendors can get an advantage using the software as a marketing tool providing free functionalities and receiving feedbacks from the community that will help them to improve their product. Another advantage for vendors is the possibility to provide scalable payable plans for professional solutions. For these reasons, the SaaS business model is the perfect way to access to small and big clients because the software is adapted to the client and not the other way around, as it used to be with the old models.

Although still traditional software vendors' major revenues come from licenses paid primarily by the enterprise clients, the buying habits are changing. IDC forecasts a 21.3% compound annual growth rate for SaaS through 2016, as the new revenue model will account for about 25% of new business software purchases. SaaS delivery will constitute about 14.2% of all software spending and 18% of all applications spending.¹⁰



Revenue growth in the software industry also reflects this trend towards SaaS. Overall, the PwC Global 100 Software Leaders recorded only a 5% increase in revenues, reaching US\$255 billion in 2012 (IDC expects just a 4% increase for 2016). In contrast to the overall growth, SaaS revenues among the Global 100 Software Leaders increased by 60% to US\$20 billion during the year.¹¹

Customers share a common infrastructure managed by the software vendor and they pay for the functionality of the software; the delivery and access to it is through the global network using IT cloud services like bulk storage solutions, network services, and cloud servers. This cloud services means

¹⁰ PwC Global 100 Software Leaders, March 2014, www.pwc.com/globalsoftware100

¹¹ Ibid.

a big investment for many small and medium Software business so finding a good partner is the most important task in order to follow this trend.

In conclusion, the global delivery trend is moving fast forward to this business model that started mainly for the mobile application demand but is growing really fast in the enterprise sector. Traditional software companies will have to change most of their internal processes to adjust to the fact that software today needs to be portable and adapted to the needs of each user or sector; the best way to do that is learning how to sell the software as a service.

4. Geographic location of IT outsourcing demand and supply

This chapter is focusing on the European software development market – both in terms of demand and supply – since it is considered most relevant for the Western Balkan countries. Here, the terminology “IT outsourcing” (ITO) is applied since the main data sources of this chapter use this categorization of the industry. A big part of ITO demand is in any case software development.

a) European ITO Demand: level of openness, market size and skills shortage

According to CBI research¹², within the European ITO market, the countries that are most open towards international outsourcing are the UK, the Netherlands, Sweden, Denmark, Finland and Norway **Figure 3**. In terms of market size, on the other hand, the UK, Germany and France have the largest ITO markets in the EU+EFTA region.

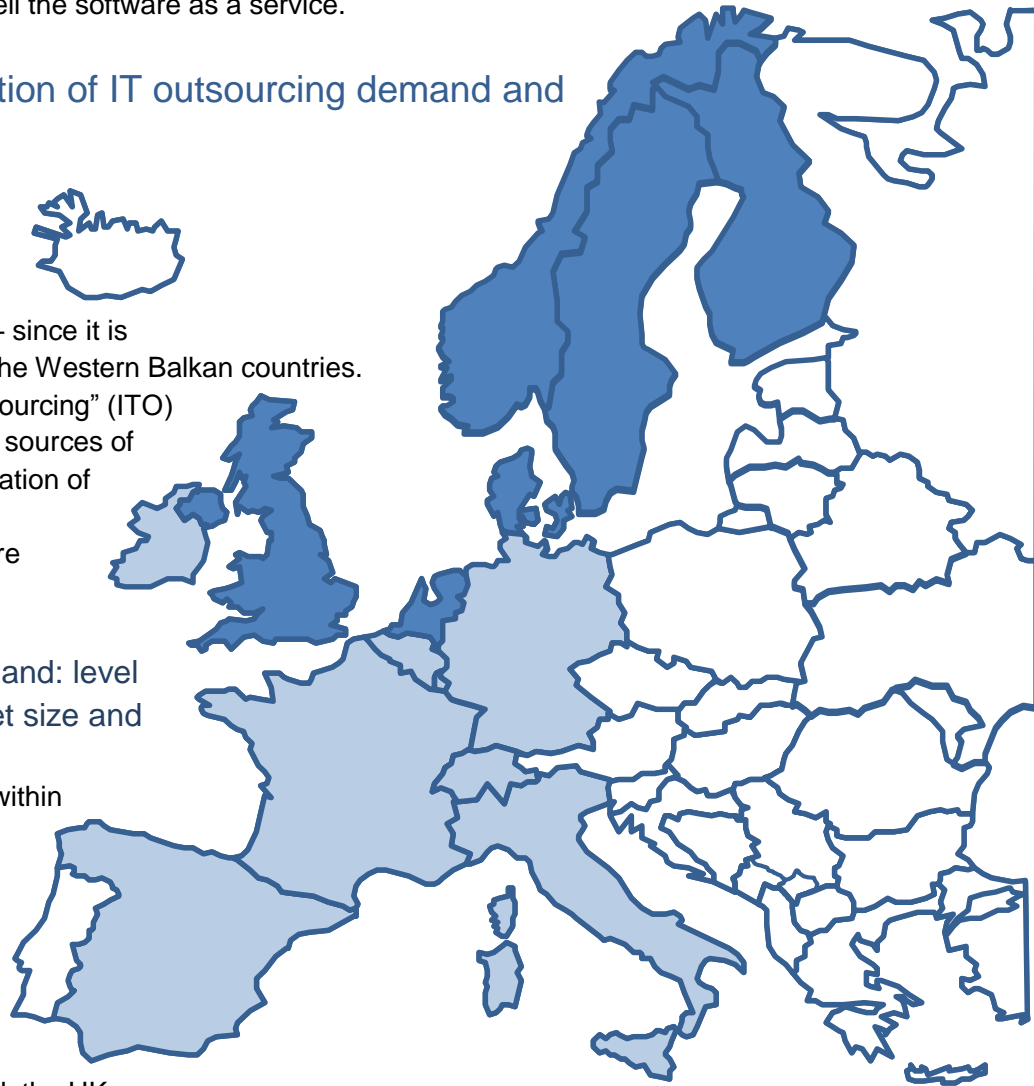


Figure 3: Level of openness towards international outsourcing of EU+EFTA countries, 2013. Dark blue > light blue

In order to determine the chances to access a certain ITO market, it is useful to distinguish the location of service production between onshore (within the same country), nearshore (in a nearby country) and offshore (two or more time zones away).

As illustrated in **Figure 4**, depicting data from 2012, in general, onshore is the most preferred option followed by nearshore, except for UK where nearshore is actually favored over onshore. Offshore

¹² CBI Tradewatch for Information Technology Outsourcing (ITO), CBI Market Information Database, www.cbi.eu, June 2013, <http://www.cbi.eu/sites/default/files/study/trade-statistics-it-outsourcing-europe-outsourcing-ito-2013.pdf>

destinations are still quite popular in Scandinavian countries like Denmark and Sweden. Although Germany is comparatively open to off-shoring, many companies prefer near-shoring due to language and cultural similarities. French companies generally prefer near-shoring to North African countries, also because of language and cultural similarities.

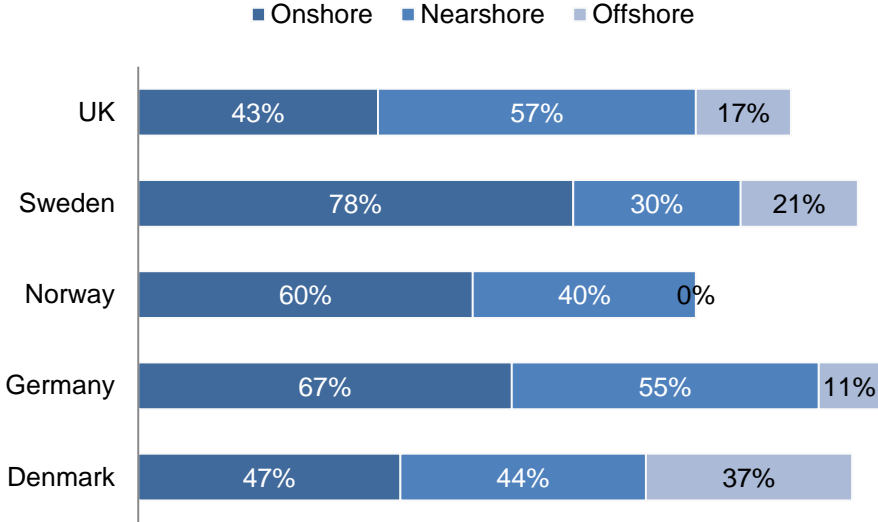


Figure 4 European companies’ replies to the question: “Where would you outsource your software development/IT in the future?”¹³

The labor shortage in IT industry still remains to be a hot issue in Western Europe. The shortage of supply is still increasing and cannot be met by local specialists. **Table 2** shows the estimated deficit in terms of IT workforce in EU countries¹⁴. It is expected that by 2015 the top six EU markets alone will need 250 000 extra employees with IT skills.

Country	ITC Workforce demand in 2015	ITC Workforce supply in 2015	Deficit
United Kingdom	1150000	1095000	55000
Germany	930000	855000	75000
France	485000	460000	25000
Spain	500000	460000	40000
Italy	470000	415000	55000

Table 2 Estimated deficit in terms of IT workforce in EU countries by 2015

b) ITO Supply in Central and Eastern Europe

Traditional ITO supply locations, such as China and India, are losing attractiveness due to the life standard increase and the fluctuation of their currencies, which have a direct impact in the costs-benefits. For these reason, and considering the nearshore preferences of the EU+EFTA countries, companies will be in search of the IT talent pool available in the Central and Eastern Europe (CEE).

¹³ IT Outsourcing Europe Research
¹⁴ Source: Ciklum blog and Computer Weekly, estimates based on EIDG study, <http://www.computerweekly.com/blogs/outsourcing/2013/02/close-enough-but-far-enoughthe.html>

As explained by CBI¹⁵, “for EU+EFTA buyers communication with Eastern European companies is perceived as easier than with offshore companies due to little time difference and more cultural and language similarities. This is very important, as many offshore projects fail due to simple communication problems. Legal and financial issues are also much simpler as many of those countries are EU members”.

Other aspects to consider are the air connections, the education, the environment, the growing economy, the life expenses and quality infrastructures. The biggest ITO suppliers in the CEE are Ukraine, Romania, Poland and Czech Republic, **Figure 5. Table 3** summarizes some key characteristics of these ITO supply markets in terms of market volume, number of companies and specialists, as well as hourly rate. Western Balkan countries will have to compare to these countries as main competitors. As a comparison therefore, **Table 3** also includes data for Albania and Serbia, the only two Western Balkan countries for which data are available from the same source (ITO Outsourcing News).



Figure 5: Biggest ITO suppliers in Europe

Characteristics	Ukraine	Romania	Poland	Czech Republic	Serbia	Albania/Kosovo
IT outsourcing market volume (USD Million)	1100	589	451	371	200	5.27
Number of IT outsourcing companies	1050	670	480	390	240	15
Number of specialists involved in IT outsourcing services industry	25000	14200	9200	7800	5200	150
Hourly rate Project Manager (USD/hour)	34	38.2	40.5	36.7	34.8	22
Hourly rate Senior Developer (USD/hour)	29	31.7	37.2	36.7	28.1	20
Hourly rate Middle Developer (USD/hour)	25	25.3	30.5	29	22	18
Hourly rate Junior Developer (USD/hour)	20	19.7	22.8	23.3	18.3	14

Table 3: Characteristics of selected CEE ITO supply markets, 2011¹⁶

¹⁵ CBI (2013)

¹⁶ Source: ITO Outsourcing News, <http://itonews.eu/> -> Market reports for the mentioned countries

Part II: Supporting Functions

In this part, selected supporting functions, that are important for software supply and demand, are analyzed. The reader will get to know basics on software lifecycle models and learn about information and intermediation services that facilitate market access. Lastly, the importance of project management and its related processes for keeping high performance and productivity of software supply is explained.

1. Software Lifecycle

The development of a good quality Software product was initially subject to an industrial process. To support the production process, project managers used several software development lifecycle models. These models have evolved over the years affected by the trends and changes of hardware and software. In order to access the global demand for software development, companies are required to apply an appropriate model or process. In the following, it is explained why a modern model like Agile is more promising than a more classical model.

In a waterfall (classical model) lifecycle process there is an attempt to define in detail all the requirements and the design before programming (see **Figure 6**). Research (collected from many sources and summarized in Larman¹⁷ shows that applying the waterfall process is a poor practice for most software projects, rather than a skillful approach. It is strongly associated with high rates of failure, lower productivity, and higher defect rates than interactive projects. On average, 45% of the features in waterfall requirements are never used because have not been checked and reviewed with the client during the workflow.

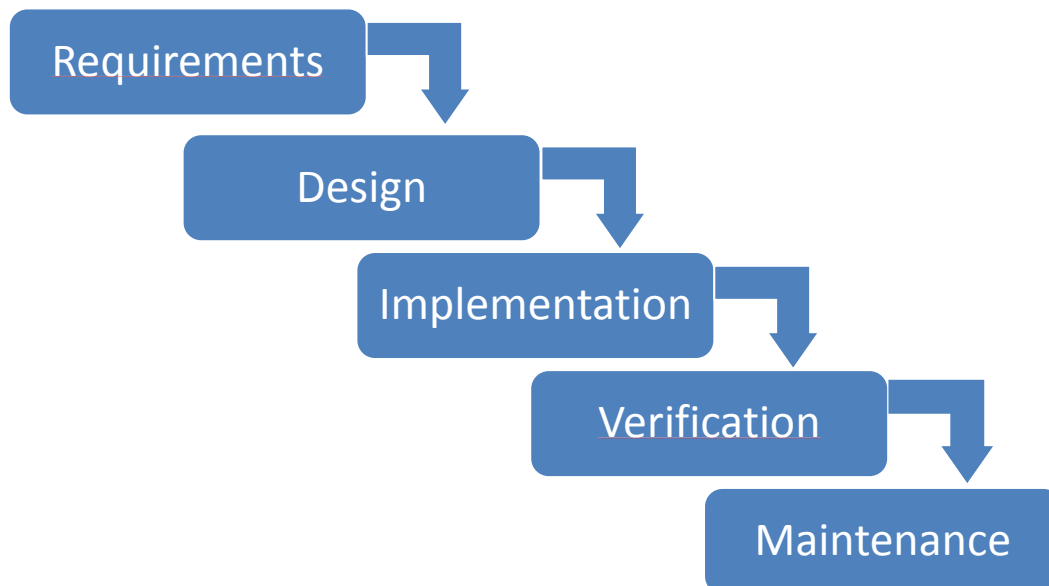


Figure 6: Waterfall model schema

¹⁷ Applying UML and Patterns: An Introduction to Object Oriented Analysis and Designs and Iterative Development, Third Edition by Craig Larman

Modern models like Agile development methods¹⁸, apply time-boxed iterative and evolutionary development, adaptive planning, promote incremental delivery, and include other values and practices that encourage agility, rapid and flexible response to changes. Agile principles consider delivering working software frequently to the client, from a couple of weeks to a couple of months. In order to be able to change requirements even in a late developing stage, business people and developers must work together daily to maintain a sustainable software product (see **Figure 7**). For all those reasons, such a model is better adapted to the current requirements in the global software development market.

According to the Project Management Institute¹⁹ “Organizations that are highly agile, nimble and able to respond quickly to changing market dynamics complete more of their strategic initiatives successfully than slower, less agile organizations (69 percent versus 45 percent). But only 15 percent of organizations report high organizational agility.”

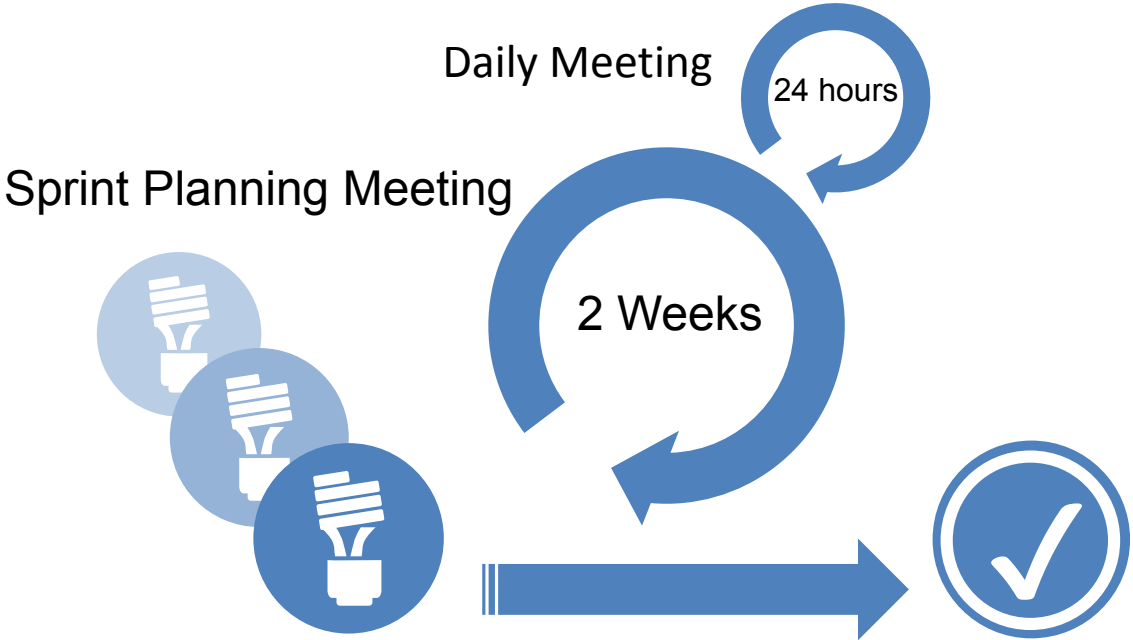


Figure 7: Agile model schema

It is therefore recommended for companies intending to access the global demand for software development to look into agile development methods like Scrum, Kanban, Lean or Extreme Programming (XP).

2. Market Information

Outsourcing decision-making is a complex process that includes estimating not only the benefits and risks, but also motivation factors. There are several types of market information that can help companies – both those who demand and those who supply software development services – in this decision-making. In the following, three types of market information are explored:

- Information service providers – mostly useful for software development suppliers to understand

¹⁸ The Agile Alliance is a nonprofit organization with global membership, committed to advancing Agile development principles and practices. Agile Alliance supports those who explore and apply Agile principles and practices in order to make the software industry more productive, humane and sustainable. <http://www.agilealliance.org/>

¹⁹ The high cost of low performance (2014), Project Management Institute, Inc. PMI.org/Pulse

the potential markets

- Intermediation service providers – to find a good commercial partner both from demand and supply perspectives
- Social networks for developers – for software developers to connect with each other and potential clients

a) Information Service providers

There are various service providers who offer regularly updated information on the global demand for software development. Several of them have been used to collect the data presented in the first part of this report. Getting this type of market information may be useful for both companies trying to access the global demand as well as institutions that give strategic support to the software development sector in specific countries. In the following, a selection of service providers are briefly introduced. Many of them provide all or a majority of the information for free.

- **The European IT Outsourcing Intelligence Reports** present the European IT Outsourcing and Software Development research conducted in 2011 (Austria, Cyprus, Denmark, Finland, Malta, Norway, Sweden, Switzerland, Netherlands and United Kingdom) and 2012 (Denmark, Germany, Norway, Sweden and United Kingdom). Several Western European companies were surveyed in order to delve into reasons that keep them away from outsourcing and explore factors that will be influencing their outsourcing decisions in the future. For downloading these reports, visit <http://slideshare.net> and search for European IT Outsourcing Intelligence Reports.
- **CBI (Centre for the Promotion of Imports from developing countries)** is an Agency of the Ministry of Foreign Affairs of the Netherlands. They share market information to help IT service providers improve their position on the European Information Outsourcing (ITO) market by mapping their most important weaknesses and giving advice on how to tackle them. <http://www.cbi.eu/market-information/outsourcing>
- **International Data Corporation (IDC)** is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. (<http://www.idc.com/about/about.jsp>)
- **International Association of Outsourcing Professionals (IAPCO)**: Information about the global outsourcing market, certification, conferences etc. <http://www.iaop.org/>
- **German Austrian Swiss Outsourcing Association**: Information about the German, Swiss and Austrian outsourcing market (ITO/BPO). <http://outsourcing-verband.org/en/>
- **National Outsourcing Association (NOA)**: Information about the global outsourcing industry, accreditation, trainings, events etc. with focus on UK and Europe. <http://www.noa.co.uk/n>

b) Intermediation service providers

For both software development supply and demand, it is important to find a decent commercial partner. A EuropeAid report²⁰ distinguishes five options for software development suppliers to enter the EU market. In options i) and iii), intermediation service providers play an important role (**Table 4**).

²⁰ Software and IT Services in the European Union Market Survey, EuropeAid, European Union's Programme for Ukraine, Available through <http://itonews.eu/files/f1238685754.pdf>

i	Partnership with an EU software company	Joint ventures between EU software companies and local software companies – for example in the Western Balkan – can make it much easier for the latter to enter the EU market. For software companies to find each other, service providers such as ITolist.eu (explained below) can be helpful.
ii	Sales office in the EU	Establishing a sales office in an EU member country is another option, but usually quite a big step for local companies. In this case, the support needed is not primarily from an intermediation service provider, but rather from a government or industry association that facilitates such an effort.
iii	Cooperation with a middleman	In this option, the intermediation service provider is central as it has the role of a specialized broker or outsourcing consultant. Below, there are two examples of service providers that take such roles, Ciklum and EuroITX.
iv	Working with an EU company directly	This option is the most direct partnership. It may include all kinds of potential industries that outsource software development projects. However, the case is rather rare as normally – and especially at the beginning – the partnership goes through a EU software company (option i.).
v	Captive offshoring	This concept refers to situations when European software companies set up businesses (subsidiaries) in software development supply countries such as in the Western Balkans. Such cases are more frequent when large amounts of software need to be created.

Table 4. Options for software development suppliers to enter the EU market

Selected intermediation service providers:

- **Ciklum** helps to hire, retain and host a Software Development teams in the locations they work with, helping you reduce costs and providing scalable growth. <http://www.ciklum.com/>
- The **European Information Technology exchange** (EuroITX) is a one-stop-shop that provides information for both buyers and suppliers of offshore / nearshore software and IT (enabled) services outsourcing. Their website has three units: Intelligence, Marketing and Supply-Demand. The Intelligence unit contains, creates and maintains all the information, papers, external resources and news. The Marketing unit promotes the associated service providers from developing countries. The Supply-Demand unit manages and develops the database of company profiles. This database contains both suppliers and buyers. It focuses on suppliers from developing countries and buyers from Europe. EuroITX is sponsored and supported by CBI. <http://www.euroitx.com>
- **ITolist.eu** is a catalogue of IT outsourcing providers from Central and Eastern Europe. ITolist.eu is the project of (Central and Eastern European Outsourcing Association - (<http://ceeo.org>)). One of the main objectives of this catalogue is to promote the information about IT outsourcing services providers from the CEE region and to create an easy to search permanent, annually updated, regional catalogue of companies providing IT outsourcing services in the CEE region. <http://itolist.eu>

c) Social networks for developers

Social networks for developers are becoming increasingly important for software development specialists to connect with each other as well as with potential clients. The following are two networks that are currently very popular.

- **GitHub** offers both paid plans for private repositories and free accounts, which are usually used to host open-source software projects. As of 2014, GitHub reports having over 3.4 million users and with 16.7 million repositories making it the largest code host in the world. (<https://github.com/>)
- **Geekli.st** is an achievement-based social portfolio builder for developers where they can communicate with colleagues and employers and build credibility in the workplace. (<https://geekli.st/home>)

3. Project Management

Developing project management processes is as central in the global software market as it is for many other industries. The increase of talent in management stimulates organizations to mature their management processes. However, although maturity means success, many organizations are not taking enough action in adding tools that can lead them to a better performance.

Management problems affect productivity

US \$ 109 million

The Project Management Institute²¹ estimates that organizations are losing an average of US\$109 million for every US\$1 billion spent on projects,

Figure 8.

High-performing organizations successfully complete 89% of their projects, while low performers complete only 36% successfully (see **Figure 9**). This difference in success results in high-performing organizations wasting nearly 12 times less than low performers.

Figure 8: Organizations lose an average of US\$109 million for every US\$1 billion spent on projects.

²¹ The high cost of low performance (2014), Project Management Institute, Inc. PMI.org/Pulse

For companies outsourcing software development, it is central to estimate correctly the costs and the probability of success of the contracted projects. There are ways to identify the capabilities of software suppliers in the global market checking if they have tested their processes and capacities; but how to know which supplier is building better products and



Figure 9: High-performing organizations successfully complete 89% of their projects

delivering better services? In the software industry, there is a particularly known model that promises support in this endeavor, the Capability Maturity Model Integration (CMMI). As explained on its website, "CMMI is an effective approach to identify the best in class. Organizations that have been appraised and rated with a "Capability" or "Maturity" level with CMMI have a repeatable, scalable approach to collecting data that helps them understand and improve the effectiveness of their operational methodologies. They are building better products and delivering better services, and they know why."²²

Organizations all over the world use the CMMI Published Appraisal Record System or PARS Database²³ to learn more about high performing suppliers that have implemented CMMI.

In conclusion, checking suppliers' appraisal, skills, techniques and capacities can help establishing an approach to keep projects on time and on budget while increasing transparency and predictability. Employees from supplier companies have to redirect their workflow through new and changing strategic initiatives. For accomplish that, organizations need to focus on the development and training of management processes. As was explained before, there is a direct correlation between effective talent management and better project performance.

Part III: Rules

In this part, several relevant aspects of the legal framework around software supply and demand are examined. Firstly, an international standard is reviewed which may guide a client in assessing the software's performance in terms of quality. The reader will then learn about a client's options on different ways for contracting new modifications and maintenance. Finally, it is explained how software needs to be protected legally for commercial purposes.

1. ISO/IEC 25000: Software Product Quality Requirements and Evaluation

Defining appropriate quality characteristics, while taking account the intended use of the resulting program, is a key factor to verify if the final result matches with the initial expectations.

²² Capability Maturity Model Integration CMMI, <http://whatis.cmmiinstitute.com/>

²³ Published CMMI® Appraisal Results <https://sas.cmmiinstitute.com/pars/>

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) created the standard ISO/IEC 25000:2014²⁴ also known as SQuaRE (Software Product Quality Requirements and Evaluation) that includes:

- ISO/IEC 2500n, Quality Management Division,
- ISO/IEC 2501n, Quality Model Division,
- ISO/IEC 2502n, Quality Measurement Division,
- ISO/IEC 2503n, Quality Requirements Division, and
- ISO/IEC 2504n, Quality Evaluation Division.

This study focuses on the Quality Model Division that classifies software quality in a structured set of characteristics and sub-characteristics²⁵ as follows:

- **Functional Suitability:** This characteristic represents the degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.
- **Performance efficiency:** This characteristic represents the performance relative to the amount of resources used under stated conditions.
- **Compatibility:** Degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.
- **Usability:** Degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.
- **Reliability:** Degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.
- **Security:** Degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.
- **Maintainability:** This characteristic represents the degree of effectiveness and efficiency with which a product or system can be modified to improve it, correct it or adapt it to changes in environment, and in requirements.
- **Portability:** Degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

Software can obtain a certificate of conformity to ISO/IEC 25000 Standard. In order to acquire such a certificate, the company will need to contract an independent evaluation service provider²⁶.

The certification of the product allows companies to verify the quality of their products and helps buyers in the decision making while regarding multiple options. Some of the benefits are:

- Differentiate from competitors, ensuring delivery times and reducing product failure after implantation into production.

²⁴ More about ISO/IEC 2500 <https://www.iso.org/obp/ui/#iso:std:iso-iec:25000:ed-2:v1:en>

²⁵ The sub-characteristics are excluded. See more under <http://iso25000.com/index.php/normas-iso-25000/7-iso-iec-2501n>

²⁶ See for example <http://www.alarcosqualitycenter.com/index.php/en/aqc-lab>

- Detect defects in the software product and proceed with their elimination before delivery, which saves costs in the subsequent maintenance phase.
- Assess and monitor the performance of the software, ensuring that you can generate the results given the constraints of time and resources established.
- Ensure that the software product developed respects the required levels of safety features (confidentiality, integrity, authenticity, non-repudiation, etc.).

In conclusion, the quality of a system is the degree to which the system satisfies the stated and implied needs of its various stakeholders, and thus provides value. Those stakeholders' needs (functionality, performance, security, maintainability, etc.) are precisely what is represented in the quality model, which categorizes the product quality into characteristics and sub-characteristics. For software suppliers that base a large part of their business on one particular software product, it is recommended to look into ISO/IEC 25000 certification.

2. Contracting

As explained in the chapters on the software lifecycle and project management, it is very frequent for software development project to undergo changes compared to initial planning. Such modifications in later stages can be due to new functional and technological needs and the control of constraints. This has consequences for the ways in which contracts are established between software suppliers and clients.

First of all, it is not recommended to use fixed-price contracts. These can create impediments for the successful completion of the project both from the suppliers and the clients' perspectives since they cannot take into account the abovementioned changes.

Second, it is not practical to rely on contracts that have to be concluded in the physical presence of both parties. Since the parties in outsourcing deals are often geographically separated, a change of contract means additional expenses in terms of travels and time.

To resolve the issues with this second aspect, the use of information and communication technologies²⁷ has brought about new and nowadays common ways of contracting that may happen by e-mail, phone, web, fax, etc. Such contracts have the advantage of saving time and money due to the aforementioned reasons. However, they also bring about certain legal aspects; in the following, it is explained what to take into account.

Companies that demand software development should be aware to analyze the laws that regulate such economic activity. This study cannot provide a general interpretation or solution that may fit all software development outsourcing contracts since they are much dependent on national laws, the type of software product, the type of actors involved, etc. However, here are a few important tips to consider by the parties:

a) The time and place of the conclusion of the contract:

This defines basically the country where the contract originates from and settles the norms that will apply to that contract. If a company is interested in outsourcing software development, it is important to review the Civil and Commerce codes of the defined country to know the rules that will be applied to the kind of contract that this company is interested in.

²⁷ <http://conventions.coe.int/treaty/en/Treaties/Html/180.htm>

b) If the contract is accepted by actors in different places and at different times:

Internet allows the conclusion of contracts between parties not present physically and in different moments of time. In these contracts the offer provided by the supplier already constitutes the supplier's agreement with a potential contract based on this offer. It is important to consider, therefore, the relevant interval time between the supplier providing an offer and the client accepting with a signed contract. An expiring date can be applied to the offer, which needs to be taken into account for determining the maximum interval time.

c) If the contract is concluded inside a EU country:

Since the EU laws are superior to the members' national laws, it is important to review the Regulation 593/2008 on the law applicable to contractual obligations²⁸ and the Regulation 44/2001 Jurisdiction and the recognition and enforcement of judgments in civil and commercial matters.²⁹ The EU Directive on electronic commerce 2000/31/CE³⁰ includes certain legal aspects of the EU market.

Besides the abovementioned tips, it is recommended for companies intending to access the global market to review international norms like the ones proposed by the United Nations Commission on International Trade Law (UNCITRAL)³¹. UNCITRAL plays an important role in improving the legal framework for international trade by preparing international legislative texts for use by States in modernizing the law of international trade and non-legislative texts for use by commercial parties in negotiating transactions. Legislative texts of interest to this study are the International sale of goods³² and the Use of Electronic Communications in International Contracts³³.

3. Intellectual Property Rights vs. Patents

Software protection provides economic benefits and entitle the creators to control the use of their creation in a number of ways such as making copies, private use, distribution, etc. and therefore be rewarded for their creativity and investment. There are two legal ways to protect the software, with the Intellectual Property Rights (normally an automatic procedure) and Patents (they need to be registered in a Governmental Office)

a) The Intellectual Property Rights protects works of authorship, such as writings, music, software, etc. that have been tangibly expressed. Also gives moral rights to identify the creator or the author.

b) A patent is a limited duration property right relating to an invention, granted by a country Patent Office in exchange for public disclosure of the invention (after a period of time, the patent will be free and all the documentation will be open to the public). One of the advantages is that the patent permits its owner to exclude others from making, using, selling, offering for sale and importing the invention into the country where it was applied as claimed in the patent. Presuming that there is a market demand for the patented product, the ability to exclude others reduces the supply of the product in the marketplace. As a result, patent owners may charge higher prices for their inventions.

In order to protect a software product, it is important to know the differences between patents and intellectual property rights. In legal terms, considering the software as an industrial invention assumes

²⁸ (EC) 593/2008 of the European parliament and of the council of 17 June 2008 http://admin.interact-eu.net/downloads/3774/Regulation_EC_No_593_2008.pdf

²⁹ (EC) 44/2001 of the European parliament of the Council of 22 December 2000, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001R0044:en:HTML>

³⁰ <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32000L0031&from=EN>

³¹ <http://www.uncitral.org/>

³² Vienna, Austria <http://www.uncitral.org/pdf/english/texts/sales/cisg/V1056997-CISG-e-book.pdf>

³³ Vienna, Austria http://www.uncitral.org/pdf/english/texts/electcom/06-57452_Ebook.pdf

the protection through patent legislation (industrial property rights); if it is considered like an artistic creation the protection is through the intellectual property rights.

As the software concept was defined in the first part of this study, it is clear that applying the intellectual property rights or patents to the software registration includes the detailed description of the computer program, documentation, manuals and the source code.

The World Intellectual Property Organization (WIPO) is the global forum for intellectual property services, policy, information and cooperation. As it is explained in its website: “In the majority of countries, and according to the Berne Convention³⁴, copyright protection is obtained automatically without the need for registration or other formalities. Most countries nonetheless have a system in place to allow for the voluntary registration of works. Such voluntary registration systems can help solve disputes over ownership or creation, as well as facilitate financial transactions, sales, and the assignment and/or transfer of rights. WIPO does not offer a copyright registration system or a searchable copyright database”.³⁵

Patents are territorially limited. The Patent Cooperation Treaty (PCT)³⁶ is an international treaty with more than 145 Contracting States³⁷. It offers the possibility to seek patent protection for an invention simultaneously in a large number of countries by filing a single “international” patent application instead of filing several separate national or regional patent applications. The granting of patents remains under the control of the national or regional patent Offices in what is called the “national phase” (see **Figure 10**).

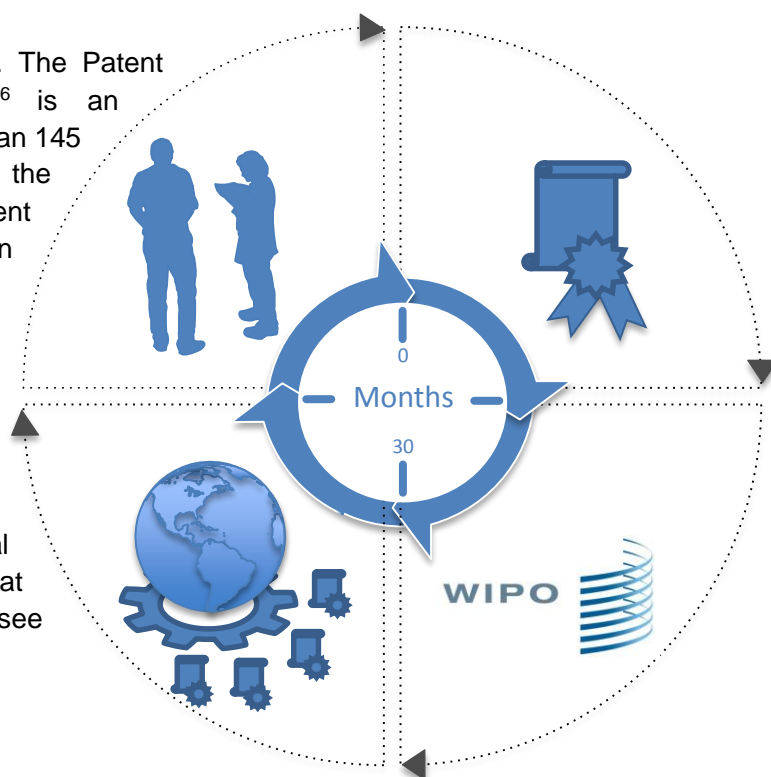


Figure 10: PCT process

In the countries of interest of this study in the Western Balkan, Albania and Bosnia and Herzegovina are members of WIPO and Contracting States of the PCT. For inventions from these countries, it is possible to use the simpler, easier and more cost-effective way of filing patent applications under PCT. For interventions from Kosovo, not being a member of WIPO nor a Contracting State of PCT, applications need to be filed separately at the same time in all of the countries in which protection is sought.

In conclusion, a company that demands software in a country that is not part of the WIPO, should check the existence of legal methods for the transfer of the ownership of the intellectual property rights. As the automatical international intellectual property rights protection will not be obtained in

³⁴ http://www.wipo.int/treaties/en/text.jsp?file_id=283698

³⁵ <http://www.wipo.int/copyright/en/>

³⁶ <http://www.wipo.int/pct/en/>

³⁷ http://www.wipo.int/pct/en/pct_contracting_states.html

this case, the buyer will have to find the best procedure, which varies depending on the terms included in the private contract for protecting the product. A good alternative in these cases is for the buyer to file for a patent. Since the patent is in principle valid only locally, this alternative is particularly appropriate if the target market is well defined.

Conclusions

From the global software demand perspective, a company that is looking for opportunities to outsource software development will have to consider the factors explained in this study for selecting the best option.

The client will demand not only the program but also the documentation and testing processes. Often, the client is quite explicit concerning the different programming languages, frameworks and platforms that are required to develop the demanded program. For this reason, it is interesting for suppliers to know the popularity of different programming languages but always trying to compare between those used for similar purposes.

As the global software demand changes with new trends, buyers consider that the software as a service model offers a new path to access bigger and smaller markets at the same time. The suppliers who understand this delivery methodology and can provide this kind of service will have the opportunity to find international partners or clients.

Before contracting particularly bigger deals, some companies may ask for certifications or audit the supplier company because it is the only possible guarantee for them. For the first case, suppliers can get ISO certifications for their software that can ensure the quality of their products. For the second case, suppliers can follow a training and appraisal program like CMMI in order to improve their maturity and capability level in project management.

Lastly, being from a country with a stable legal system that can provide the protection of the intellectual property rights or the chance to register patents is very appreciated in the global market. The buyers want to make sure that the contracting system of such services will not affect the exploitation rights so their future benefits will not be affected due to legal problems about ownerships and creation.