

SOFTWARE SOLUTIONS ADOPTED BY SMES: CASE STUDY REGARDING ROMANIAN SMES

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ABSTRACT. During the last decades, the ICT industry imposed new tendencies concerning the communization of software platforms and solutions; thus a continuously growing phenomenon has been developed, namely that of open source software. In the present context, when companies have to manage large databases and exploit them to develop a business intelligence allowing them to create important competitive advantages within the global economy, open source software solutions become viable alternatives to be adopted by any company. Taking into account the global trends in open source software development, and also the increase in the level of utilization of this type of software in companies, the present study assesses the types of software solutions used by Romanian SMEs, identifying comparative aspects of use and perception of SMEs regarding the two important categories of software: open source and commercial. An SME profile is also identified from point of view of SMEs as final consumers of software products used to support their business processes. The results of the study can be considered as an important source of information for the business environment, starting with the companies' decision makers responsible for the elaboration of the development strategy for their company, continuing with the commercial software providers and open source software communities and developers:

Key words: free software, freeware, open source, commercial software, SME

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1. Introduction

Informational globalization allowed companies to develop new collaborative and innovative competencies in their own business environment. ICT industry provides companies with specific solutions in order to create and maintain an active competitive advantage in a globalized business environment. The last years have brought about important changes at global level, which can be included in the wave of informational globalization, starting with the development of hardware, software and communication infrastructures from the individual, home-user level up to its universalization; the development of public Internet network transformed, without precedent in the history, both interpersonal and business communication; thus the possibility and ability to communicate and transaction information at global level made possible for companies to develop new collaborative and innovative capacities and competences for their business environment.

From another perspective, the globalization of digital infrastructure and mobile technologies changed the global competitive polarity, this, at its turn, also becoming global. Any company must fight on the global competitive front and, as a consequence, and with this aim, must develop higher level adaptability abilities and competences.

In this context, companies have the opportunity to use tools and solutions put as disposal by the ICT industry for their own development and for creating and maintaining an active competitive advantage in a globalized business environment.

From the perspective of solutions offered to companies by the ICT industry, it is very useful to identify a phenomenon that has been hugely amplified during the last decades, namely the development of open source software industry.

The practice of the business environment as well as the economic crisis, transformed the OSS (Open source Software) industry into a long term viable alternative providing companies with reliable and advantageous solutions with important benefits to their competitiveness in the global business environment.

The software industry offers companies important alternatives in adoption of software support solutions for business processes, from commercial software packages, solutions for renting software to, not in the least, open source solutions.

OSS developed as a contemporary phenomenon, with sustained growth tendency within ICT industry, as well as in the field of software adoption by companies (Marsana et al, 2012). Despite the development of this industry, the rate of adoption of OSS by companies on a global level remains at low level due to some important loopholes in elaboration of adoption and development policies and procedures at company level. (Marsana et al., 2012).

ICT literature indicates that open source may lead to enhancing quality and innovation in the business environment. Regarding the adoption of open source solutions by companies, a series of motivations were formulated that suggest, on one hand, the fact that this adoption is carried out by companies desiring to obtain a competitive advantage in their field of activity, on the other hand, the impact of these software products on the perception of companies regarding open source vs. commercial solutions is underlined, having as final result a re-evaluation of software products in companies and development of long term open source strategies (Asundia et al., 2012).

Starting from these aspects and from the global tendencies regarding the OSS development and the increasing adoption rate of these solutions within the companies, the present study evaluates the adoption of open source software vs. commercial software in Romanian SMEs, drawing a profile of SMEs as final users of software products for supporting business processes.

The study's results offer an important source of information for the business environment, starting with open source software providers, continuing with those providing commercial software and decision makers in companies in charge of the elaboration of their development strategies. On another level, additional to identifying the level of usage of open source software in SMEs, the study also identifies the advantages and disadvantages perceived by them regarding the adoption of open source software and the perception of SMEs in relation to their future adoption.

2. Literature review

Software industry can be considered as having one of the most rapid rates of growth, being also an obvious representative of globalization.

According to MarketLine, the global software market had revenues of 292.9 billion dollars in 2011, having a compounded annual growth (CAGR) of 3.6% between 2007-2011

(<http://www.reportlinker.com/ci02072/Software.html>, accessed January 2013). According to the same source, a 6.3% annual growth rate is estimated for the 5 years period between 2011- 2016, expected to lead to a revenue of 396.7 billion dollars on the market by the end of year 2016.

In 2012, International Data Corporation (IDC) indicated that the software market at global level grew by 3.6% year by year; it has also forecasted a growth rate of 5.7% for 2013 and a compounded annual growth rate of 6.3% for the period 2012 - 2017

(<http://www.idc.com/getdoc.jsp?containerId=prUS24127113>, accessed March 2013).

Open source industry brought about changes in the software market at global level; within the global software market having a value of almost 300 billion dollars, the open source software market is expected to register a yearly growth rate of 22%, exceeding 8 billion dollars in 2013

(<http://www.reportlinker.com/ci02075/Open-Source-and-Free-Software.html> accessed March 2013).

Llanesa & De Elejalde (2013) determined the conditions under which open source companies and proprietary companies co-exist in a balance characterized by a market with asymmetrical structure; “proprietary firms invest more in R&D and obtain a larger market share than open source firms. Open source firms, on the other hand, benefit from lower development costs.”

According to the study carried out in 2013 by Venture Partners and Black Duck Software, among the main drivers for choosing open source by companies we can find innovation, collaboration partnerships and possibilities for infrastructure development

(<http://open source.com/business/13/4/open-source-2013-survey>, accessed May 2013).

From the perspective of success achieved by open source solutions on the global software market, Midha & Prashant (2012) identified among the success factors of OSS the users and the developers, based on more than 300,000 OSS projects available only on SourceForge in October 2011.

The software industry and ICT literature assign two meanings to free, community software, namely free and open source software. The

term “free” of “free software” refers to the final user’s freedom and not to its costless acquisition. The first complete definition was published in GNU’s Bulletin, in February 1986

(<http://fsfe.org/about/basics/freesoftware.en.html>, accessed on April 2013) and comprises the four freedoms conferred by the free software category its users, namely: freedom to use, copy, distribute, change and improve the adopted software

(<http://www.gnu.org/philosophy/free-sw.html> accessed April 2013).

A clear distinction has to be made between the two established terms of software industry: free software, respectively freeware. While free software grants the four cumulated attributes to the products, also supposing, evidently, access to the source code, in case of freeware is meant that category of software that can be downloaded from the Internet by any person and can be used for free, without access to the source code and without possibility of modifying, personalizing, improving it.

In this context, the other category, open source, does not only indicate access to the source code; but there are also other criteria included in its definition. Open source software supposes free redistribution of software products, without any licensing restrictions, in order to allow modifications and distribution under the same conditions as the original software; open source supposes equality between user groups and fields of activities or industries. (<http://open source.org/osd> accessed April 2013).

At the invisible border between free and open source software we can find the new tendencies of some fix and mobile equipment supplier companies to offer attached to the equipment, some free software applications which can be considered free and open source code; but suppliers do not allow the installation of modified versions; upgrading of these applications can be done only by the producer companies. These practices are called in the industry as “tivoization”.

(<http://www.gnu.org/philosophy/open-source-misses-the-point.html>, accessed May 2013).

From point of view of open source licenses, the most well-known and the most used were defined by the Proliferation Report of Open Source Initiative (OSI) in 2006 and are: Apache License 2.0, BSD 3-Clause "New" or "Revised" license; BSD 2-Clause "Simplified" or "FreeBSD" license; GNU General Public License (GPL); GNU Library or "Lesser"

General Public License (LGPL); MIT license; Mozilla Public License 2.0; Common Development and Distribution License; Eclipse Public License (<http://open source.org/licenses>, accessed April 2013).

Daffara Carlo (2011) underlined the fact that choice of a type of license for F/LOSS (Free/libre OSS) is influenced by the adopted business model “property-efficiency”, depending on two parameters: intellectual property and efficiency of adopted software solutions.

Mens & Goeminne (2011) bring a new vision into the understanding of OSS demonstrating the important impact of social aspects on the temporal evolution of OSS ecosystems. The authors underline the existence of an important link between the evolution of the software and that of the software community.

Margea (2009) highlighted aspects related to the growing tendency of adopting OSS as a viable alternative for commercial and proprietary applications in companies and public administrations from Europe.

Sen et al. (2012) underlined aspects related to the success of open source projects from the double perspective of developers and of users. Their analysis identified the fact that projects that develop OS software for Windows/UNIX/ Linux operational systems and those using language C or derived languages attract a higher number of users as well as developers; other aspect is related to OSS projects accepting financial donations and that have a large number of users; another dimension identified is related to the proportionality between the number of users and the age of the OS solution.

Mertik (2011) in a study concerning the adoption of open source in Slovenia points out that open source gained ground as an opportunity for the business environment, bringing an important added value to SMEs.

Hunter & Walli Stephen (2013) concluded as a result of their study that software developed in collaborative environment and under open source licenses continue to offer an increase in productivity for developers as well as for users and companies.

Gartner Consulting Company, demonstrated that from the perspective of ICT infrastructure development, up to 2016, SMEs at global level will spend 1 Trillion dollars; the biggest growth opportunities are forecasted in Software & Services, and Asia will be the region with the most important opportunities for development.

(http://www.gartner.com/it/content/2273800/2273821/january_8_itspending_forecast_final.pdf?userId=59645980, accessed May 2013).

According to the same source, it is envisaged that software industry will have a yearly increase of 6.8% until the year 2016; in emerging economies the increase will be determined by ERP (enterprise resource planning) solutions and DBMS (database management system), while in mature economies by security and CRM (customer management system) solutions.

Macredie & Kabiru (2011), identified a set of factors that can profile an empiric framework for adoption of OSS solutions by SMEs. In identifying the perception of SMEs on the adoption of OSS solutions, the authors used as starting point the attitudinal belief structure regarding benefits, complexity and comparability of OSS solutions. The identified factors were: low costs of the software licence acquisition, lack of drivers corresponding to these solutions, functionality, support offered by the OSS community, web media, innovativeness, capital investments and communication infrastructure in case of adopting such solutions.

Pande & Gomes (2012), identified among the benefits of adopting OSS solutions by SMEs the following: easy personalisation of the solutions, increase in visibility in the OSS developers' community, increase in the quality of solutions from collaborative point of view, unlimited use of OSS solutions and the large support in the process of utilisation offered by the OSS community.

Werber & Žnidaršič (2011), through their study concerning the level of awareness of OSS solutions and their use by micro-companies in Slovenia, identified the following aspects: almost half of the studied companies used a category of software without licence, 34% of the managers had no knowledge about OSS, and the percentage of using OSS solutions in comparison to commercial software was very low.

Open source in Romania

In Romania, representatives of Zitec Company developed over 250 projects using mainly open source technologies, having allocating on average nine months of work per project (http://www.forbes.ro/Cat-timp-acorda-specialistii-romani-unui-proiect-it-open-source_0_6962.html, accessed April 2013).

In Romania, 2013, was marked by the entry on the Romanian market of the global leader in open source technology, Red Hat; the main advantages of Red Hat solutions attracted over 70 Romanian companies in

adopting open source solutions (<http://www.agora.ro/stire/tehnologia-open-source-un-trend-companiile-din-romania>, accessed May 2013).

The Romanian company BIT Software is the developer and provider of some open source solutions; SocrateOpen ERP&CRM is used by companies in the field of professional services like Avangate or Byblos (<http://www.aries.ro/socrateopen-erpcrm-solutia-potrivita-pentru-companiile-de-servicii-profesionale/>, accessed April 2013).

3. Material and methods

The global image of the open source industry's development, as well as the increasing global tendencies of adoption of these solutions in companies, determined the implementation of an ample research regarding the level of adoption of open source vs. commercial solutions in SMEs from our country.

The complexity of research allows identification of some important aspects starting with the perception of SMEs regarding existing open source solutions, the level of use them in their specific activities, SME's perception concerning the benefits and risks of their adoption, respectively their vision concerning the necessity of adopting these solutions on short term and the global evolution of open source vs. commercial solutions.

In carrying out the research it was necessary to have an optimal mix of online and offline research tools, respectively of those specific to mobile devices.

It is well-known the difficulty of carrying out research using tools that are specific to the digital environment and mobile technologies, due to the dispersed character of the subjects' geo-location and the impossibility of integrally contacting the population included in the research. As a consequence of this shortcoming, common to web and mobile based studies, the selection of the population and of the research tools was done to ensure the best possible representation in order to obtain conclusive results.

The research covered all SMEs registered online in Romania and was carried out between January 2012 and June 2013.

The research concept was to identify some very important aspects for the software industry, viewed both from the perspective of demand and that of the supply of these products, namely:

- The comparative level of use of open source vs. commercial solutions and the share of these in SMEs;
- Types of users of open source solutions in relation to the length of adoption of open source solutions;
- Existence of ICT staff specialized on open source technologies, in SMEs;
- Solutions and categories of open source compared to commercial solutions used in SMEs in present;
- SMEs' perception of advantages and risks of adopting open source solutions;
- SMEs' vision regarding the short term adoption of open source vs. commercial solutions;
- SMEs' perception of future development trend concerning open source vs. commercial.

It was necessary to combine primary information collected through the questionnaire answered by SMEs with secondary information resulting from statistical resources, existing researches and studies, online information sources.

The questionnaire developed for the research was conceived in shared format, using collaborative tools of Google Drive, taking into account the possibility of quick and automated collection of data.

The questionnaire was disseminated using several tools, being transmitted in embedded format using email and SMS, but QR code was also generated with the URL of the questionnaire and information on the research.

The questionnaire was conceived in a modular structure, based on the concept and aims of the research, and included a total of 15 questions:

- The first module comprised questions for identifying SMEs in relation to the county where SMEs were registered, the environment they operate in (urban/rural), the field of activity according to NACE, and number of employees;
- The second module contained questions concerning use of open source solutions and the proportion of these solutions in comparison to commercial solutions, length of using open source solutions and existence of ICT staff specialized in using open source technologies;

- The third module included questions regarding the categories of software and open source solutions used in practice by SMEs compared to commercial software;
- The fourth module contained questions aimed to identify the SMEs perception on the advantages and risks linked to the open source solutions that could be adopted;
- The last module presented questions related to SMEs' vision regarding adoption of open source vs. commercial solutions and future development tendencies of open source solutions.

As a consequence of previous experiences, and taking into account aspects linked to the highly technical character and the specific terminology used in the questionnaire, in order to ensure the most competent answers to the questions, an explanatory index of the terms used in the questionnaire was developed and attached to it.

The most laborious and difficult part of the research was identifying the data on SMEs registered in the digital environment; with this aim online resources were identified and used such as free web directories and statistical websites listing for free data of SMEs from Romania.

The set-up of the database of SMEs with online presence, with valid contact information (email address, telephone number and website) was carried out correlating the data from these free resources with the data listed on the service portal of the National Company Registry, using its Recom online free service (<https://portal.onrc.ro/ONRCPortalWeb>).

In this context, to identify SMEs as subjects of the research, free online resources listing Romanian companies per county and field of activity were used and analyzed. We selected for consideration websites and specialized directories as:

<http://www.firme.ro>, <http://www.listafirme.ro/>, <http://www.firme.info/>,
<http://www.datefirme.ro/>, www.firme-on-line.ro/, www.firmepenet.net/,
<http://www.directorfirme.ro/>, <http://www.economia-online.ro/>,
www.bizoo.ro/catalog-firme/.

After collecting the data, 12,246 SMEs registered in Romania and listed by specialized sources were identified; the data was subjected to filtering and structuring based on the existence and correctness of the data. Only those SMEs were selected that had active website, valid email address or telephone number.

SMEs identified as subjects of the research were invited to participate using diverse online tools available: emails, social media using a topic created especially for this purpose, SMS and mobile or landline telephone calls, all indicating the URLs where the questionnaire could be completed.

The selection resulted in retaining and building a research population consisting of 11,796 SMEs registered in Romania, subjected in their totality to surveying using the above mentioned method.

By comparing the number of SMEs registered statistically in Romania, 529,015 SMEs,

(http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/countries-sheets/2012/romania_ro.pdf, accessed on January 2013) and the number of those identified as a result of the research as being registered on online resources (without considering the existence and accuracy of contact information) (12,246 SMEs), we can conclude a very low level of SME presence in the digital environment (2.31%). This situation may be caused by the lack of information on new technologies and software solutions to support specific activities, revealed among SMEs in our country.

The most important percentages among the subjects were represented by SMEs having the following fields of activity: Construction, Architecture, Design, Cadastre (20.36%), followed by SMEs from the field of Computers, Software, Communications, Office automation (9.34%), and having a share between 5-10% SMEs from Business Services, Marketing, Publicity, Services - other activities, Machinery and equipment.

A very low percentage, below 1%, was registered by SMEs belonging to the field of Footwear, Leather, Glass, Ceramic, Industry - other activities.

It is important to point out that many SMEs from multiple fields had a low share, between 1-5%, making up 40.47% of the selected subjects; this may indicate important aspects related to lack of visibility and active online presence of a worryingly high percentage of Romanian SMEs that are practically not adapted to the online business environment which would ensure their global integration in an efficient, rapid and mainly free of charge manner.

Other aspect, otherwise well-known in relation to the web-based surveys, should be pointed out, namely that related to the unsatisfactory answer rate achieved at completion of the questionnaire placed on web

and mobile-based interfaces; this shortcoming requires a supplementary effort in carrying out the research calling for classical, offline interviewing activities using telephone or face-to-face. The final rate of responses was only of 58.06% from the total population included in the research representing 6,849 SMEs.

4. Results and discussions

The first module of questions provided *identification data of SMEs in relation to the county of registration, the environment in which the company deploys its activities, the field of activity and the number of employees.*

The analysis of data identified two categories of counties with totally opposed rates of representation; the best represented counties were: Cluj, Timis, Contanta, Brasov, Ilfov, Bihor, Prahova, while among the counties with the lowest representation we find: Covasna, Botosani, Ialomita, Calarasi, Vaslui; the capital city of the country, Bucharest, was situated among the well represented regions.

From point of view of the environment in which the subject deploys their activities, the SMEs indicated urban environment in proportion of 79.85%, the rest belonging to rural environment.

The best and the worst represented fields of activity, in decreasing order are presented in Table 1.

The analysis of data regarding number of employees indicated by the respondents presents a structuring of SMEs that puts on the first place small companies (number of employees between 10 and 50) with 62.21% of total, followed by micro-companies (with less than 10 employees) with 23.17%, while only 14.62% represented medium companies (with more than 50, but less than 250 employees).

Tabel 1: SMEs by field of activity

Field of activity	Percentage
The best represented	
Media, Printing	73.31%
Computers, Software, Communications, Office automation	72.60%
Marketing, Publicity	70.14%
Construction, Architecture, Design, Cadastre	69.86%

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Business services	67.60%
Motor vehicles, Transport equipment, Fuel	66.45%
Services-other activities	63.86%
Tourism, Hospitality, Restaurants	62.28%
Electrical machinery and appliances, Electronic equipment. Precision Instruments	61.54%
The worst represented (fewer than 35%)	
Industry - other activities	35.94%
Textile. Clothing	35.34%
Metallurgical Products	35.25%
Health care	32.73%
Glass, Ceramic	30.77%
Forestry, Logging and gathering of reed, Processing of timber. Pulp paper and paperboard	22.05%

The analysis of data resulting from the second module of questions revealed the following aspects:

- *Usage of open source vs. commercial solutions* points out non-users in the highest proportion (52.67%), followed by those who plan using open source solutions (36.30%), while only 11.03% declared themselves users of open source solutions (Figure 1).

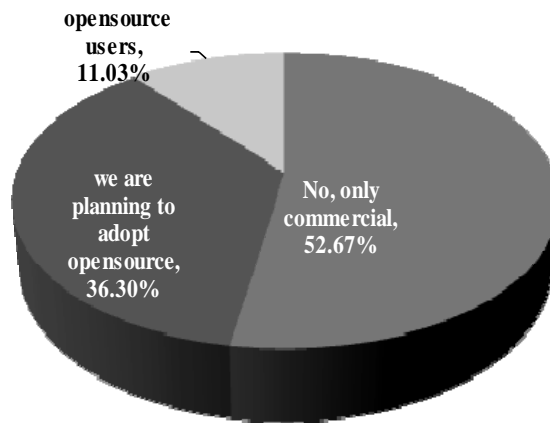


Figure 1. Usage of open source vs. commercial solutions

- Taking into account the proportion of *open source solutions used* by the respondents, most of them (49.12%) indicated non-usage of them, while 11.12% pointed out a lower proportion of used open source

solutions than that of commercial solutions; these respondents subscribe to the category of non-users of open source and to that of SMEs planning to adopt open source solutions in the future.

- The *category of open source users* indicated a usage of 100% of these solutions (10.6%) together with 29.09% who used more open source than commercial software.

- The *length of using open source solutions by SMEs* shows four types of users: users below 3 years, represented in the highest percentage (40.75%), followed by users between 3 and 5 years (29.34%), and then, having very close percentages, the groups of short term users, those who use these solutions for less than one year (14.02%) and the long term users, with over 5 years (15.89%) (Figure 2).

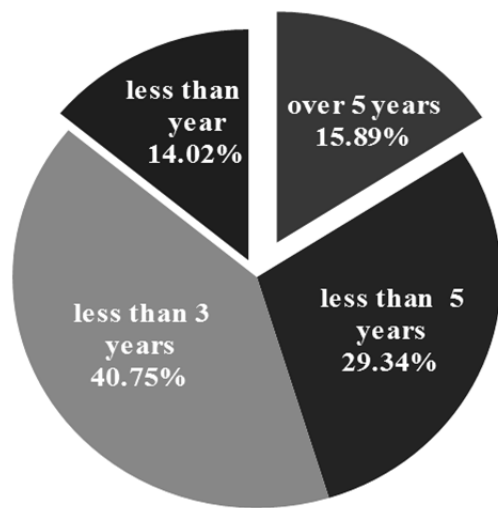


Figure 2. The length of using open source solutions

- The question related to *the existence of ICT staff specialized in using open source technologies in SMEs* indicates a percentage of 65.12% of SMEs having qualified IT staff; this very high percentage is surprising and it is not at all covered by SMEs using only open source and refers to SMEs with over 3 years of experience in using these solutions.

The data from the questionnaire's third module provides, after analysis, relevant information regarding:

- *The main categories of open source software actually used by SMEs in comparison to commercial software; from this perspective the analysis covered client and server operation systems, web servers, proxy servers, application servers, desktop applications, office applications, system tools, file management applications, multimedia applications; graphical and image management applications, Internet tools, statistical tools, others;*
 - *the image of the open source software categories used by SMEs, in decreasing order of percentages, is shown in Figure 3.*

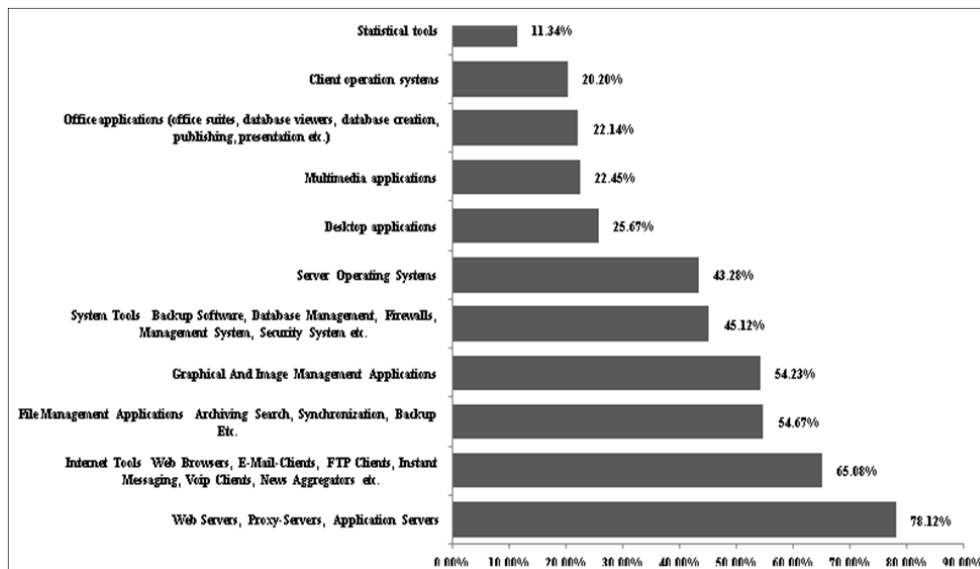


Figure 3. Open source software categories used

- *the most used categories of commercial software are indicated in Figure 4:*
 - *another aspect revealed by the data analysis refers the open source software categories in use ahead of commercial software;*
 - *in this area the following categories were indicated: Internet tools, File management applications, Web servers, Proxy servers, Application servers, System tools, Graphical and image management applications and Server operating systems;*

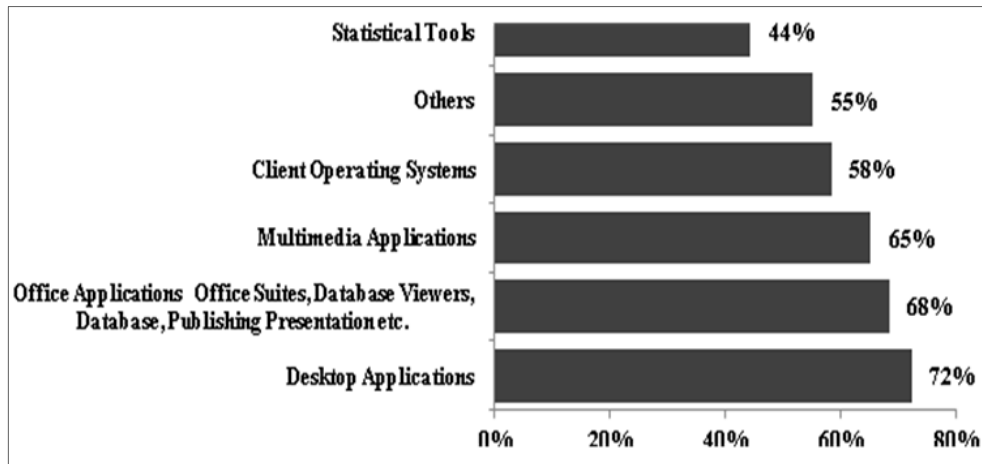


Figure 4. The most used categories of commercial software

○ the *comparison between the average percentages for using open source vs. commercial solutions* shows that commercial software categories were named as being used in a higher proportion (41.42%) ahead of open source (39.70%); however, it must be pointed out the fact that the difference between the two percentages is very small.

- The identification of *two specific classes of software solutions actually used by SMEs, from the same comparative perspective - open source vs. commercial*; in this context we considered business applications and software development applications;

- for the class of **business applications** the most important and most used applications were identified, as follows: Accounting software, Collaboration software, CRM (customer relationship management) software, e-commerce software, Groupware software, Invoice software, POS (point of sale) systems, Project management, Document management, Asset management, Business intelligence, ECM (enterprise content management) and portals, ERP (enterprise resource planning), HRM (Human resource management), Issue tracking, Others;

- the analysis of collected data for these *open source applications* puts in front of the list solutions of the following types: Collaboration software, Document management, ECM and portals, E-commerce solutions, Project management (Figure 5).

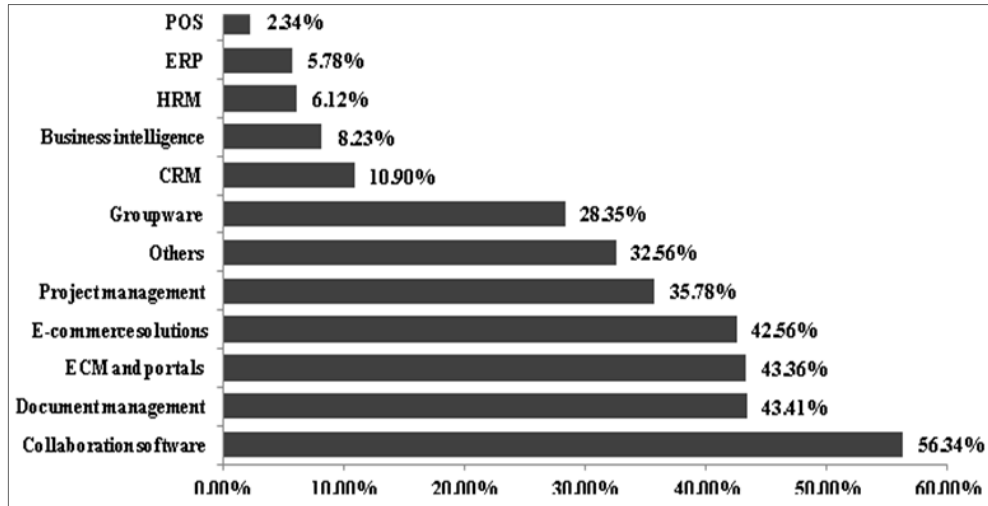


Figure 5. The most used open source business applications

o from *commercial software categories* the most used were the following solutions: POS systems, Accounting software, Invoices software, HRM, CRM software (Figure 6).

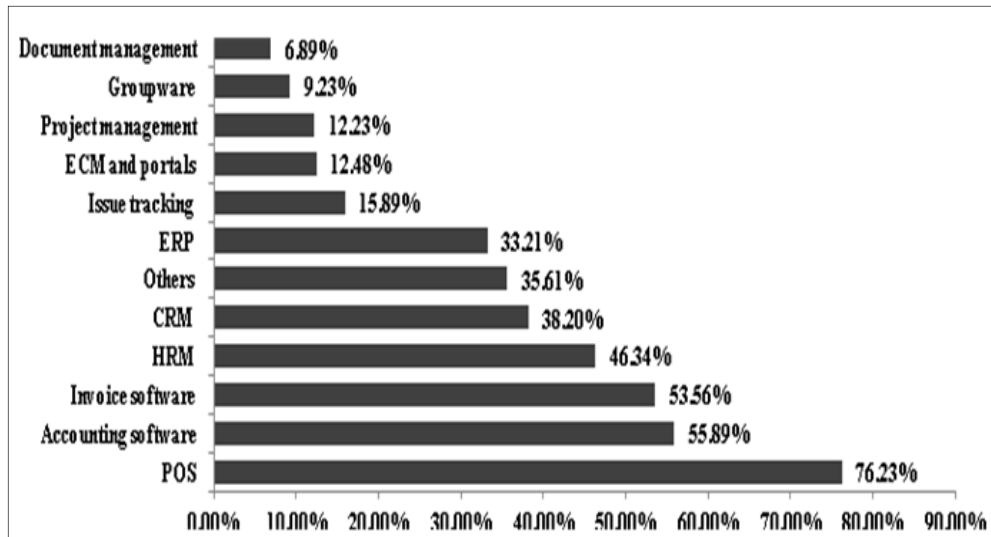


Figure 6. The most used commercial business applications

- *comparative analysis of open source software categories used ahead of commercial software* shows the following categories: Collaboration software, E-commerce software, Issue tracking, ECM and portals, project management, Groupware software and Document management;
- *the average of percentages* indicated for using open source business solutions is 22.78%, while for commercial software is 30.7%;
- an important difference is noticeable between the two figures, indicating a clear preference for commercial solutions for this class of applications;
- in case of the **second class**, that of **software development**, analysis of data concerned the most important software development tools, namely: Web Development (blog software, CMS, Social networking, text editors and IDEs, Web forums, Web frameworks, Web galleries, Webmail, etc.), App development (App frameworks, IDEs, Issue tracking, Programming tools, revision software, text editors, UML tools, etc.), Mobile development (frameworks, mobile tools, etc.), others;
 - this category indicates the prevalence of using open source solutions ahead of commercial solutions; thus, in the *open source category* the ranking based on percentages is as follows: Web Development 2.56%, App Development 79.23%, Mobile development 78.98%, others 76.43%, while in the *commercial category* the decreasing order of used development applications is: others 2.65%, Web Development 11.65%, Mobile development 8.94%, App Development 8.54%; the *comparison of average percentages of using open source development applications* (79.30%) is very high in relation to that of the commercial category (10.45%) (Table 2).

Table 2: Software development - comparative use

Product	OSS	Commercial
Web Development	2.56%	11.65%
App Development	79.23%	8.54%
Mobile App development	78.98%	8.94%
Others	76.43%	2.65%

- this result explains the fact that open source solutions are very common and used by ICT staff from companies, those who also have knowledge of these technologies and possess development abilities and

competencies; from here also results an important relationship between the existence of ICT staff in possession of development competencies and adoption of open source technologies in SMEs.

The analysis of the data collected from the answers to the questions forming the fourth module of the questionnaire put face to face *the advantages and the risks perceived by SMEs in the adoption of open source solutions*; respondents considered as the most important advantage zero costs related to acquisition, implementation, development and upgrading of the solutions (89.76%), while experimental use for innovation was indicated as the less important perceived advantage (23.89%) (Figure 7).

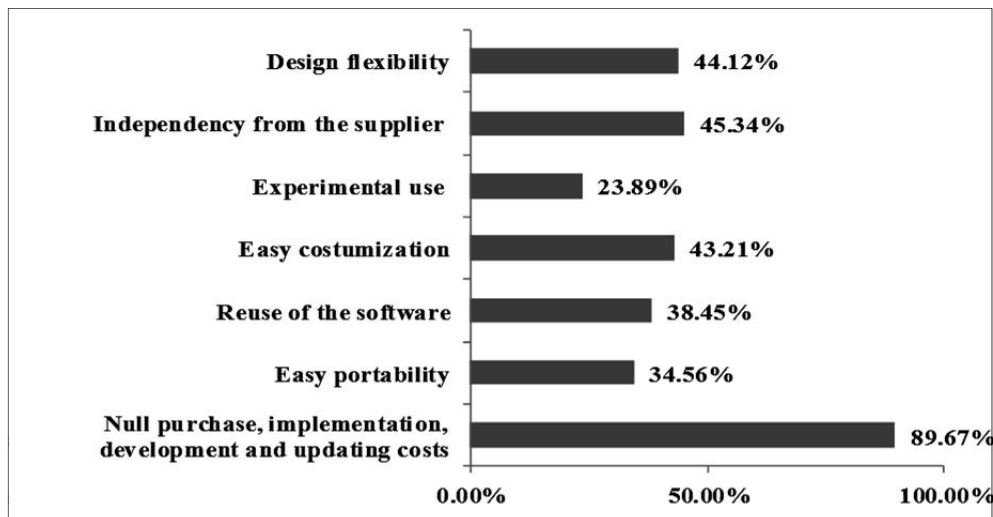


Figure 7. Advantages of adopting open source software

Within the category of *disadvantages perceived by SMEs* regarding the use of open source solutions the most important one was the requirement of specialized ICT staff and developers (43.24%), while the less important disadvantage was considered to be the lack of observance of intellectual property rights (12.45%) (Figure 8).

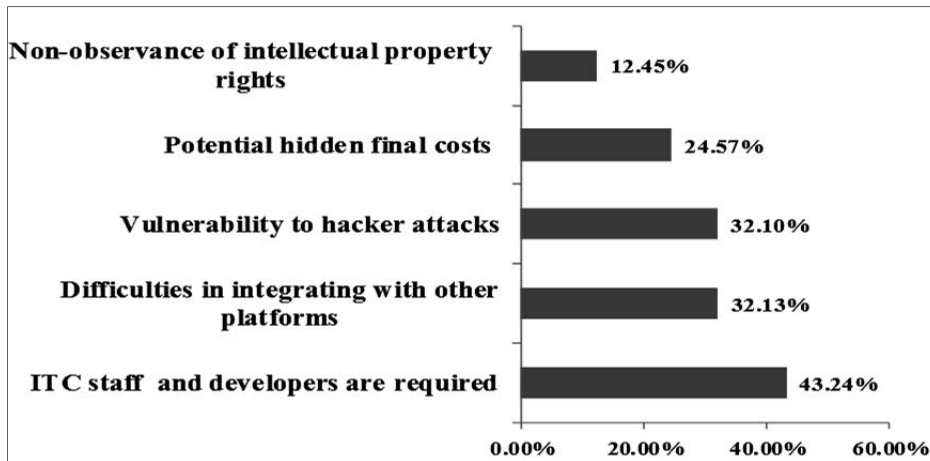


Figure 8. Disadvantages of adoption of open source software

The analysis of data resulting from the last module of questions highlights, on one hand, *the vision of SMEs related to adopting open source solutions vs. commercial solutions on short term (less than one year)*, on the other hand, prognosis of SMEs regarding future tendencies in the development of open source solutions; the percentage of those planning to adopt open source solutions on short term is prevailing (47.17%), followed by those remaining faithful to using only commercial software (40.26%); a very low percentage is identified as devoted users of open source solutions (12.57%) (Figure 9).

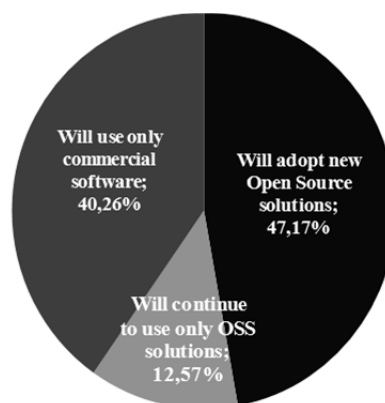


Figure 9. The short-term adoption of open source vs commercial solutions

The perception of SMEs regarding future development tendencies of open source vs. commercial software indicates the highest percentage for those optimistic about the development of open source (38.53%); very close percentage present companies considering that commercial software industry will maintain its dominance (37.34%); only 24.13% of respondents are convinced that open source solutions will dominate the software market (Figure 10).

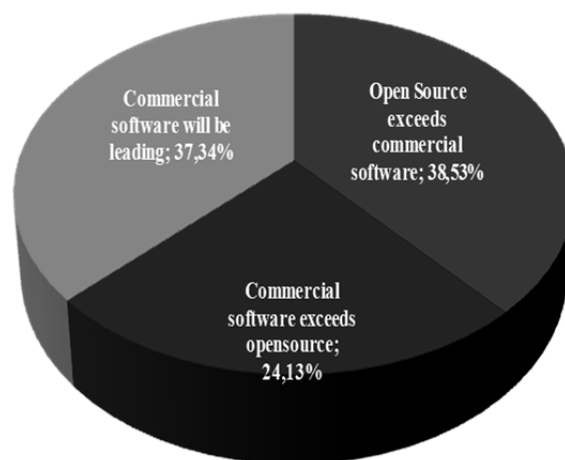


Figure 10. Future development trend of open source vs. commercial software

The data analysis results allow outlining *a profile of SMEs from the perspective of consumer of open source vs. commercial solutions*; the final consumer of compared software solutions is a micro-company registered in one of the following counties: Cluj, Timis, Contanta, Brasov, Ilfov, Bihor, Prahova, which:

- deploys its activities in urban environment in fields like Media, Printing, Computers, Software, Communications, Office automation, Marketing, Publicity, Construction, Architecture, Design, Cadastre, Motor vehicles, Transport equipment, Fuel Services-other activities, Tourism, Hospitality, Restaurants, Electrical machinery and appliances, Electronic equipment, Precision Instruments;
- is non-user of open source solutions, but plans to adopt this type of solutions, or already uses them;

- belongs to the category of users with less than 3 years of experience in using open source solutions;
- has ICT staff specialized on open source technologies;
- is an user of the following software categories: server and client operational systems, web servers, proxy servers, application servers, system tools, graphical and image management applications, file management applications, Internet tools; from open source business applications uses Collaboration software, Document management, ECM and portals, e-commerce software, project management, Groupware;
- indicated the main open source development tools used: Web Development, followed by App Development, Mobile development;
- stressed as a first advantage in adopting open source solutions considers the null costs of acquisition, implementation, development and upgrading of these solutions;
- identified the main disadvantage is the necessity of having specialized ICT staff and developers;
- will adopt open source solutions on short term and considers that the open source software will dominate the software market.

5. Conclusions

It is known the fact that in the dynamics of economic development both at national and at global level the SMEs sector may be considered as a very important driving factor and for its support and development medium and long term strategies are developed.

The research carried out had as starting point also this important aspect, supplemented by an extremely dynamic sector, the ICT industry in general, and software industry in particular; these industries contribute significantly to the support and development of global economy; as a consequence, using software solutions to support SMEs' activities should be considered as desirable for all companies aiming to maintain themselves on a globally competitive market.

From this perspective, the results of the present study can be considered useful for decision makers in SMEs, who should pay attention to the following aspects:

- The development of an ICT infrastructure adapted to present technologies and that will lead to the creation of a competitive advantage visible at local, regional and global level;
- To consider the aspects related to open source software solutions as a costless, flexible, viable and secure alternative to commercial solutions, and permitting, on one hand, reduction of costs, on the other hand, maintenance at high and continuously updated level of the software infrastructure;
- To consider the elaboration of correlated ICT development and HRM strategies, including the adoption of open source ICT solutions and using specialized ICT staff.

Regarding the categories of open source and commercial software providers, the results of the research provide useful information concerning the profile of potential consumers in SMEs, able to outline a new market segment that is very dynamic at local level as well as at global level; the software categories that remain uncovered with software solutions could be identified and become the target of the activities promoting open source or commercial software solutions.

The providers of open source software solutions can identify the important shortcomings in the SMEs' information level regarding open source solutions existing on the ICT market, and thus are able to develop information and presentation strategies of these solutions using online collaborative tools.

Commercial and open source software developers, based on the results of the present study, may identify ICT development trend, the rates of using commercial vs. open source solutions, perceptions and visions concerning the adoption of open source solutions that could represent important elements to be taken into account in software development tendencies.

Starting from the disadvantages and risks perceived by SMEs in relation to adopting OS solutions, there is a need for better information from the part of providers and developers to dissolve the fears of SMEs with sound arguments.

One of the risk factors perceived by open source software users is connected to security of these solutions; from this point of view, Craig-Wood Kate (2013), in a case study regarding the design of a hosting/cloud IaaS (infrastructure as a service) using only open source software tools, strengthens the fact that open source software solutions are more secure than the solutions offered on the software market.

Finally, but not in the least, open source communities can be considered final beneficiaries of this study, they being able to substantiate new information and awareness raising strategies directed to SMEs about aspects related to existing open source tools and solutions which can be adopted under very profitable and competitive conditions at global level.

The results of the study can also be considered as a set of elements useable by any person or company, having the role of raising awareness on the needs for information and efficient adaptation of any kind of human and economic activity to community and collaborative solutions of the open source industry.

Although the research can be considered very wide and laborious, it has its *limitations* related firstly to the difficulties in identifying complete and correct data on SMEs registered in Romania; this fact required a laborious web-mining activity and correlation of different information available for free in the digital environment. Another limitation can be correlated with the level of representativeness of the studied population at the level of the entire country, or at regional, or continental level. Taking into account these limitations, the exploratory character of the research, and the qualitative results obtained, large opportunities of research extension are opened from geographical point of view, at the level of larger regions. The results of the research can also be used in comparative analysis concerning similar aspects from other countries, also allowing further detailing the research on classes and types of software solutions which make the object of present and future technological trends.

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