Aspects of Accounting Cost for Development of Customized Software Products

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Abstract

In today's context, marked by digitization and the development of information technology, one of the topics that needs to be addressed is the "costs of software development". This study investigates the evolution of scientific production related to the research topic based on descriptive and bibliometric analysis of selected articles on Web of Science and EBSCO, thus continuing existing research in the field. The importance of this theme is due to the increasing interest of entities to use customized software products that help them to achieve the desired results. The scientific approach is based on information from national and international literature and practice and various electronic sources. It has been shown that the development costs of custom software depend largely on the number of technical resources, the number and complexity of software product features and design patterns. Therefore, accurate estimation is impossible without prior analysis of the software design, business objectives and cost factors.

Key words: accounting cost, customized software products, IT sector
J.E.L. classification: M41, L86

1. Introduction

Today's economic activities are characterised by extensive processes of reform, digitalisation and globalisation. The development of information technology is becoming increasingly sophisticated and widespread in the activities of entities. The adoption of new technologies can be a turning point for entities. They must therefore continue to modernise their IT infrastructure to remain competitive and relevant. In this context, the success of entities depends to a large extent on the coordination of the work of its subdivisions, on the competence and professionalism of the collaborators, on the quality of the means and tools for automation and management of the entity's resources. Entities can therefore rely on various standard or customised solutions, so that they can be easily integrated into their work.

The literature and business practice point to the application of various automated solutions for managing entity resources: soft Business - on demand (Wren and Storey, 2002), Customer Relationship Management (Kyrylieva et al., 2023), Enterprise Resource Planning (Bruenninghaus and Redeker, 2023), (Butarbutar et al., 2023), (Barna and Ionescu, 2023), custom intranet system, custom management solutions (Driessen et al., 2023), etc. Therefore, custom software development requires an individual approach (Turevska and Shubin, 2015), and the issues presented involve reflection on IT research and business practice.

From this point of view, custom software development costs depend largely on a large number of technical resources, the number and complexity of software product features and design patterns. This contributes significantly to how custom software is recognised, valued and accounted for. Therefore, correct estimation is impossible without a prior analysis of the software project, business objectives and cost factors such as the type of development (custom, low-code or platform-based) and the software development team, which contribute to the quality of the software developed. We note that workers in this field have to consume certain intellectual resources, which in practice are based on creativity, a mental and social process involving the generation of new ideas or concepts, or new associations of the creative mind between existing ideas or concepts. At the same time, professional skills are required with reference to those who design and develop software, databases, system engineers and system administrators, network engineers, web designers, graphic designers, design engineers etc.

Respectively, the generated changes are not sufficiently addressed from an accounting point of view, as there are issues related to the recognition and valuation of IT products and services, the selection of a relevant costing method, the correlation of cost of sales with related revenue in the context of research, development, experimentation, delivery and consumption processes, etc. (Cojocaru et al., 2023).

Since software products are the result of a research and development process, the need to determine the cost of production arises, at which point several questions arise: how the cost of software products is formed, what calculation method is relevant to use, what is the composition of the costs, what are the most relevant bases for allocating indirect costs relating to software development, etc. Economic practice in the IT field shows that the cost of software products is predominantly due to salary costs, which represent the remuneration of each employee involved in several contracts for research, development and development of software products in one and the same management period. In this context, arising from the concurrent participation of employees in various research and development projects for software products, the problem of the distribution of personnel costs arises.

The importance of this topic is driven by the growing interest of entities in all business areas to use customised software products to help them achieve the desired results. Therefore, the above circumstances confirm the topicality of the investigated topic and impose the necessity of examining the issues of software product accounting and its improvement in accordance with the current development trends of entities in the field, since there is currently no exhaustive research on the research topic.

The scientific approach is based on information from the literature and practice of the field, for the realization of the work, reference books in the field and other related disciplines, articles and studies published in specialized journals and volumes of scientific conferences, specific legislative regulations, specialized dictionaries, as well as various electronic resources. Elements of comparison, analysis and inference were applied to the exposition of the material. In order to identify the degree of international scientific research in the field of software development costs, the Web of Science and EBSCO search engines were used.

The purpose of this paper is to highlight the theoretical and practical aspects of software development costs and to emphasize their relevance in determining the cost of developing a software package. The objective of this research is to analyse the current situation regarding the composition of production costs in the IT field, their description, how they are allocated and included in the cost, as well as a practical aspect regarding the accounting of costs related to the development of custom software based on various contracts concluded with beneficiaries.

In the following sections of the paper we will present the main ideas from the literature on custom software devolution costs, the research methodology, data processing and analysis, and the final conclusions of the study, limitations and future research directions.

2. Literature review

In a concise, selective way, the current state of knowledge at international as well as national level will be highlighted below. In the context of the evolutionary aspects, software production faces a number of specific challenges, generated by changing technologies and the central role of information technology support to any economic activity. The term software is used generically for any computer program in any field in order to define the computer applications used to command and control any electronic system [5]. Therefore, addressing software development costs and accounting issues requires studying the technological process of software product development and its peculiarities.
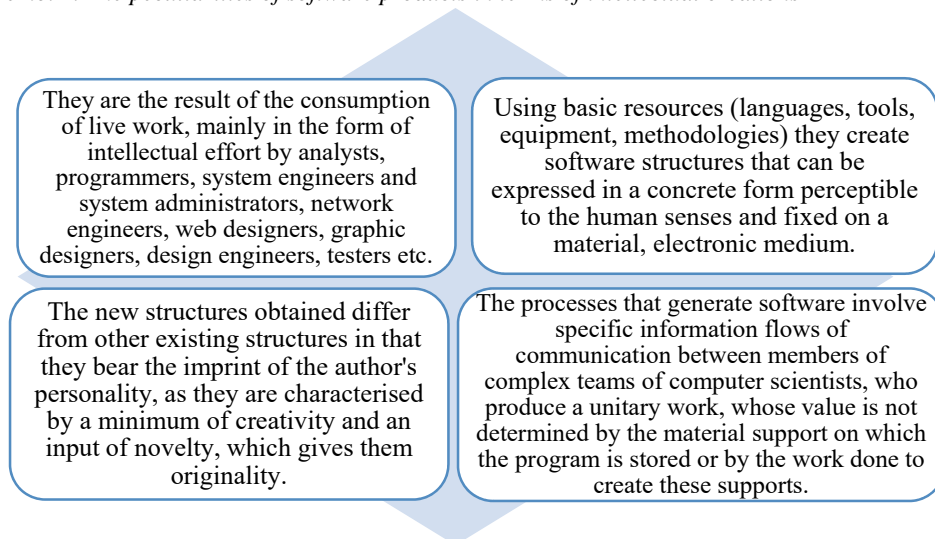
We note that studying the cost of software development is an important issue for both academic and commercial circles, "software production has a relatively short history, dating back to the 1970s and 1980s, since manufacturers of hardware products realised that they had relatively lower costs in producing software compared to producing computers and circuits. Initially software production came as a necessity to ensure the functionality of hard products, later they were separated as an independent activity" (Țurcanu, 2018).

According to Majid Aramand (2008), "high-tech products are characterized as having short life cycles and being state-of-the-art because they are affected by changes in the software industry and the requirements of software users in various industries".

The literature indicates that "conventional estimates could significantly increase the development costs of software products. Therefore, the evolution of automated analysis techniques allows requirements modelling and analysis to be done formally, quickly and automatically, avoiding the mistakes made by animosity between developers and users, thus saving a lot of time and manpower. Thus, experiments have shown that the algorithm called Intelligent Planning based Requirement Analysis (IPRA) can obtain a complete planning domain and convert it into the requirements specification of each developed software product" (Zhang, 2016). At the same time, there are software applications that manage and keep track of the tasks performed by the employees of IT entities, generate reports and evaluate what work was done by it on each particular order, what is the budgeted time to perform it, how much time was actually used (Cojocaru and Bădicu, 2022).

Studies in the literature approach software products in terms of the requirements of an intellectual creation, as shown in Figure no. 1, which is the subject of copyright.

Figure no. 1. The peculiarities of software products in terms of intellectual creations

They are the result of the consumption of live work, mainly in the form of intellectual effort by analysts, programmers, system engineers and system administrators, network engineers, web designers, graphic designers, design engineers, testers etc.

Using basic resources (languages, tools, equipment, methodologies) they create software structures that can be expressed in a concrete form perceptible to the human senses and fixed on a material, electronic medium.

The new structures obtained differ from other existing structures in that they bear the imprint of the author's personality, as they are characterised by a minimum of creativity and an input of novelty, which gives them originality.

The processes that generate software involve specific information flows of communication between members of complex teams of computer scientists, who produce a unitary work, whose value is not determined by the material support on which the program is stored or by the work done to create these supports.

Source: Own interpretation after (Norris et al., 1993)

In this context, we note that for the development of a computer application, materialised by a software product and a database, the social relations created in relation to software products and databases, as results of individual or collective creative work carried out by individuals or in processes developed by legal entities, are governed by the legal rules in the field of intellectual property, more specifically in the field of copyright.

Some authors (Phongpaibul and Aroonvatanaporn, 2015) treat "software development characteristics and costs as unquantifiable due to the abstract nature of software. Therefore, current software estimation methodologies may open up areas for corruption because estimated budgets and costs are difficult to verify and validate".

Beydeda (2005) is of the opinion that optimizing software development costs is to reuse existing software products. In his view, reuse has the potential to reduce costs, but this reduction must be set against the risks inherent in third-party software, such as complexity, which can complicate testing or the unavailability of information needed for testing.

Another topic covered in the literature is the quality of software products. "Marking duplicate errors in bug report data has the significance of reducing software development effort and costs. To remedy this situation, the authors discovered some elements in bug report data that lead to high quality services" (Chen et al., 2016.).

The studies show that "the methods proposed by theorists for assessing software development costs are not applicable in practice due to various unpredictable factors such as depression, which can affect the software development budget, changes in computer technology, which can affect the cost of software development, and software adoption, which is a different concept from management, which can affect an entity's willingness to invest in software development. On the other hand, it is hoped that the cost of software development can be properly controlled by considering several requirements" (Huang et al., 2005).

In this context, Liu (2009) considers that the Earned Value Method is an internationally recognized project management tool for tracking software progress. A method to track the software development progress based on the earned value analysis and use case point was proposed, and an experiment had been undertaken, which proved the effectiveness of this method to monitor and control the areas of schedule and costs of software development (Liu, 2009).

Software development and development is characterised by a pronounced immateriality of the products produced, which leads to major difficulties in estimating development costs, the degree of completion of an intermediate or final product. The assessment risks in this respect have consequences for the timeliness of software completion and the quality of the software product.

3. Research methodology

Our gool is to identify the extent of international scientific research in the area of software development costs using scientific articles dealing with this topic. In order to quantify the results, the authors used a bibliometric analysis of selected articles from the Web of Science and EBSCO platform, using the keyword "costs of software development" requesting that this phrase be included in All Fields. The selection of the reference period was based on the availability of research data at the time of the study.

Descriptive analysis was used to analyse the information extracted from the Web of Science database: main topics; years of publication; countries of publication; citations. The sample consisted of 24 articles relevant on the Web of Science platform for the subject of the paper, published between 1992-2023. Most articles were produced in 2015 - 3 articles and 2016 - 4 articles. The most citations were in the year 2022 in the number of 10. We mention that the first scientific paper addressing in its subject "costs of software development" is published in the year 1992, and in the year 2023, there are 2 scientific papers published in WoS on this topic. Following the analysis of the variation in the number of publications, it is appropriate to investigate the geographical location of their authors. Thus, the most productive countries in terms of publication rate on the topic "costs of software

development" are China (6), the United States of America (3), whose authors published articles, and Germany, Italy and Taiwan (2 scientific papers each). The general results generated by the analysis of the Web of Science data are shown in Figure no. 2.

Figure no. 2. Evolution of publications with the topic "costs of software development" in the years 1992-2023
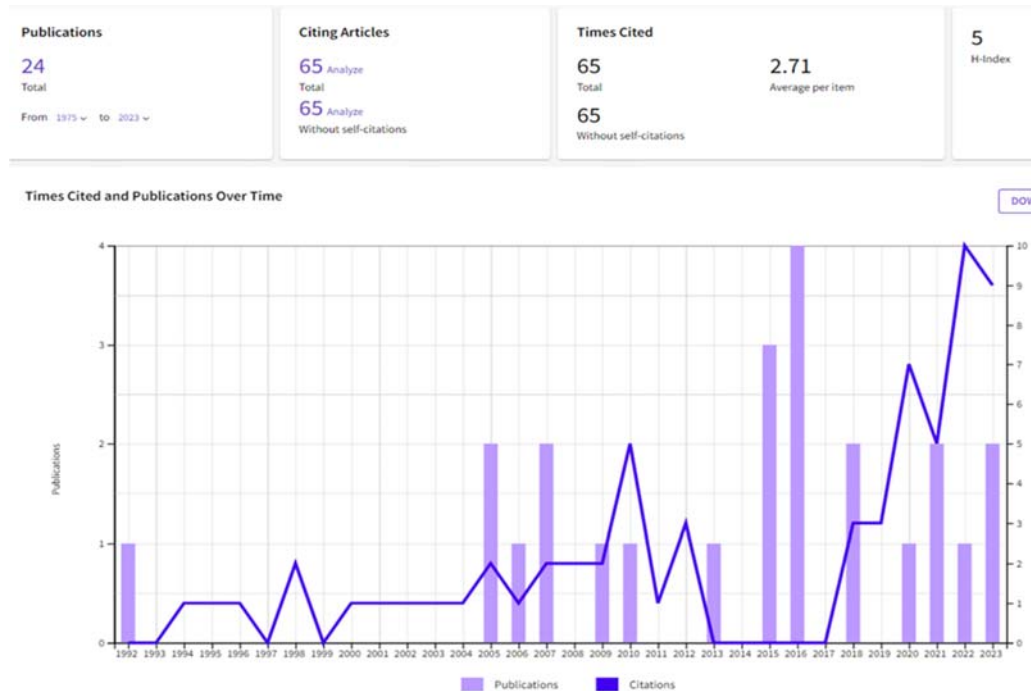
Source: Data processing from Web of Science

Our research carried out on the EBSCO platform consist on 16 scientific papers published between 1996 and 2019 in 5 sources. The first scientific paper that addresses in its subject "costs of software development" is published in 1996, and in 2023, there is no scientific paper published in EBSCO on this subject.

Figure no. 2. Evolution of publications in EBSCO with the topic "costs of software development" in the years 1996-2019
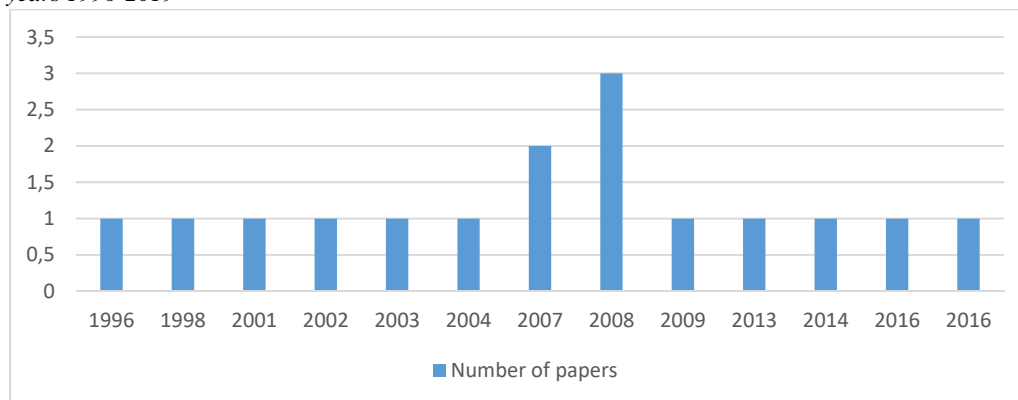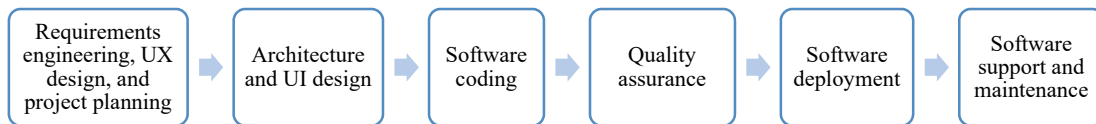

Source: EBSCO data processing

Considering the articles selected to substantiate the theoretical basis of the present article, the authors concluded that the year-on-year evolution on both platforms is slow and uneven, and the number of papers indicates the interest of international researchers, as there is a positive upward trend.

4. Findings

As mentioned, the costs of custom software development depend largely on a large number of technical resources, the number and complexity of software product features and design patterns, as they require an individual approach.

Thus, the software development process, referred to as the "software development lifecycle", can be separated into several different stages that support the design of software to meet business requirements. Before the software engineering team can come up with the general idea for any software, it is essential that they gather the business requirements and write down the exact requirements needed for any software. Figure no. 3 shows the stages of software product development.

Figure no. 3. Steps in software development

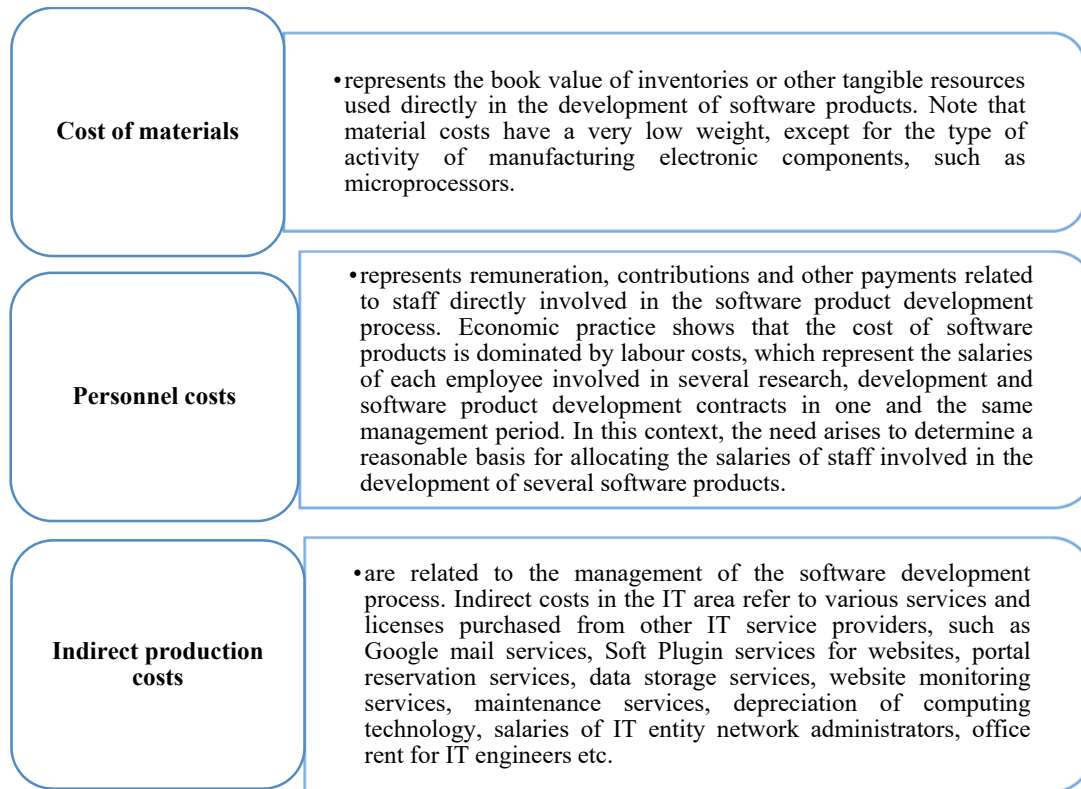| Requirements engineering, UX design, and project planning | → | Architecture and UI design | → | Software coding | → | Quality assurance | → | Software deployment | → | Software support and maintenance |

Source: based on data [15]

So, in the first stage, the project team will analyse the consumer entity's requirements, existing processes and software and plan the software features. Then it will prepare the design, create the project roadmap, develop the budget and potential project risks. In the design phase, the team transforms the requirements specification into a specific technology stack, which contains the technical design and UI software design. Back-end developers write server-side code and APIs and conduct unit tests. Front-end developers turn static user interface mockups provided by UI designers into fully functional GUIs. In the quality check phase, the team checks whether the software meets the specified functional and non-functional requirements and reports defects found, if any. In the implementation phase, the team makes the software available for use, which may include installation, customisation, user acceptance testing, creation of user guides and user training. Software support and maintenance includes fixing errors that occur after the software is delivered to end users.

Custom software development requires the application of cost accounting and job costing. If the contract term does not exceed 12 months, the parties may negotiate the payment of the R&D work related to the software development on a full (one-off) or instalment basis, or with advance payment. Where the time limit for execution of the work exceeds 12 months, the parties may negotiate payment for the work in stages. After completion of the development work, testing and trial of the software in progress, the parties shall draw up a Receipt and Delivery Certificate for the work carried out. The beneficiary of the order on the basis of this document becomes the exclusive owner of the software developed. A problem inherent in the development of software products is that the development process can take from a few months to two years or more. In some cases the initial contract period may be extended. In this context, it is necessary to determine and present information on costs accrued at the time of the milestone reporting.

The composition of IT cost items is shown in Figure no. 4.

Figure no. 4. Description of software development costs

Cost of materials	• represents the book value of inventories or other tangible resources used directly in the development of software products. Note that material costs have a very low weight, except for the type of activity of manufacturing electronic components, such as microprocessors.
Personnel costs	• represents remuneration, contributions and other payments related to staff directly involved in the software product development process. Economic practice shows that the cost of software products is dominated by labour costs, which represent the salaries of each employee involved in several research, development and software product development contracts in one and the same management period. In this context, the need arises to determine a reasonable basis for allocating the salaries of staff involved in the development of several software products.
Indirect production costs	• are related to the management of the software development process. Indirect costs in the IT area refer to various services and licenses purchased from other IT service providers, such as Google mail services, Soft Plugin services for websites, portal reservation services, data storage services, website monitoring services, maintenance services, depreciation of computing technology, salaries of IT entity network administrators, office rent for IT engineers etc.

Source: Own interpretation

In the following, we aim to exemplify the software product development process from an accounting point of view, taking into account the stages of the software process and the problematic aspects.

Case study 1.

IT entity develops two software profuct "001" and "002". According to the contracts concluded with the beneficiaries the income from the development of the software "001" will be 450,000 monetary units and of the software "002" - 95,000 monetary units. At the beginning of December 202x the cost of the development in progress for software "001" was 125,000 monetary units. In December 202x the entity incurred indirect software development costs totalling 63,990 monetary units, of which:

    - amortisation of fixed assets - 29,700 monetary units;

    - utilities - 13,650 monetary units,

    - office rent - 10,500 monetary units,

    - other costs - 10,140 monetary units.

Personnel costs involved in software development in December 202x totalled 112,300 monetary units, of which:

    - employee 1 - 33,800 monetary units,

    - employee 2 - 45,600 monetary units,

    - employee 3 - 32,900 monetary units.

On 31.12.202x the development work on the "002" software was completed and handed over to the beneficiary. The coefficients of participation of each employee in the development of software "001" and "002" determined on the basis of the software application that manages the record of tasks performed by employees, is shown in Table no. 1.

Table no. 1. Breakdown of salary according to the degree of involvement of each employee in software development

Employees	Salary, monetary units	Software 001		Software 002	
		Participation quota,%	Sum, monetary units	Participation quota,%	Sum, monetary units
1	2	3	4 = 2×3/100	5	6 = 2×5/100
Employee 1	33,800	45	15,210	55	18,590
Employee 2	45,600	30	13,680	70	31,920
Employee 3	32,900	60	19,740	40	13,160
Total	112,300	X	48 630	X	63,670

Source: Own interpretation

In accordance with accounting policies, the basis for allocating indirect production costs has been determined on the basis of sales income for each individual contract. On the basis of the data presented it is necessary to make the following calculations (Table no. 2).

Table no. 2. Breakdown of indirect costs by sales revenue per contract, monetary units

Indicators	Distribution coefficient	Software 001	Software 002	Total
1	2	3 = 2 × 450,000	4 = 2 × 95,000	**5**
Income from sales	X	450,000	95,000	545,000
Amortisation of fixed assets	29700÷545000 = 0,05449541284	24,523	5,177	29,700
Communal services	13 650÷545000 = 0,02504587155	11,271	2,379	13,650
Location of the office	10 500÷545000 = 0,01926605504	8,670	1,830	10,500
Other costs	10 140÷545000 = 0,01860550458	8,372	1,768	10,140
Total indirect costs	X	52,836	11,154	63,990

Source: Own interpretation

On the basis of the data in Table no. 2 for each component of indirect production costs, the respective allocation coefficient was determined. On the basis of the above calculations in the entity's accounts, the actual calculation of the software, Table no. 3, will be prepared.

Table no. 3. Effective calculation of software developed, monetary units

Nr.crt.	Elements of cost	Software 001	Software 002
1.	Cost of work in progress of software 001 at the beginning of the period	125,000	x
2.	Salaries calculated for software development	48,630	63,670
3.	Calculated social security contributions (24%)	11,671	15,281
4.	Share of indirect software development costs:	52,836	11,154
	a) Amortisation of fixed assets	24,523	5,177
	b) Communal services	11,271	2,379
	c) Location of the office	8,670	1,830
	d) Other costs	8,372	1,768
5.	Actual cost of the finished software (2+3+4)	x	74,842
6.	Actual cost of software in progress (1+2+3+4)	226,466	x
7.	Income from software delivery	x	95,000
8.	Profitability of sales, %	x	21,22

Source: Own calculation

Based on the data in Table 3, it appears that the software "002" was completed during the reporting period and its cost was charged to the period expenses (cost of sales), while the software "001" will be reflected in the balance sheet at the cumulative cost of 226 466 lei as work in progress. Once the work related to the development of the software products has been completed, the IT entity draws up the invoice and the minutes of receipt-delivery of the work carried out. Payment for development work is usually made by applying an advance payment in advance or full payment after completion of the software development work.

5. Conclusions

This research confirms the low level of research in the field of "costs of software development", but with a positive trend of growth from year to year, demonstrated by discrete and bibliometric analysis of selected articles from the Web of Science and EBSCO platform. The studies carried out in the literature approach software products through the prism of the requirements of an intellectual creation, including professional skills with reference to those who design and develop software, databases, system engineers and system administrators, network engineers, web designers, graphic designers, design engineers, etc.

At the same time, it has been shown that custom software development costs depend largely on a large number of technical resources, the number and complexity of software product features and design patterns. This contributes significantly to how custom software is recognised, valued and accounted for. Therefore, correct estimation is impossible without prior analysis of the software design, business objectives and cost factors.

A limitation of this work is the small number of papers in this area, although the extent of use of software products has grown rapidly. Also, this paper leaves much room for further research in the area of software product development costs, focusing on other aspects than just the costs of custom software development under various contracts, which could have a significant impact.

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