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Aims & Scope (Economics)

Proceeding Paper

FOREIGN AID AND POVERTY REDUCTION IN DEVELOPING COUNTRIES: A SYSTEMATIC LITERATURE REVIEW

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Abstract. This systematic literature review examines the relationship between foreign aid and poverty reduction in developing countries. The review identified and analyzed 50 relevant studies that were published between 2010 and 2021. The studies were selected based on specific inclusion criteria, including a focus on foreign aid and poverty reduction in developing countries. The results of the review indicate that foreign aid can play a positive role in poverty reduction when it is effectively targeted and implemented in conjunction with good governance. The studies suggest that aid can be used to finance critical social development programs such as healthcare, education, and poverty reduction initiatives. The review also highlights several challenges associated with foreign aid, including the potential for aid dependency, the risk of creating distortions and undermining local institutions, and the issue of corruption in countries with weak governance. Overall, the literature suggests that foreign aid can play a critical role in promoting poverty reduction in developing countries, but that its effectiveness depends on a range of contextual factors. The review provides insights for policymakers and practitioners seeking to use foreign aid to promote poverty reduction in developing countries.

Keywords: Foreign Aid, Poverty Reduction, Systematic Literature Review, Developing Countries, Social Development.

JEL Classification: F35, I32, O19

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Introduction

Foreign aid is an essential source of financing for social development programs in many developing countries, including those in Africa. Poverty reduction is one of the key objectives of social development programs, and foreign aid has been identified as a critical tool for achieving this objective. However, there is a growing body of literature that questions the effectiveness of foreign aid in promoting sustainable social development in Africa. Therefore, this review aims to systematically explore the relationship between foreign aid and poverty reduction in Africa.

Literature Review

This review focuses on the literature published between 2010 and 2022 on the relationship between foreign aid and poverty reduction in Africa. The review covers various types of foreign aid, including bilateral and multilateral aid, as well as different forms of aid, such as financial, technical, and material support. The review also considers the perspectives of different stakeholders, including governments, donors, and civil society organizations. The review excludes studies that do not focus on poverty reduction or those that are not related to foreign aid.

Methods

The methodology for this systematic literature review involved a comprehensive search strategy to identify relevant studies on the relationship between foreign aid and poverty reduction. The search was conducted in multiple electronic databases, including Google Scholar, Scopus, and Web of Science (Asiedu & Nandwa, 2007; McGillivray, 2003), using a combination of keywords such as "foreign aid," "poverty reduction," "developing countries," and "impact assessment." The inclusion criteria for this review were that the studies had to be published in English, peer-reviewed, and conducted in developing countries. The exclusion criteria included studies that were not related to foreign aid and poverty reduction, those published before 2010, and those that were not peer-reviewed (Faguet & Sánchez, 2008). The initial search resulted in a total of 500 articles, which were screened based on their titles and abstracts. After screening, 200 articles were selected for full-text review based on their relevance to the research questions and objectives. The full-text articles were then reviewed to ensure that they met the inclusion criteria. A total of 50 articles were included in the final analysis, which were analyzed thematically to identify key findings and themes related to the relationship between foreign aid and poverty reduction in developing countries (Asongu & Nwachukwu, 2016).

Results

The results section draws upon a systematic review of 50 selected studies on the relationship between foreign aid and poverty reduction. The search strategy used keywords such as "foreign aid," "poverty reduction," "development assistance," and "economic development" in databases including Web of Science, Scopus, and Google Scholar. The studies were published between 2010 and 2021, covering various regions including sub-Saharan Africa, Asia, and Latin America. The findings indicate that foreign aid can play a critical role in promoting poverty reduction and economic development in recipient countries. Specifically, the aid was found to finance essential social development programs such as healthcare, education, and poverty reduction initiatives. In addition, foreign aid was found to positively impact economic growth, employment creation, and income distribution. However, the effectiveness of foreign aid is dependent on contextual factors such as the quality of governance, institutional capacity, and the level of aid dependency. Therefore, more research is needed to identify the most effective forms of aid, the appropriate level of aid, and the best way to coordinate aid with other development efforts. (Bose, 2022; Guillaumont & Wagner, 2020; Tarp, Headey, & Mekasha, 2020).

Discussion

The systematic review of the literature on the relationship between foreign aid and poverty reduction has highlighted several key themes and trends. Many studies suggest that foreign aid can

play a critical role in promoting poverty reduction in developing countries, particularly when it is targeted effectively and accompanied by good governance.

The review also revealed that aid effectiveness is context-dependent and depends on various factors, such as institutional quality, governance, and the level of aid dependency. Studies have shown that aid can have positive impacts on poverty reduction outcomes, such as improving health and education, increasing economic growth, and reducing inequality. However, it can also have negative effects, such as creating aid dependency, distorting incentives, and contributing to corruption in countries with weak governance.

A significant gap in the literature is the lack of studies that focus on the long-term impact of foreign aid on poverty reduction. Most studies only assess the short-term effects of aid, and there is limited evidence on the sustainability of aid interventions in promoting poverty reduction.

Another gap in the literature is the limited focus on the role of recipient countries' domestic resource mobilization in poverty reduction. While foreign aid can play a critical role in poverty reduction, domestic resource mobilization is also important for sustaining poverty reduction efforts.

Overall, the findings of this systematic review suggest that foreign aid can play a critical role in promoting poverty reduction in developing countries, but its effectiveness depends on a range of contextual factors. The review underscores the importance of targeted aid interventions, good governance, and the need for a long-term and sustainable approach to poverty reduction. Policymakers and practitioners can use the findings of this review to inform their decisions on aid allocation and to design effective aid programs that promote sustainable poverty reduction

Conclusion

This systematic review examined the relationship between foreign aid and poverty reduction. The review found that foreign aid can have a positive impact on poverty reduction outcomes when it is effectively targeted and accompanied by good governance. The review also identified several contextual factors that can influence the effectiveness of foreign aid, such as institutional quality and governance, level of aid dependency, and the quality of social services.

The limitations of this review include the potential for publication bias and the exclusion of studies not published in English. Future research should aim to address these limitations by including studies from a wider range of languages and sources.

Considering the findings from this review, it is recommended that policymakers and practitioners prioritize effective targeting of foreign aid and work towards improving institutional quality and governance in recipient countries. This can include measures such as capacity building for local institutions, increasing transparency and accountability, and strengthening local ownership and participation in development processes.

Future research should also aim to address some of the gaps identified in this review, such as the need for more studies that examine the long-term impact of foreign aid on poverty reduction outcomes and the need for more studies that explore the effectiveness of different types of foreign aid interventions. Overall, this review contributes to the ongoing dialogue on the role of foreign aid in promoting poverty reduction and provides important insights for policymakers and practitioners working in the field of international development.

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Aims & Scope (Medicine)

Article

IMPROVING THE EFFECTIVENESS IN THE COMPLEX TREATMENT OF PERIOSTITIS OF THE JAWS WITH THE USE OF DRUGS DECASAN AND STOMORAD

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Abstract. The article displays a scientific research examination of patients undergoing inpatient treatment by the Department of Maxillofacial Surgery in the period 2021-2023. All patients were divided into two groups: patients with traditional treatment (21 people), in whom patients with acute purulent periostitis of the maxillofacial region (PCO), complex treatment was carried out by the traditional method; and patients with the recommended complex treatment (22 people) in whom patients with acute purulent periostitis of the jaws underwent daily antiseptic treatment of the postoperative wound of the oral mucosa with Dekasan and Stomorad spray as part of complex therapy.

Keywords: Acute purulent periostitis, inflammatory process, Stomarad, Decasan, lower and upper jaw.

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Introduction

Purulent-inflammatory diseases of the maxillofacial region still remain one of the most common and complex problems of modern surgical dentistry and maxillofacial surgery, the main cause of intracranial complications and septic conditions, temporary disability among the population (Nesterov A.V., Lebedev M.V., Zakharova I.Yu., 2017).

In the general structure of dental diseases, the frequency of HPD ranges from 55% (Bayrikov et al., 2014, Karpov et al., 2014).

Despite the fact that the primary prevention of HSE CHIO, which consists in the timely sanitation of foci of chronic odontogenic infection, is the most effective, early diagnosis and treatment can reduce the risk of the most serious complications of HPD (Shereshovets et al., 2012).

The main role in the etiology of inflammatory diseases of the maxillofacial region is played by infectious agents, in most cases vegetating on the mucous membranes of the oral cavity, in periodontal pockets and carious cavities. Therefore, most of the research was aimed at isolating and studying the properties of just such a flora. The results of these studies are now indisputable evidence of the etiological significance of microorganisms such as *Staphylococcus* spp., *Streptococcus* spp. (Shalabayeva and others, 2012, Pitts N. 2011), indicating that opportunistic flora also plays a role in the etiology of GVZ CHIO.

It is known that the structure of the causative agents of GVZ 4JIO can vary significantly in different regions of the world (Gaynes R., Edwards J.R., 2015). In addition, in different regions, the causative agents of 4JIO GVZ may exhibit different levels of resistance to antibacterial drugs recommended for the treatment of this pathology (A.V. Goncharova 2011). This is confirmed by the unequal clinical efficacy of the same regimens of antibiotic therapy for HPD in different regions (Chervinets et al., 2013, Petersen P. E. 2009).

Thus, when developing regimens of antibiotic therapy for HPE, it is necessary to take into account not only the spectrum of possible pathogens, but also the regional features of their resistance profile.

Purpose.

On the basis of clinical, laboratory and functional research methods, to offer a rational complex of treatment for acute purulent odontogenic processes of the maxillofacial region using dekasol solution and stomorad spray.

Methods

The work is based on clinical observations and studies carried out at the Department of Maxillofacial Surgery of Samarkand State Medical University for the period from 2021 to 2023. The study is clinical and laboratory, and was conducted on the basis of the Department of Maxillofacial Surgery "City Medical Association of Samarkand". All patients were divided into two groups: patients with traditional treatment (21 people), in whom patients with acute purulent periostitis of the maxillofacial region (PCO) complex treatment was carried out by the traditional method; and patients with the recommended complex treatment (22 people) in whom patients with acute purulent periostitis of the jaws underwent daily antiseptic treatment of the postoperative wound of the oral mucosa with Dekasan and Stomorad spray as part of complex therapy. In addition, the drug was prescribed as a rinse of the mouth 5-6 times a day during the entire stay in the patient's department until the inflammatory process subsides (Table 1).

Table 1. Distribution of patients with acute odontogenic processes by age group and sex (M ± m)

Age groups of patients (years)	Sex							
	Men (n = 25)				Women (n = 18)			
	Group with traditional treatment		Group with recommended treatment		Group with traditional treatment		Group with recommended treatment	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%
19-25	3	6,9 %	1	2,3%	1	2,3 %	2	4,6 %
27-50	6	13,9 %	5	11,6 %	2	4,6 %	5	11,6 %
Over 50 years old	6	13,9%	4	9,3%	3	6,9%	5	11,6 %
The amount	15	34,8%	10	23,2 %	6	13,9%	12	27,9%
Subtotal	25 (58.1 %)				18 (41,9 %)			
Total	43 (100%)							

In total, 25 (58.1%) men with acute odontogenic periostitis were treated, of which 15 (34.8%) used traditional methods of treatment, and in 10 (23.2%) patients with acute purulent periostitis of the upper and lower jaw underwent daily antiseptic treatment of the postoperative wound of the oral mucosa with Dekasan and Stomorad spray as part of complex therapy. In addition, the drug was prescribed as a rinse of the mouth 5-6 times a day during the entire stay in the patient's department until the inflammatory process subsides. Among the 18 (41.9%) women under treatment, traditional methods were used in 6 (13.9%) people, and the recommended comprehensive treatment was used in 12 (27.9%). The age composition of the patients, according to the distribution groups, was approximately the same.

According to the literature data, in the lower jaw in the first place the cause of collateral edema in the area of the lower jaw is the left lower first molar, in the second - the right lower first molar, in the third - the second molars of the lower jaw.

When examining patients with acute odontogenic periostitis, generally accepted diagnostic methods and laboratory tests, examination and consultations of a maxillofacial surgeon and other specialists were used, according to indications.

Attention was paid to the appearance of the patient: facial asymmetry, collateral swelling of the soft tissues of the face, skin color. From the side of the oral cavity, attention was paid to the smoothness of the transitional fold, the size of the inflammatory focus, palpation, percussion of the "causal" teeth were performed. Intraoral contact radiography of the "causal" teeth was performed when patients went to the doctor. The indicators of the general analysis of blood and urine, blood biochemistry, blood sugar in inflammatory processes that were on inpatient treatment in the department of maxillofacial surgery and other departments of the city medical association of the city of Samarkand were evaluated.

The material for microbiological research was exudate after tooth extraction. The collection of material was carried out immediately after the operation of tooth extraction and periostotomy, three days later.

Microbiological indicators of the quantitative content of microorganisms in the wound discharge were calculated by the method of serial dilutions with the determination of the indicator "colony-forming units" (CFU) in 1 ml (CFU/ml). A concentration taken as microbial contamination sufficient to cause acute inflammation is a value of 10⁵ CFU/ml.

Cytological studies. The material for the cytological method of research was a smear-scraping from the socket of the extracted tooth and also in the dynamics of treatment, as well as in inflammatory processes of the upper and lower jaw on the day of treatment after tooth extraction and three days after the operation, on the subsequent days of illness. The substrate for cytological examination was taken using a surgical iron. After taking a smear-scraping from the hole, the discharge was applied to a dry sterile slide closer to the short side, carefully distributed with a second slide over the surface, marked, allowed to dry. During the first days after sampling, the material was delivered to the clinical diagnostic laboratory.

Coloring of cytological preparations was carried out according to the Romanovsky-Giemsa method: a dried fixed smear was placed in a cuvette with a working solution of Romanovsky-Giemsa dye for 30 minutes. Washed, dried. Counting of cells in smears-preparations of the wound was carried out by the method "for 200 cells", calculating the percentage.

Statistical processing of the results of the study was carried out using the application package "Microsoft Office - 2010". The reliability of the level of difference between the compared values was assessed using the 1 - Student's test. The relationship of the studied parameters was assessed using the correlation coefficient at the significance level of $p < 0.05$ and $p < 0.01$.

Results

The results of the obtained microbiological studies in patients with the recommended complex treatment. It should be noted that immediately after the opening of the purulent focus, associations of microorganisms were detected, as well as in patients of the comparison group. The most common associations of three microorganisms (Staph. aureus, Str. viridians, Bacteroides; Staph, aureus, Str. viridians, Peptostreptococcus) - in 12 (54.54%) patients. Associations of four microorganisms (Staph, aureus, Str. viridians, Bacteroides, Peptococcus; Staph, aureus, Str. viridians, Bacteroides, yeast-like fungi of the genus Candida) were observed in 6 (27.27%) patients, two microorganisms (Staph, aureus, Str. pyogenes; Staph, aureus, Str. salivarius) - 4 (18.18%) patients. None of the patients in the wound exudate after periostotomy, as well as in the first group of patients, did not detect a monoculture of microorganisms.

Three days after surgery, a monoculture of microorganisms began to be sown in 17 (77.2%) people, associations of two microorganisms were detected in 5 (22.8%) people. None of the patients in the wound discharge revealed associations of three and four microorganisms. Consequently, there has been a positive trend in the normalization of the microbial landscape of a purulent wound.

Data from the microbiological examination of the wound discharge of the postoperative wound immediately after the operation verified 91 strains. Str. viridians was most often sown in 39 (42.85%) crops, Staph, aureus - 18 (19.78%), Str. salivarius 14 (15.38%), Staph, epidermidis - not sown. Str. pyogenes - 8 (8.79%), yeast-like fungi Candida - 12 (13.18%) cases, respectively.

After three days, in the group of patients with recommended treatments, microorganisms were verified in 44 strains. At the same time, bacteria *Str. viridans* were sown in 25 (56.81%) crops, *Staph. aureus* - 17 (38.63%), *Staph. epidermidis* - in 2 (4.54%). He was determined during verification on *Str. salivarius*, *Str. pyogenes*, *Candida media* in relation to the previous study period.

It was noted that the concentration of microorganisms in 1 ml of wound discharge during this period was an order of magnitude lower than the "critical level" - 102 CFU.

These indicators of quantitative determination of the content of pathogens in a purulent wound in the dynamics of treatment in patients with the use of Stomorad after meals. 1 injection was prescribed for 4-8 injections for 7 days indicate a more rapid normalization of the microbial landscape of the wound, compared with patients of the first group. The contamination of the postoperative wound with microorganisms decreases.

Along with the study of the microbial landscape in acute purulent periostitis of the jaws in patients, we studied the dynamics of healing of the postoperative wound according to cytological studies. In patients using Stomorad topically, after meals. 1 injection of 8 injections for 7 days immediately after the opening of the subperiosteal purulent focus, the following cell content is noted: segmented neutrophils - (79.65 ± 0.25)%, stab neutrophils - (2.30 ± 0.72), basophils - (0.15 ± 0.07), eosinophils - (1.00 ± 0.29)%, lymphocytes - (11.95 ± 0.21), monocytes - (4.18 ± 0.43)%, macrophages - (0.59 ± 0.23), plasma cells - (0.18 ± 0.13) %.

After three days, the relative content of segmented neutrophils decreased to (77.85 ± 2.39) % ($p = 0.898$ and $p_1 = 0.192$); stab neutrophils and basophils - 0%, eosinophils - (0.03 ± 0.005) % ($p = 0.066$ and $p = 0.001$), lymphocytes - (10.8 ± 0.21) % ($p < 0.001$ and $p_1 = 0.001$). The relative content of macrophages increased significantly - up to (5.47 ± 0.38) % ($p < 0.001$ and $p_1 = 0.001$), monocytes - (4.29 ± 0.23) % ($p = 0.824$ and $p_1 = 0.001$), plasma cells (1.35 ± 0.26) % ($p < 0.001$ and $p_1 = 0.001$). In addition, during this period, fibrocytes and fibroblasts appeared in the wound in an amount of (0.18 ± 0.09), which indicates the beginning of the regeneration phase.

Thus, the use of Stomorad spray and dekasan antiseptic solution topically, after eating 8 injections of 7 days of purulent wounds in the treatment of patients with acute purulent odontogenic periostitis of the jaws according to cytological studies, activates reparative processes, promotes faster wound healing.

Discussion

According to the literature, we did not find information regarding the use of a combination of Dekasan antiseptics and Stomorad spray for topical use in the treatment of acute purulent odontogenic periostitis of the jaws. Application: a combination of Dekasan antiseptics and Stomorad spray has an anti-inflammatory and local analgesic effect, has an antiseptic effect against a wide range of microorganisms.

The mechanism of action of the drug is associated with stabilization of cell membranes and inhibition of prostaglandin synthesis.

Benzylamine has an antibacterial effect due to the rapid penetration of microorganisms through the membranes, followed by damage to cellular structures, disruption of metabolic processes and cell lysis.

It has an antifungal effect against *Candida albicans*. It causes structural modifications to the cell wall of fungi and the metabolic chains of mycetes and thus inhibits their reproduction. This property was the basis for the use of benzylamine in inflammatory processes in the oral cavity, incl. infectious etiology.

Until now, microbiological, cytological changes in a purulent wound have not been studied in detail with various methods of treating this disease.

To solve the tasks set in the work, clinical, laboratory and functional studies of patients were carried out, which were performed on the clinical basis of the Department of Maxillofacial Surgery of the Samarkand State Medical Institute in the Department of Maxillofacial Surgery of the city medical association.

43 patients with acute purulent odontogenic periostitis of the jaws were under observation, including 27 men and 16 women. All patients were divided into two groups: those with traditional

and recommended complex treatment. When seeking medical help in the clinic, all patients complained of pain in the jaws, the presence of a "causal" tooth, as well as a subperiosteal abscess.

In the group of patients with traditional treatment (21 people), rubber strips made of sterile glove rubber and gauze graduates were used to drain the subperiosteal purulent focus, conventional drug therapy with the use of anti-inflammatory, antibiotic and desensitizing agents was prescribed, physiotherapy was used.

In the dynamics of treatment, a microbiological, cytological assessment of a purulent wound was carried out. The most common associations of two microorganisms (Staph: aureus and Bacteroides; Staph, aureus and Peptostreptococcus; Staph, aureus and Peptococcus; Staph, aureus and Str. salivarius) - in 17 (80.9 %) patients, less often associations of three microorganisms (Staph, aureus, Str. viridians, Bacteroides; Staph, aureus, Str. pyogenes and Bacteroides) - in 3 (14.3 %) patients. A combination of four microorganisms (Str. viridians, Staph, epidermidis, Bacteroides, Candida albicans; Str. viridians, Staph, epidermidis, Bacteroides, Candida tropicalis) was detected in two patients. Monoculture was not detected in any of the patients in cultures. Three days after surgery, a monoculture began to be sown in 5 (23.8%) people, associations of two microorganisms were detected in 12 (66.6%), associations of three microorganisms in 4 (19.04%). None of the patients in the wound discharge revealed associations of four microorganisms.

On the first day after the operation, 105 strains of infectious agents were verified. A significant proportion was a series of aerobic microorganisms - 105 (47.51%). Str. viridians - 36 (34.29%) and Staph, aureus - 27 (25.7%) were predominantly sown from this series of bacteria, Str. salivarius - 16 (15.23%), Str. pyogenes - 7 (6.66%), Staph, epidermidis - 1 (0.95%) and Candida fungi - 18 (17.14%) were sown less often.

The quantitative content of pathogens in the wound discharge was also subject to variations. In particular, the concentration of aerobic microorganisms for some species in the wound discharge reached or exceeded the "critical level" of 105 CFU/ml. The highest number of bacterial cells was Staph, aureus - 106 CFU/ml, Str. viridians and Str. pyogenes - 105 CFU/ml, the number of other aerobic organisms was below the "critical level".

After three days, in the group of patients with traditional methods of treatment, aerobic microorganisms were verified in 66 cultures. Str. viridians was still predominantly determined in 33 (50.00%) crops, Staph, aureus - 25 (37.87%), Staph, epidermidis - in 8 (12.12%). He was determined during verification on Str. salivarius, Str. pyogenes, Candida media in relation to the previous study period.

At the same time, it was noted that the concentration of microorganisms in 1 ml of wound discharge during this period was an order of magnitude lower than the "critical level" - 105 CFU / ml.

Thus, in the dynamics of traditional treatment of patients with acute purulent odontogenic periostitis of the jaws, there has been a positive trend in the normalization of the microbial flora of the wound discharge. Associations of four microorganisms disappeared, were not verified by re-examination of bacteria of the species Str. salivarius, Str. pyogenes, Candida.

Along with the study of the microbial landscape in acute purulent odontogenic periostitis of the jaws, we studied the dynamics of healing of the postoperative wound according to cytological studies.

Immediately after the opening of the subperiosteal abscess, a typical cytological picture of acute purulent inflammation was verified. Degeneratively altered segmented, stab neutrophils were predominantly detected, macrophages, lymphocytes, plasma cells, monocytes and other cells were present.

On the first day after the opening of the subperiosteal abscess in the wound, the following cell content was noted: segmented neutrophils - (81.03 ± 0.40), stab neutrophils - (2.03 ± 0.78), basophils - (0.17 ± 0.08), eosinophils - (0.97 ± 0.32), lymphocytes - (10.70 ± 0.54), monocytes - (4.30 ± 0.44), macrophages - (0.67 ± 0.24), plasma cells - (0.13 ± 0.08). Thus, degeneratively altered segmented neutrophils were predominantly detected.

After three days, with traditional treatment, the relative number of segmented neutrophils decreased statistically insignificantly to (80.53 ± 0.74) % ($p = 0.430$); stab neutrophils - ($0.40 \pm$

0.11) % ($p = 0.08$); basophils - 0%; eosinophils - $(0.43 \pm 0.12)\%$ ($p = 0.062$). The percentage of monocytes decreased statistically significantly to $(2.90 \pm 0.23)\%$ ($p = 0.002$); The relative content of lymphocytes increased - $(14.47 \pm 0.28)\%$ ($p < 0.001$), insignificantly - macrophages to $(0.90 \pm 0.16)\%$ ($p = 0.172$), as well as statistically significant plasmacytes - $(0.37 \pm 0.05)\%$ ($p = 0.017$).

In the group of patients with the recommended complex treatment (22 people) of the antiseptic solution Dekasan and spray Stomorat has an anti-inflammatory and local analgesic effect, which has an antiseptic effect against a wide range of microorganisms. Dekasan solution and Stomorat spray were applied topically, after eating from 4 to 8 injections for 7 days. And also prescribed conventional drug therapy with the use of anti-inflammatory, antibiotic and desensitizing agents, physiotherapy was used.

According to microbiological studies, immediately after the opening of the purulent focus, typical associations of microorganisms were detected, as in patients of the comparison group. The associations of three microorganisms (Staph, aureus, Str. viridians, Bacteroides; Staph, aureus, Str. viridians, Peptostreptococcus) - in 12 (54.54%) patients. Associations of four microorganisms (Staph, aureus, Str. viridians, Bacteroides, Peptococcus; Staph, aureus, Str. viridians, Bacteroides, yeast-like fungi of the genus Candida) were observed in 6 (27.27%) patients, two microorganisms (Staph, aureus, Str. pyogenes; Staph, aureus, Str. salivarius) — 4 (18.18%) patients.

In total, 91 (58.71%) strains of microorganisms were verified, the contamination of the postoperative wound with microorganisms decreases, as well as the intensity of seeding of microflora.

In the group of patients using Tantum Verde topically, after eating 8 injections for 7 days immediately after the opening of the subperiosteal purulent focus, the following cell content was noted: segmented neutrophils - $(79.65 \pm 0.25)\%$ stab neutrophils - $(2.30 \pm 0.72)\%$, basophils - $(0.15 \pm 0.07)\%$, eosinophils - $(1.00 \pm 0.29)\%$, lymphocytes - $(11.95 \pm 0.21)\%$, monocytes - $(4.18 \pm 0.43)\%$, macrophages - $(0.59 \pm 0.23)\%$, plasma cells - $(0.18 \pm 0.13)\%$.

After three days, the relative content of segmented neutrophils decreased to $(77.85 \pm 2.39)\%$ ($p = 0.898$ and $p_1 = 0.192$); stab neutrophils and basophils - 0%, eosinophils - $(0.03 \pm 0.005)\%$ ($p = 0.066$ and $p = 0.001$), lymphocytes - $(10.8 \pm 0.21)\%$ ($p < 0.001$ and $p_1 = 0.001$). The relative content of macrophages increased significantly - up to $(5.47 \pm 0.38)\%$ ($p < 0.001$ and $p_i = 0.001$), monocytes - $(4.29 \pm 0.23)\%$ ($p = 0.824$ and $p_1 = 0.001$), plasma cells $(1.35 \pm 0.26)\%$ ($p < 0.001$ and $p_1 = 0.001$). In addition, during this period, fibrocytes and fibroblasts appeared in the wound in an amount of (0.18 ± 0.09) , which indicates the beginning of the regeneration phase.

In conclusion, it should be noted that the use of Dekasan and Stomorat spray topically, after eating 8 injections for 7 days in the treatment of patients with acute purulent odontogenic periostitis of the jaws, according to microbiological, cytological studies, activates reparative processes, promotes faster wound healing and reduces the duration of hospitalization.

Conclusion

It was revealed that after opening the subperiosteal purulent focus, aerobic microorganisms are verified in 52.13% of crops, and their concentration exceeds the "critical level" - 105 CFU/ml. Degeneratively altered segmented neutrophils and other inflammatory cells are detected in the wound.

Application: the use of Dekasan solution and Stomorat spray topically, after eating 8 injections for 7 days after the operation, the removal of the causative tooth and the operation of periostotomy helps to reduce their contamination, significantly reduces the intensity, seeding of aerobic microphora in the wound, cells of regenerative and phagocytic type (fibrocytes, fibroblasts and macrophages) are detected.

Positive clinical and laboratory parameters according to microbiological, cytological studies contributed to a reduction in the duration of hospitalization.

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Aims & Scope (Economics)

Article

STRUCTURAL-QUALITY CONSTRUCTION OF ENTERPRISE HR-SERVICES BASED ON INDICATIVE APPROACH

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Abstract. The purpose of the scientific article is to develop methodological and applied principles of structural and qualitative construction of HR service of the enterprise using an indicative approach.

The methodological basis of the article is formed on the indicative and target methods of evaluating the appropriateness of HR services, calculation models for determining the level of efficiency of services and departments of the enterprise. Structural and functional modeling of activity of personnel management services was used.

The application of the card of assessment of professional skills and competences of HR personnel of the enterprise is formed and substantiated. A map of recording and analysis of evaluation results of specialist competencies has been developed. A table tool for ranking results by criteria and subsystems has been put into practice.

The practical value of scientific work is the development of methodological and applied support for economic evaluation and construction of HR services of enterprises. In the future, it is planned to form and apply a standard organizational structure of the HR service, which will be based on the design of twelve subsystems that will allow enterprises to include a particular subsystem in the HR service.

Further original research can be formed in the direction of substantiation of the need to separate the HR service into an autonomous structural element of the management system; to introduce economic, social and organizational criteria for evaluating the performance of the HR service, and to ensure the systematic implementation of performance evaluation to guarantee the effective operation of the enterprise.

Keywords: enterprise HR service, personnel competences, professional-qualification characteristic of the employee, indicative approach.

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Introduction

In the conditions of global spread of information and computerization of production and economic processes the activity of the enterprise without the involvement of people is impossible. People are an integral part of the enterprise's resources needed to fulfill its goals and objectives, that is, take the form of "labor" or "human" resources. For improving the efficiency of the personnel management system in the enterprise, it is necessary to search for new tools and methods of construction, operation and development of a special separate element of the management system (HR service), which will be responsible for working with different categories of personnel.

Literature Review

Scientists such as (Armstrong 1997; Hofstede 2010; Massora 2017; Hidayah, Zarkasyi 2017) have made significant contributions to the study of basic HR issues, and some theoretical aspects of HR management have been covered by such scholars as (Albinger, Freeman 2000; Backhaus et al. 2002; Lievens et al. 2007; Theriou 2015). In addition, the possibility of improving staffing services can be considered in the works (Berthon et al. 2005; Newburry et al. 2006; Roy 2008). The scientific works of the authors in this area relate mainly to the consideration of personnel management as an impact on people through various forms and methods of management, but this influence does not always imply achievement of certain goals and determining the role of HR service in the effective work of the enterprise.

Methods

The study used general scientific and specific methods according to the formulation of the topic. Logical and historical approach to the analysis and conceptual reproduction of the evolution processes regarding the economic system of society have become methodological basis for the theoretical study of the transformation processes of financial intermediation institutions, which in turn made it possible to obtain a comprehensive theoretical description of the current stage of financial intermediation development.

Results

The modern enterprise consists of a certain number of employees who are its personnel. Each manager makes his own decisions about their number, structure, subordination, etc. However, these decisions must be substantiated and validated. For this, enterprises use a lot of tools, mechanisms, analytical studies. It is possible to quantify the adequacy of the competencies of HR service personnel using the indicator of professional and qualification characteristics of the employee (IK), which is proposed to be calculated by the equation:

$$I_K = \frac{N_{kv}}{N_{kvz}} \tag{1}$$

where N_{kv} - is the number of high-level employee qualifications;

N_{kvz} - is the total number of professional and qualification characteristics of the employee which the worker must fully possess at a high level.

The optimal value of this criterion is its approximation to 1, that means the best match of the specialist to the corresponding subsystem of HR service. For this purpose we propose to use a map of professional skills and competencies, which should be filled in by HR specialists of the enterprise in order to identify their level of competences (Table 1).

Table 1. Map of the professional skills and competencies of the employee of the HR service of the enterprise

Professional skills and competences that an HR specialist should possess	Level of skills and competences **			
	High	Sufficient	Average	Low
1	2	3	4	5
HR planning subsystem (I1)				
Ability to carry out HR planning in order to determine future staffing needs	5			
Ability to develop HR strategies and plans		4		
Ability to plan and calculate staffing requirements (number of managers, number of executors, staff structure (both by occupational groups, age, gender, etc.)				
Ability to form a “tree of HR goals”	5			
Ability to plan “tree of HR works executors”				1
Ability to plan work of other subsystems of personnel management (during the filling specify them)			2	
Business HR Subsystem (I2)				
Ability to analyze and select sources of candidate search				1
Ability to recruit and select staff according to vacant positions in a timely manner and qualifications			3	
Ability to use modern technologies and tools of personnel support	5			
Appropriate, high-quality and safe working conditions subsystem (I7)				

Ability to carry out analysis at the enterprise with the purpose of creation of proper, working conditions	5			
Ability to identify deficiencies in the labor protection system, to provide suggestions for their elimination		4		
Ability to monitor and implement modern technologies to create appropriate working conditions			3	
Subsystem of information and legal support (I8)				
Ability to collect, analyze information support activities and bring the necessary information to the recipients		4		
Ability to carry out legal support of work with personnel		4		
Subsystem of resource support of work with personnel (I9)				
The ability to analyze the need for resources for the effective work of HR-service and carry out resource support activities	5			
Ability to analyze the quality of use of resources and ways of their application, identify defects and eliminate them	5			
Personnel accounting subsystem (I5)				
Ability to analyze the structure, quality, number of staff		4		
Ability to analyze work activity levels and carry out their normalization		4		
Staff evaluation and certification subsystem (I4)				
Ability to analyze the qualitative composition of staff, to carry out his certification		4		
Ability to evaluate employee work	5			
Ability to form high-quality decisions about the employee's future work based on the results of his assessment				1
Subsystem of training and improvement of professional and qualification characteristics (I10)				
Ability to analyze training and improve professional development needs			3	
Ability to select and apply the most effective methods of professional development		4		
Personnel development subsystem (I11)				
Skills and abilities to provide comprehensive development of the worker (when filling it is expedient to indicate what is the focus: socio-cultural, professional, career, moral, ethical, business, etc.)	5			
Personnel motivation subsystem (I6)				
Ability to analyze and use the necessary effective remuneration systems		4		
Ability to select and apply effective methods, tools of personnel motivation			3	
Rotation and personnel reserve subsystem (I3)				
Ability to provide timely rotation of personnel, in accordance with the conditions that determine the need for it		4		
The ability to monitor the possible outflow of personnel, and the creation of a personnel reserve in accordance with it				1
Worker socialization subsystem (I12)				
Ability to create a favorable social and psychological climate	5			
Ability to develop a culture and “instill” to employees		4		
Ability to adapt workers		4		
Ability to develop socialization programs			2	

*** For evaluation it is proposed to use a five-point scale, according to which a high level is estimated at 5 points, 4 points - sufficient; 2-3 points - average; 1 point – low.*

Source: Froese, Garrett 2010; Sivertzen et al. 2013

It should be noted that the above list of competences is typical and can be used as the basis for any enterprise, but the composition of competences can be supplemented or reduced depending on the target (Broadbent, Guthrie 2008).

The next step is to fill in the competency map by HR and data processing specialists. For this purpose, based on the results of the expert group, a scale for each criterion and separately for each subsystem is proposed (Delery, Roumpi 2017). After that, a map of the results of competency assessment is formed, let us consider the example of the basic questionnaire (Table 2).

To identify and select the best candidate for a specific subsystem of the HR management, the candidate is ranked according to criteria and subsystems (Table 3).

Table 2. The map of the results of the competency assessment

HR service subsystems	Competence levels				
	L1	L2	L3	L4	L5
I1	5	4	5	1	2
I2	1	3	5		
I3	4	1			
I4	4	5	1	3	4
I5	4	4			
I6	4	3			
I7	5	4	3		
I8	4	4			
I9	5	5			
I10	3	4			
I11	5				
I12	5	4	4	2	

Source: compiled by the authors

Table 3. Ranking of specialist results by criteria and subsystems

HR service subsystems	Competence levels					The average weighted level of competence of one subsystem	The weight of the subsystems of HR	The average weighted level of competence by subsystem
	L1	L2	L3	L4	L5			
I1	0,294	0,235	0,294	0,059	0,118	0,205	0,05	1,03
Weight of competencies I1 subsystem	0,23	0,21	0,18	0,16	0,22			
I2	0,111	0,333	0,556			0,196	0,2	3,91
Weight of competencies I2 subsystem	0,34	0,38	0,28					
I3	0,8	0,2				0,320	0,03	0,96
Weight of competencies I3 subsystem	0,6	0,4						
I4	0,235	0,294	0,059	0,176	0,235	0,348	0,1	3,48
Weight of competencies I4 subsystem	0,2	0,22	0,21	0,19	0,18			
I5	0,5	0,5				0,560	0,07	3,92
Weight of competencies I5 subsystem	0,51	0,49						
I6	0,571	0,429				0,259	0,1	2,59
Weight of competencies I6 subsystem	0,43	0,57						
I7	0,417	0,333	0,25			0,200	0,05	1,00
Weight of competencies I7 subsystem	0,6	0,4						
I8	0,5	0,5				0,210	0,05	1,05
Weight of competencies I8 subsystem	0,5	0,5						
I9	0,5	0,5				0,500	0,08	4,00
Weight of competencies I9 subsystem	0,48	0,52						
I10	0,429	0,571				0,501	0,1	5,01
Weight of competencies I10 subsystem	0,5	0,5						
I11	5					0,490	0,11	5,39
Weight of competencies I11 subsystem	1							
I12	0,333	0,267	0,267	0,133		0,369	0,06	2,21
Weight of competencies I12 subsystem	0,27	0,26	0,24	0,23				

Source: compiled by the authors

Thus, the weighted average level of competencies by subsystems is established, on the basis of which we build the competence profile of the HR service employee (Figure 1).

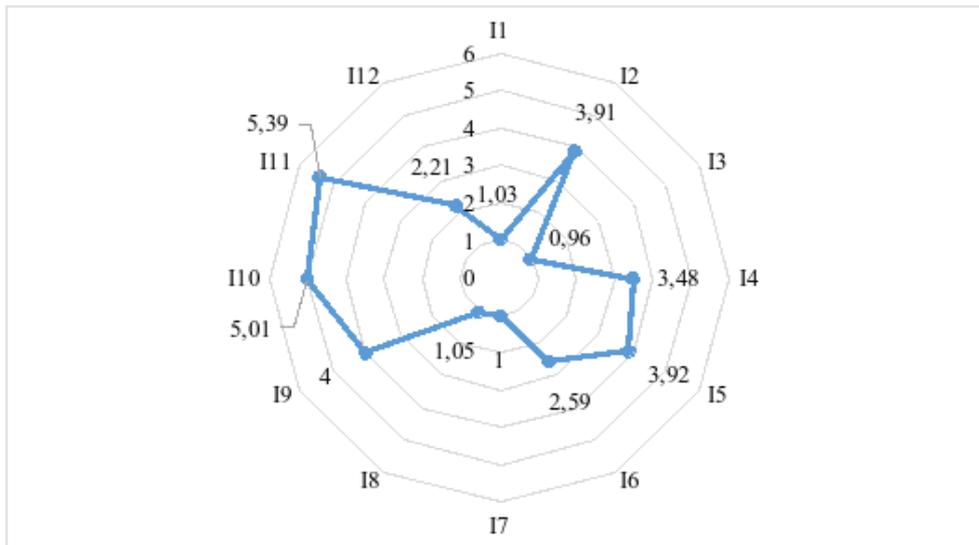


Figure 1. Competence profile of the employee of HR-service of the enterprise

Source: compiled by the authors

The Figure 1 shows that a high level of competence is set for the subsystem I11, respectively, such an employee is more effective to involve in the work of this subsystem. If this subsystem is already staffed, it is possible to continue the selection by descending gradation or with the exception of the subsystem from the evaluation map.

Conclusion

The work was carried out construction and structural filling of HR service of the enterprise on the basis of application of indicative approach which provides development of system of indicators on the basis of which the enterprise can justify need of structural filling of HR service and to calculate its quantitative indicators. Quantitative and qualitative formation of HR service will be carried out in accordance with the current structure of the enterprise and the tasks that are responsible for ensuring the HR service of the enterprise. Based on the use of these indicators, it will be possible for an enterprise to justify the need to distinguish the HR service as a separate element of the management apparatus, to provide economic justification for its creation and to calculate its structural content.

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Aims & Scope (Economics)

Article

IMPROVEMENT OF COMPLEX INVESTMENT PROCESS MANAGEMENT IN INDUSTRIAL CLUSTER

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Abstract. The article demonstrates features of managing investment activities and projects at the level of an industrial cluster. The necessity to take into account the investment climate and peculiarities of the cluster's investment strategy has been proved in order to identify the sources of investment resources and mechanisms for their involvement in implementation of the selected directions. The economic and mathematical model of investment support of an industrial cluster which is based on a comparative approach to the selection of optimal investment projects from a number of similar starting conditions was built and tested.

Keywords: industrial cluster, investment process, investment project, model of investment support, internal funds, cluster participants.

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Introduction

The effective reform of the national economy of a country is impossible without large-scale investments, which is the most important factor of economic growth and renewal, which provides an opportunity for modernization of existing production facilities, creation and introduction of the latest equipment and technologies, modern systems of organization and management of economic processes, qualitative upgrading of production, transport and market infrastructure. National and local industrial investment processes are characterized by a significant difference between investment inputs and investment needs, reduced volume of investments, deterioration of their technological and regeneration structure, limited capabilities to finance investments from different sources, which, as a whole, have a negative impact on renewal processes in the country and leads to increased levels of risk and create unfavorable conditions for real investment.

Scientific works (Arnold, 2010; Huggins and Hiro 2011; Porter, 2008) reveal a professional opinion that in unstable economic conditions, it seems irrational to rely solely on a market-based mechanism for managing investment activity, which, being essentially a self-regulating and self-adjusting system, in a crisis situation is not able to automatically ensure the efficiency of investment processes. At the same time, a number of researchers (Azman-Saini et al. 2010; de Mel et al. 2008; Masron & Hassan 2016; Storper, 2013) indicate that corporate regulation of investment activity should be a key stimulating factor, support of investments and entrepreneurship for development and efficient functioning of the industrial sectoral and cluster investment sphere.

Scholars such as (Ackert, Deaves, 2010; Aghion et al. 2005; Barca, Fabrizio et al. 2012; Francis, Ibbotson, 2002) indicate that investment management is a system of principles and methods for development and implementation of management decisions, related to implementation of various aspects of industrial investment activity. Such management is an organic part of the overall financial management system, being one of its main functional subsystems, which enables implementation of predominantly strategic decisions within industrial clusters. This list of arguments points to the importance and value of such research and shapes the field for further scientific work in the sphere of industrial investment management.

Methods

As a methodological basis, we have chosen the formats of the country's investment climate, which defines investment activity at the micro level and a risk management model that determines feasibility and security of our own investment. When using the risk approach as a component of the investment climate, we identify three main options for methodological justification: 1) investment potential; 2) investment risks; 3) extended (factor) approach.

1. Cluster investment potential is estimated on the basis of microeconomic characteristics, including: availability of production factors, including human resources; consumer demand; the level of science development and its achievements; development of leading market economy institutions; availability of comprehensive infrastructure (Caniëls & Romijn, 2005).

2. Investment risks are estimated by probability of loss of investment and income. These risks include: economic, financial, political, social, environmental, criminal and legislative. The second variant of the risk approach is based on assessment of investment climate from the point of view of development of the public system of the state as a whole. Among other indicators, human potential, material resources of development, socio-political environment and political risk factors, the state of the economy and the level of its management are taken into account (Lin and Monga, 2011).

3. The extended (factor) approach is based on assessment of a number of factors affecting the investment climate from the perspective of an industrial cluster. Distinctive features of the multifactorial approach to investment climate assessment are: contrariety of categories of the investment climate and the investment risk; relationship between the investment climate and investment in the real economy sector; the objective nature of the assessment of investment climate of the territory, its independence from the behavior of individual investors; the relationship between the investment climate and the fixed capital investment; the multilevel nature of this approach; the relationship between investment climate, investment potential and conditions of investor activity.

Results

3.1. Investment activity at the industrial cluster level

The main goal of managing investment activity at the industrial cluster level is to step up investment activity and create a favorable investment climate within the cluster. To achieve this goal, a number of strategic and tactical tasks should be resolved. Strategic objectives of investment management are tasks aimed at stabilizing and progressively developing the cluster economy; restructuring of the cluster economic complex; creating attractive investment conditions. Tactical tasks of cluster investment management include development of functions and organizational structure of investment activity management at the industrial cluster level; facilitating implementation of investment policy at the level of an industrial cluster; development on its basis and implementation of local investment policy; selection and justification of priority industrial investment objects; improvement of efficiency of investment processes; reduction of the investment risk of cluster companies (Delgado et al. 2016).

The objects of investment activity management at the industrial cluster level are conditions of formation and use of investment resources of different sources of financing, investment complex of the cluster, which include investors, design firms and architecture, infrastructure of the cluster investment market. Directions of cluster investment management are presented in the figure 1.

Cluster investment strategy is a search and selection of market opportunities, as well as a search for investment resources and mechanisms for attracting them to implement the selected

directions. The cluster investment strategy is subordinate to the national overall economic development strategy. On the other hand, an investment strategy, developed in the process of analyzing existing and potential sources and mechanisms of investment financing, has an impact on the overall economic strategy and in some cases leads to its adjustment. Based on the investment strategy at the industrial cluster level, a local investment policy is developed, aimed at creating a favorable investment climate, attracting domestic and foreign investors to the country and the cluster itself.

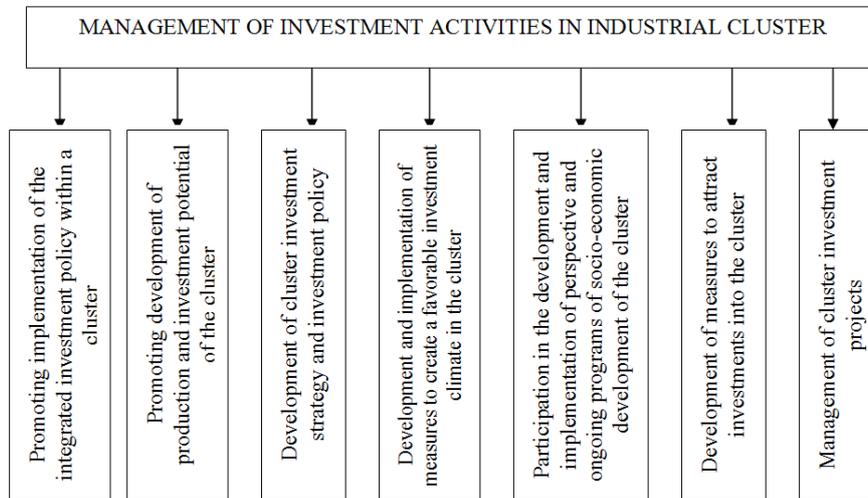


Figure 1. Key directions for managing investment activity at the industrial cluster level

Source: compiled by the authors

Formation of investment policy will require consideration of the following factors of development (Armstrong and Taylor, 2000; Roberts and Enright, 2002):

- strategic socio-economic orientation of the cluster;
- availability of unbiased information for direct formation of investment policy and conducting investment research at the cluster level;
- availability of a professional team capable of developing the cluster investment policy and its further implementation;
- availability of natural, demographic, production, financial resources necessary for practical implementation of cluster investment policy;
- aspects of the cluster investment climate, cluster industrial policy, living standards of the cluster population;
- quantitative and cost parameters of industrial, social and economic factors of cluster investment policy.

3.2. Economic and mathematical substantiation of industrial cluster investment support

Improving the efficiency of managing cluster investment requires development of an appropriate economic and mathematical justification for making decisions on the use of scarce investment resources. A rational combination of investment resources constrained by the cluster's investment capabilities, on the one hand, and diverse investment projects, which is an investment demand within the cluster, requires a mathematical justification for making decisions on financing a local project, allowing the use of scarce resources more effectively (Nicolini, 2001).

It should be noted that there are a number of reasons that complicate creation and use of economic and mathematical models of management processes at the industrial cluster level, which stem from the features of the processes of managing the cluster itself as a system. First, it is the need to accurately formulate a managerial decision to regulate economic processes in uncertainty, secondly, the dynamic environment, which limits the possibility of building an object model, and third, violation of the dynamic equilibrium of the system and environment due to existing disparities in development socio-economic systems. This should be taken into account when making management decisions using mathematical methods. The algorithm for deciding on financing of investment projects from one source or another is presented in Figure 2.

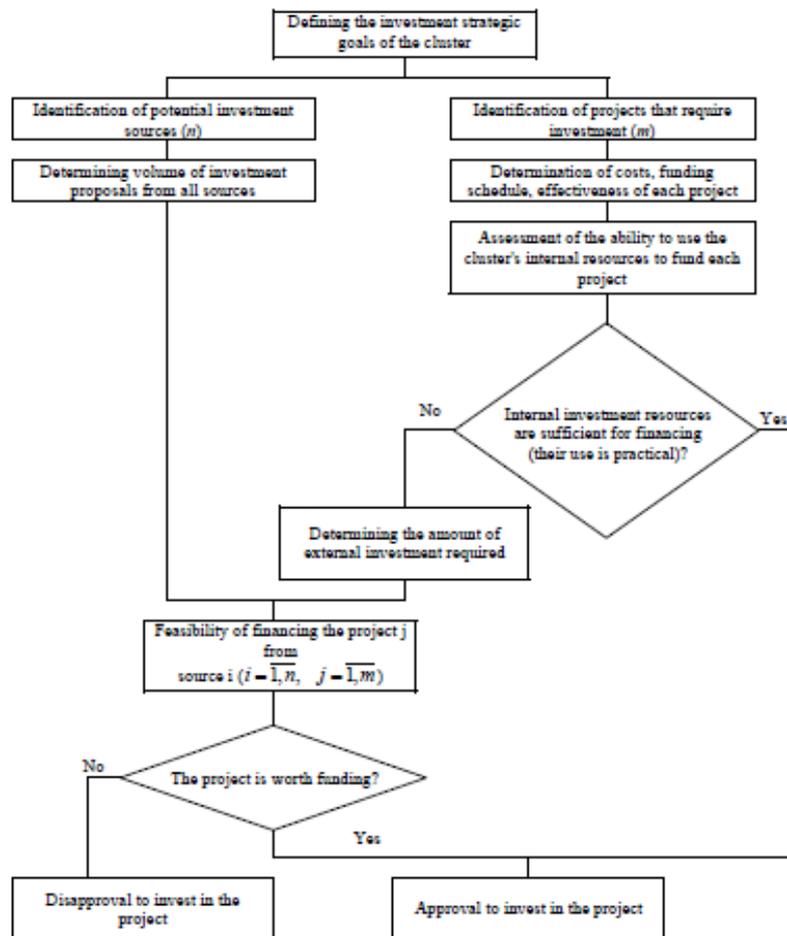


Figure 2. Decision-making algorithm for financing investment projects from industrial cluster internal sources

Source: compiled by the authors

It is proposed to optimize the process of financing investments from different sources in stages, including the following steps:

- identification of potential sources of investment financing and volume of the investment proposal;
- identification of the amount of investment required for the economy, i.e. figuring out investment demand at the industrial cluster level;
- identification of criterion of practicality of financing investment projects within the cluster;
- combination of investment resources with investment projects, i.e. investment supply with investment demand, according to the accepted criterion;
- determination of the optimal structure for allocation of investments from different sources of funding within the cluster (Ketels, Protsiv; 2016).

To solve this task, it is necessary:

- to create an economic and mathematical model for optimizing the use of industrial cluster investment resources;
- to create software and data support of the economic and mathematical model.

The investment demand of an industrial cluster is the total amount of investment required in the manufacturing sector. It consists of many investment projects, each of which corresponds to a certain amount of necessary investments:

$$E = \sum_{j=1}^m E_j, \tag{1}$$

where E_j - the amount of investment required for the j^{th} investment project ($j = 1, \dots, m$), m – the number of investment projects.

The investment needed to finance the j^{th} project amounts to:

$$E_j = C_j + \sum_{i=1}^n K_{ij}, \quad j = 1, \dots, m, \quad (2)$$

where C_j - own funds of the participating company,
 K_{ij} - external investment from the i^{th} source into the j^{th} project.

The goal is to find the best solution for lodging cluster investment resources. In this connection, first of all, it is necessary to find out whether the companies belonging to the cluster own sufficient funds for implementation of the project. In case of sufficiency (when $E_j \leq C_j$), the company itself finances the project. In case of insufficiency of internal funds or financing from own sources is not planned due to impracticality (when $E_j > C_j$), such project should be considered as potential for external investment.

The amount of investment resources within a cluster is always limited. In this regard, the main stage of finding a solution is to determine the criterion and calculation, according to the accepted criterion, the feasibility of financing a project from external sources. The task is to invest R investment resources in m investment projects in order to maximize profits (Wilmott, 2009). The most appropriate modeling tool for this process is application of dynamic programming methods based on the Bellman optimality principle.

Let us consider solution of the problem of allocation of S ($S \leq R, S > 0$) investment resources between m projects P_1, P_2, \dots, P_m , which are allocated for one period.

Based on the principle of optimality, the task can be considered as a step-by-step process of managing a system, with the number of steps being equal to the number of investment projects ($k = 1, m$). And, whatever the state of the S system as a result of any number of steps, the next step is to choose control so that in conjunction with optimal control in all the previous steps it should lead to optimal result in all remaining steps, including this one.

If x_k is the number of units of the investment resource allocated at the k^{th} step, then the probable distribution of investments can be represented as a vector $X(x_1, x_2, \dots, x_m)$. Let us denote remainder of the investment resource after the k^{th} step as s_k , which depends only on the previous state of s_{k-1} and the control at the k^{th} step as x_k . The amount of return on investment in a k^{th} company can be mathematically expressed as a function of $f_k(s_{k-1}, x_k)$. The target function is the index of effectiveness of this controlled operation (in this case, total profit) depends on the initial state (of investment resources) and management in the cluster.

$$Z = F(S, X). \quad (3)$$

The target function (3) becomes additive from the index of effectiveness of each step. We denote the index of the effectiveness of the k^{th} step as:

$$Z_k(s_k) = f_k(s_{k-1}, x_k), \quad k = 1, 2, \dots, m \quad (4)$$

then:

$$Z = \sum_{k=1}^m f_k(s_{k-1}, x_k). \quad (5)$$

Thus, mathematically, such problem is formulated as follows: it is necessary to determine such admissible control X , in which the target function (5) acquires the greatest value. The solution to the problem begins with the m^{th} step. Let us denote by $Z_m^*(s_{m-1})$ maximum of the target function - the index of effectiveness of this step, provided that before beginning of the last step the system S was in an undefined state s_{m-1} , and at the last step control was optimal. Obviously, the conditional maximum of the target function in the m^{th} step should be equal to:

$$Z_m^*(s_{m-1}) = \max_{\{x_m\}} f_m(s_{m-1}, x_m), \quad (6)$$

$x_m = x_m^*(s_{m-1})$ - conditional optimal solution at the m^{th} step.

Conducting inductive reasoning and using the reverse move, for the k^{th} step we hold the following considerations. We denote by $Z_k^*(s_{k-1})$ a conditional maximum of the target function obtained at optimal control on $n, - k + 1$ steps, starting from k to the end, provided that by the beginning of the k^{th} step the system was in the state s_{k-1} . In fact, this function should be equal to:

$$Z_k^*(s_{k-1}) = \max_{\{(x_k, \dots, x_m)\}} \sum_{i=k}^m f_i(s_{i-1}, x_i). \tag{7}$$

then:

$$Z_{k+1}^*(s_k) = \max_{\{(x_{k+1}, \dots, x_m)\}} \sum_{i=k+1}^m f_i(s_{i-1}, x_i). \tag{8}$$

The target function at the $m - k$ last steps (Figure 3) at an undefined control x_k at k^{th} step and optimal solution at further $m - k$ steps should be equal to:

$$f_k(s_{k-1}, x_k) + Z_{k+1}^*(s_k) \tag{9}$$

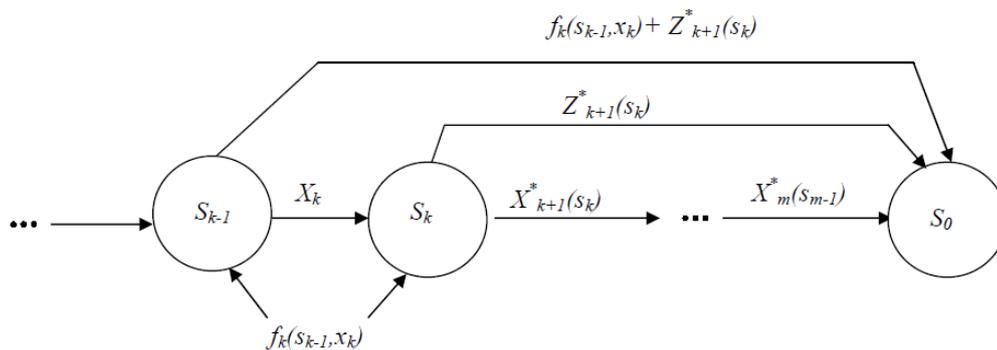


Figure 3. Diagram for optimizing the use of investment resources with the Bellman equation

According to the principle of optimality, x_k is chosen from the maximum of this sum, i.e.:

$$Z_k^*(s_{k-1}) = \max_{\{x_k\}} \{f_k(s_{k-1}, x_k) + Z_{k+1}^*(s_k)\}, \quad k=m-1, m-2, \dots, 2, 1. \tag{10}$$

Solving the Bellman equation (10), we get a conditional optimal solution at the k^{th} step - $x_k = x_k^*(s_{k-1})$.

As a result of conditional optimization, two sequences are obtained using the recurrence relations (6), (10):

$Z_m^*(s_{m-1}), Z_{m-1}^*(s_{m-2}), \dots, Z_2^*(s_1), Z_1^*(s_0)$ - optimal volumes of investment in the j^{th} project ($j=k, j=1, \dots, m$);

$X_m^*(s_{m-1}), X_{m-1}^*(s_{m-2}), \dots, X_2^*(s_1), X_1^*(s_0)$ - balance of the investment fund after each step.

In this case, the maximum profit should be equal to $Z_{\max} = Z_1^*(s_0)$.

Using sequences, conditional optimal solutions and equations of states, we can find solutions to the problem with the m and S .

The following aspects should be considered when solving the problem (Nofsinger, 2008):

- investments are financed from various sources, the volumes of which are always limited by objective capabilities;
- cluster investment resources should be used to the full, i.e. investment demand and investment supply should be optimally combined;
- the recipient company that needs a certain amount of investment may disagree with the lesser amount proposed for financing;
- first of all, it is necessary to finance projects that give maximum effect to the cluster.

Since optimization of investment resources is considered, first of all, from the point of view of the investor who decides on the financing of the project in order to maximize profit, the effectiveness of the approved development options is also considered in relation to the investor. The investor, considering various investment projects to select the best investment option, uses the above equations and can select those projects that will provide sufficient effect at an acceptable level of risk for the investor (Jones, 2010).

The input for the task are:

1. Many sources of investment resources of the territorial-industrial complex.
2. The value of the planned investment resources for each source.
3. Numerous proposed investment projects considered as potential investment objects.
4. Investment volume and performance estimates for each of the potential investment projects.

3.3. Case: Investment projects within the industrial cluster

Using the above scheme, let us solve a specific problem of rational investment in a separate industrial cluster within one year. Investments of €102840 million are planned from the cluster budget. Consideration is given to five investment projects. The amount of the investments in each project and estimated value of the investor's profit from that investment (at the end of the period) are shown in Table 1. It is necessary to determine the amount of funds to be invested rationally in each of the possible projects to maximize the total profit. In this case, we will assume that the profit planned for each project does not depend on the investment in other projects, and the total profit will be equal to the sum of profits received from each project that will be implemented.

Table 1. Input information to solve the problem of allocation of investment resources within a separate industrial cluster (Model 1)

Amount of investments mln. €, (x)	Estimated profit on projects, mln. €				
	f1(x)	f2(x)	f3(x)	f4(x)	f5(x)
20568	10680	5000	7080	8200	4200
41136	18800	10400	14520	16900	10600
61704	31500	14900	22860	31480	18360
82272	40200	20500	36160	44220	20400
102840	50600	45400	48020	51000	25080

Let us construct an economic and mathematical model of this problem. The following notations will be introduced: x_k – investments in k^{th} project ($k=1,2,3,4,5$), $f(x)$ - profit on projects. Then the total profit will be:

$$Z = \sum_{k=1}^5 f_k(x_k) \tag{11}$$

Variable x is restricted as follows: $\sum_{k=1}^5 x_k = 51420$,

$$x_k \geq 0, k = \overline{1,5}. \tag{12}$$

It is necessary to find the variables x_1, x_2, \dots, x_5 , which comply with the limitations (12) and which turn the function (11) to maximum.

Calculations as per the described scheme, result: $Z_{max} = Z_1^*(102840) = €54900$ million, when $x_1^* = x_1^*(102840) = 20568$, $x_4^* = x_4^*(82272) = 82272$, that is $X = (20568, 0, 0, 82272, 0)$.

Maximum total profit will be equal to €54.9 million provided that €20568 million is allocated for the first project and €82272 million for the fourth project.

Let us now solve the problem of allocating €4728 million of investment across six investment projects (initial figures are given in the Table 2).

Table 2. The input information to solve the problem of allocation of investment resources within a separate industrial cluster (Model 2)

Amount of investments mln. €, (x)	Estimated profit on projects, mln. €					
	f1(x)	f2(x)	f3(x)	f4(x)	f5(x)	f6(x)
945.6	450	270	190	270	136	370
1891.2	906	684	364	630	270	720
2836.8	1290	810	676	944	540	1090
3782.4	1880	1208	900	1260	900	1968
4728	2250	1350	1124	1898	1350	2275

Having carried out calculations using a similar algorithm, we obtain the following result. The maximum profit will be €2418 million with allocation of investment resources of €945.6 million for the first project and €3782.4 million for the sixth project.

Thus, the industrial cluster, as an investor, looks at different options for investing resources in investment projects and selects projects that can maximize the effect when comparing projects. In our opinion, the methodological approach presented is effective for assessing the optimal structure of formation and use of investment resources necessary to meet the investment needs of the industrial cluster (Gitman et. al. 2008). The proposed equations can be used for brief analysis of investment options using computational algorithms, which will allow in the shortest time to calculate alternative options in order to choose the most appropriate.

With the proposed criterion, it is possible to optimize the investment from a number of sources of investment financing (internal funds of companies, funds of the industrial cluster itself, mobilized through banking institutions, long-term and short-term bank loans) in those projects that can maximize the effect. Such method allows to automate the process of allocation of investment resources and eliminate the subjective approach to decision making. In each case, the decision to choose the best investment option using the proposed optimization technique is made by the investor himself.

The investment cluster balance indicators cover all financial resources that are created in the cluster and used for investment purposes during the forecast period. The scorecard includes the estimated cluster investment capacity indicators; estimated investment forecasts of cluster companies; forecast of future investments; the banking sector forecasts for long- and medium-term credit programs in the economy. The use of an investment balance will allow to reflect the investment situation in the industrial cluster in full extent, to identify its internal investment reserves, to characterize the sources of investment resources and the direction of use of cash flows as fully as possible.

Discussion

The performed analysis and the established methodological provisions can be further developed by new calculations of investment efficiency by formal methods of analysis of the effectiveness of real investments by calculating the net present effect (value), the internal rate of return of the project, the profitability index, the coefficient of investment efficiency, etc. Based on the results of the proposed calculations, as well as using investment forecast indicators at the industrial cluster level, it is possible to form a rational investment balance that will include the investment resources of new members of the industrial cluster, as well as the directions of their investment flows. The investment balance is a program that provides investment processes at the industrial cluster level. The cluster's investment balance should include a system of indicators that reflect the cluster's investment capacity, formation of its investment resources and the directions of their use.

The main provisions of the investment policy within the industrial cluster should be: strategic goals of the companies participating in the industrial cluster; the priorities of the integrated cluster investment program; definition of criteria for selection of investment projects and programs, which will be supported by all participants of the industrial cluster in case of equity financing; the scope of the investment program and potential real sources of its financing; the basic elements of the cluster's investment infrastructure and the ways of their further development; the task of intensifying investment cooperation.

Conclusion

Improving the efficiency of investment management at the industrial cluster level involves a comprehensive analysis of investment processes in the country's economy, study of sectoral and territorial structure of investment, classifying specifics of investment in order to identify the main directions of improvement of cluster management processes. Development of the investment balance should be aimed at the following tasks: 1) determination of the investment capacity of the cluster; 2) identification of the total amount of investment resources of the participating companies, which are directed to investment purposes; 3) determination of the total amount of investment

resources aimed at development of production, infrastructure; substantiation of use of revealed total amount of investment resources directed to the cluster system; 4) identification of the internal reserves of the cluster and ensuring their rational use; 5) establishment of trends and patterns of formation of investment resources at the industrial cluster level.

It has been determined that improving the efficiency of cluster investment management is facilitated by refinement of the mathematical support of decision making on the choice of investment options. It is proposed to optimize the use of limited investment resources by stages, including the following steps: identification of potential sources of investment financing and volume of the investment proposal; determination of the amount of investment required for the cluster; determination of the criterion of expediency of financing investment projects; combining investment resources with investment projects according to the accepted criterion; determination of the optimal structure of investment placement. It is proposed to use the Bellman criterion as the criterion of optimization.

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Aims & Scope (Social Sciences)

Article

THE PROCESS OF DESIGNING THE INFORMATION-ANALYTICAL MODEL OF UNIVERSITY MANAGEMENT IN THE ENTREPRENEURSHIP EDUCATION SYSTEM

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Abstract. The creation and implementation concept regarding the information-analytical system of university management is based on the idea of efficient and scientifically grounded usage of modern pedagogical and information-communication technologies.. Structurally, the concept consists of three components: organizational, pedagogical and technological. Model of information-analytical system of entrepreneurship education & university management is built with the usage of modular architecture, which provides standardized realization of its particular parts (modules). This makes it possible to develop several independent modules simultaneously by different developers. It is revealed that the implementation of information system modules, which is based on the complex usage of different modeling technologies and takes into account the complex relationships between all educational process subjects, in particular, characterized by the integrated use of object-oriented modeling of complex systems and imitation systems modeling technologies is an effective tool for research and development of new technologies for managing the university's educational process.

Keywords: university management, information-analytical system, entrepreneurship education, higher education institution, visual modeling.

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Introduction

The urgent problems of socio-economic, scientific and technological development of modern society include the following: development, improvement and implementation of information and communication technologies (ICT) in everyday practice, the use of which significantly increases the efficiency of information processes - collection, search, systematization, analysis, storage, generalization, processing, submission and transmission of various data.

This is especially true in the field of social and economic process management, which remains a source of social problems. Due to the introduction of information and communication technologies, all components of human activity management have acquired new powerful tools. However, the problems regarding effective usage of these tools added to the typical problems of business process management.

However, there are also problems in managing business processes in the educational sector, including in higher education institutions (HEI). Moreover, the synchronization complexity of actions between different systems, the differences in the data presentation and, as a consequence, the complexity of data exchange between them, create new problems related to redundancy of data, delays in obtaining the needed data, fragmentation of business processes occurring in HEI. All this complicates the efforts of educational subjects to transfer routine processes to ICT tools.

Another problem for most HEIs is the redundancy of service personnel, whose functions can be performed more efficiently by automated information systems and complexes. The solution of this problem will not only have an economic effect, but it will also provide an opportunity to get rid of the undesirable, "human" factor: mistakes, incompetence, bias, etc, when making management decisions. However, the approaches to solving this problem must be thoroughly researched and balanced.

Specialists in the field of automation, creation and implementation of information and communication technologies into education, pedagogy, psychology, theory and methodology of teaching computer science, pay considerable attention to finding ways of solving these problems.

The major aim of the research is to substantiate theoretically and to create a methodical system for designing and implementing web-oriented university information-analytical management system.

Literature Review

However, the issues of designing web-oriented information systems for managing the university's educational process and their systematic implementation and usage of higher education institutions in the information environment are still not explored enough.

Theoretical analysis of the current state of scientific research and practical aspects of the ICT usage for the purposes of organizing and managing the HEIs educational process, indicates the existence of contradictions between:

society's objective need to renew the educational process management system in order to improve the quality of preparing the future higher education professionals (Cao, Y., Kirilova, G. I., & Grunis, M. L.; 2017), and the lack of development of its conceptual, scientific and applied provisions;

the rapid increase in the impact of information technology on all processes occurring in the HEI, and the lack of theoretical and methodological research regarding the systematic usage of ICT in the educational process;

the need to overcome fragmentation in the usage of ICT tools during the management process regarding educational operations, and the need for their justified usage in order to support the educational activities of the university's scientific and teaching staff;

available technological opportunities to use modern information and communication technologies in order to support the educational sphere, in particular, web-oriented and cloud-oriented technologies (Whitlatch, C. J., & Orsulic-Jeras, S.; 2018), and insufficient readiness of the educational process HEIs members for their scientifically grounded, pedagogically balanced and effective usage (Król, K., & Gawroński, K.; 2018);

significant didactic potential of the information systems usage in managing the educational process of HEI, and the shortage of theoretically justified models and effective techniques for their development and implementation (Cioruța, B., Coman, M., Luran, A., & Cioruța, A. A.; 2018).

Methods

A complex of scientific research methods was used in order to achieve set goals and to solve certain tasks. The following theoretical methods apply to them: analysis of current standards of higher education, programs, monographs, dissertation research on educational issues, articles and materials from scientific and methodological conferences, application problems regarding modern information and communication technologies in the HEI, existing experience of such work in higher education institutions; generalization of the existing experience of applying ICT into the HEIs management and personal organizational and pedagogical experience of developing, implementing and using information systems for managing the HEIs educational process.

Results

The university's decision to choose the creation ways of its information-analytical management system requires consideration and analysis of a large amount of different, sometimes contradictory factors, taking into account the state of the university's IT-infrastructure and its capabilities, and this decision is often in favor of independent development of its information system.

Further consideration will be aimed at discovering the key features of developing a Information-analytical system of university management (IASUM) (Fig. 1), which refers to the component "Management of the educational process" as the most complex and resource-intensive component of the university's management system.

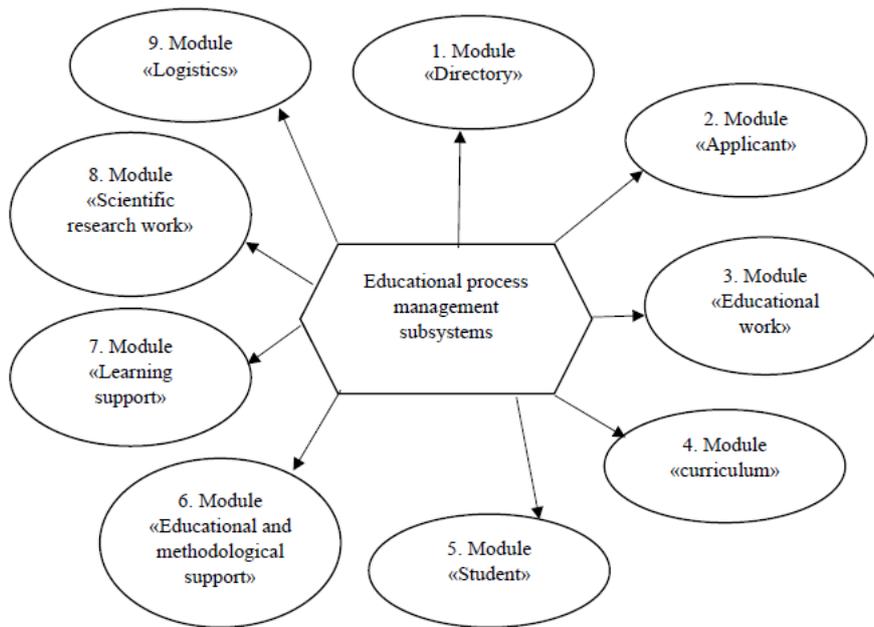


Figure 1. Structure of the management subsystem regarding the educational process of the university's management information-analytical system (author's development)

As shown in Figure 1, the IASU Educational Process Management subsystem has a modular architecture. The modularity of information system (IS) implementation is that it involves relatively independent modules.

The implementation of individual modules of the system is standardized and realizes under a single scheme. Due to this, the creation of several independent modules of different developers can be organized at the same time. Next, we propose to briefly consider the modules of subsystem for managing the educational process of IASU "University".

The "Directory" module contains the most requested, by various modules of the system, data about the following aspects: specialties, institutes, faculties, departments, teaching staff, positions, roles, permissions, system users, etc. This subsystem module is linked to all of the following modules using a unified data format and controlling their relevance individually for each subsystem.

The module "Applicant". This module of the subsystem provides informational and analytical support for the processes of managing interaction with applicants, as well as automates the routine processes (Fig. 2) at all stages of the introductory campaign of the higher education institution. The applicant module includes a range of search tools (electronic questionnaires, competitions, training courses, etc.).

During the introductory campaign, online data exchange is ensured, in particular, obtaining an up-to-date version of the rating list of entrants, automated verification of data in electronic applications submitted through the official service, their automated registration in the module "Applicant", receiving up-to-date lists of applications, operative receiving of statistics regarding applications submitted by entrants, automated decision making of the Admission Committee (changing the applications status in accordance with the made decision).

Based on the data from this module, rating lists of entrants are formed for their further publication on the University website. Data on enrolled students are automatically transferred to the module "Student".

Module "Educational work". This module provides informational and analytical support for the planning and organization activities regarding the educational process, as well as, automates the activities of all structural units involved into the educational process.

The curriculum of the respective specialty is automatically formed, based on the specialty's educational standard in the Curriculum block.

Annually, on the basis of the curriculum, in the block "Working curriculum" a working curriculum and schedule of the educational process of the relevant specialty is formed automatically.

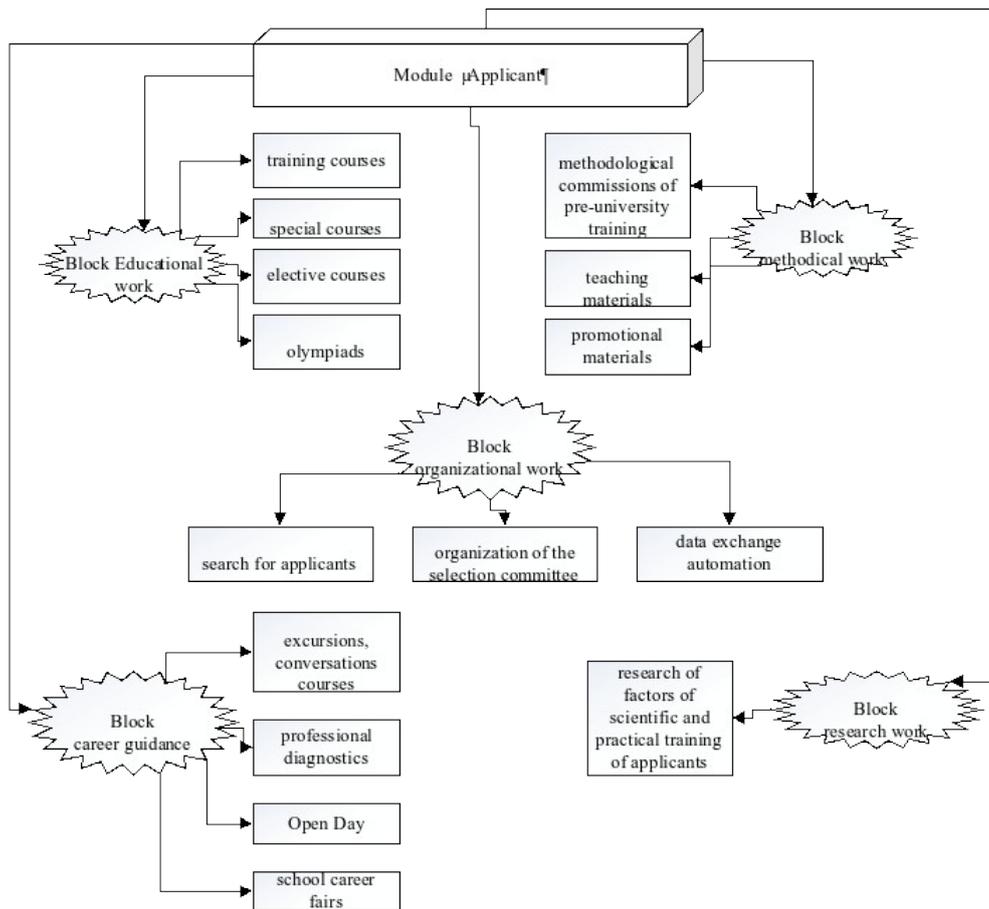


Figure 2. Structure of the model «Applicant» (author's development)

After the approval process, data from the work curriculum and schedule of the learning process are used in the module «Student» to form individual student curricula.

The block "Calculation of educational load" automatically calculates the amount of educational load for the corresponding contingent (stream, group, subgroup), based on data from the working curriculum and data on the contingent, obtained from the module "Student", taking into account the time standards for the implementation of different types of educational work. This block provides the opportunity to unite students, depending on the chosen discipline, into streams, groups or subgroups.

Based on the data from the block "Calculation of educational load" in the block "Educational load of academic departments", automatic distribution of educational load between the departments, as well as the calculation of scientific and teaching staff are carried out, using the approved algorithm for calculating rates.

Using data from the block "Educational load of academic departments" in the block "Teachers' educational load", the educational load between teachers is automatically distributed in the departments.

Module «Schedule». This module of the subsystem provides informational and analytical support for the processes of forming and using the schedule of classes, sessions, and other events.

Based on the data, received from the block "Teachers' educational load" of the module "Educational work" and taking into account the appropriate schedule of the educational process and the available classroom resources, the schedule of the educational process, schedules of consultations and examinations are automatically formed in the module "Schedule".

This module contains the automatic search tools for automatically finding the free audiences, required for certain types of classes, and checks the ability of a particular teacher to hold classes at specific times for specific groups of students.

The module provides different formats for printing schedules (DOC, XLS, PDF), as well as for displaying them on University sites using a range of filters (by faculty, specialty, group, teacher, etc.).

Module «Student». This module provides informational and analytical support for student learning management processes and automates the activities of directorates (deans). After the enrollment command, the data from the "Entrant" module is transferred to the "Student" module regarding the enrolled students in a certain specialty. Using this data, student ID cards are generated automatically, and, using quantitative characteristics of the contingent, groups and subgroups of students could be created automatically. After forming a contingent of student groups, information about them is transmitted on request to the module "Educational work" for the calculation of academic load.

The individual curriculum of each student for the current academic year are formed on the basis of data from the block "Work curriculum" of the module "Educational work" and personal students' application formed in the module "Student" on the list of selected subjects in the category "at the student's choice". Individual plan data is analyzed, summarized and transmitted to the module «Schedule» on request.

The module contains the means of automatic formation of examination-credit information for the students, taking into account their individual directions of study for each academic discipline.

Also, the module «Student» has a mechanism for automatically gathering data from the module "Learning support" to a students' success log, included in this module.

Based on the data from the success log, commands are formed automatically: transfer to the next course, appointment of scholarships, deductions from the university, admission to attestation, etc, as well as, diploma supplements and other supporting documents are formed. Information about the current and final academic progress of students are transmitted to the subsystem «Logistics» on request.

Module «Educational and methodological disciplines support» (EMDS). This module provides information and analytical support for the formation and systematization processes of educational and methodological provision of disciplines, as well as automation of data exchange with the module «Learning support» .

On the basis of data from the educational program and data from the block «Working curriculum» of the module «Educational work», teachers of departments automatically carry out the formation of educational programs and work programs of educational disciplines. Teachers of the departments also create a list of relevant educational and methodological literature that is included into the electronic repository of the university, as well as form lists of questions for the intended types of control.

Based on the data collected, the EMDS module automatically generates all required documents and provides public access to them from various modules, where it is necessary, in particular from the module «Learning support» and the University portal.

The module contains analytical means for controlling the availability, completeness and quality of the educational and methodological disciplines support.

Module «Learning support». The module provides information and analytical support for the educational process, provides effective tools for organizing the interaction between its participants, using a formed model of learning support, which is created on the basis of the systems Moodle and Google APPS for Education.

Such module, together with the modules «Educational work», «EMDS» та «Student», gives the opportunity to provide:

- management of the development of educational materials for different disciplines;
- formation of disciplines' educational programs of, using a single base of educational materials;
- managing the development and support of disciplines' e-courses;
- organization and support of students' educational activities using distance learning technologies;

- control of student studying organization.

The module «Scientific research work» (RTD). This module provides information and analytical support for teachers, doctoral students, postgraduates and students in conducting scientific research work.

The block «RTD Planning» provides an opportunity to formulate general RTD plans, RTD thematic plans, plans for scientific events (competitions, exhibitions, etc.).

The block «RTD results accounting» provides an opportunity to register and account applications for RTD activities, automatic inclusion of approved applications into the R&D plan, as well as accounting of staff involved into research activities, reports and other documents.

The block «Analysis and prediction of the RTD results» provides an opportunity to analyze scientific publications, the effectiveness of RTD achievements of scientific and pedagogical staff, current success of postgraduates and doctoral students.

The block "Organization and accounting of scientific personnel training" provides the opportunity to manage a contingent of postgraduates, doctoral students, scheduling lessons, examinations and other events, as well as controlling documentation (orders, licenses, certificates, etc.).

Block «Report Generation» provides an opportunity to automate the process of forming the annual report on the university's scientific activity, the annual reports of departments about employees' research activity, the annual report on the work of postgraduate and doctoral studies, the preparation of reports on the students' scientific achievements, etc.

Module «Logistics». Together with the considered modules, it provides informational and analytical support for the monitoring and analysis processes of educational activities, as well as predicting the outcome of the recruitment process, analyzing the university's ranking among other educational institutions, automated job search on demand provides automated graduation resume creation.

Discussion

The subsystem's model «Managing educational load» is recommended to be developed based on the usage of modern network technologies and a single data backup, which provides a simple mechanism for integrating data into a unified information resource of the university and enables to share it, taking into account the access differentiation mechanism (for data protection purposes) for many users: university administration, teachers, students of various education forms, entrants, which in turn, provides an opportunity to achieve a high level of data integrity and create conditions for the implementation of complex automated control system of educational process with the following functions: development (modernization) of curriculum according to directions and specialties, as well as educational curriculum for the next academic year; calculation of the university's teaching staff; distribution of teachers' educational load; forming the schedule of study groups at the university; accounting of the intermediate (rating) and final academic performance of students; formation of diploma supplement.

The designed model of the subsystem "Control and assessment of students achievements" has become the basis for the development of computer testing system, which should take into account and support the fulfillment of the basic didactic principles of the studying control, to ensure the implementation of the various types of computer testing for students of any discipline, as well as provide tools for analyzing and interpreting test results.

Conclusion

In our opinion, one of the main directions of the university's development regarding informational educational and scientific environment is the formation and implementation of informational and analytical management system, in particular, managing its educational process, which will enable to:

- intensify the usage of existing and create new effective and high-quality educational and scientific resources;
- open the access to these resources for students, teachers, employees of education and science governing bodies, public organizations, a wide range of users;

- create an organizational and technological base for the introduction of teaching information technologies into the traditional educational process, as well as to support distance learning at universities;
- reduce the cost of educational processes;
- increase the level of students' professional training of all education forms;
- ensure that the general public has access to educational and scientific resources;
- improve the process of interaction between the departments of the university, as well as with other educational and scientific institutions;
- improve the efficiency of student learning and the productivity of the teaching staff;
- create a unified platform for the provision of educational services;
- ensure transparency and investment attractiveness of the university;
- increase the level of graduates' competitiveness in the labor market;
- integrate the university into regional, national, European and global educational and scientific spaces.

Due to the complexity of these processes, their dynamism and even, sometimes, unpredictability, the issue of careful selecting the means of designing the information system appears. The main tools for the creation of university's management information-analytical system are the following: project management system, visual modeling tools, web frameworks.

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Aims & Scope (Accounting)

Article

ORGANIZATION OF MANAGEMENT ACCOUNTING OF INTANGIBLE ASSETS OF THE ENTERPRISE IN THE INFORMATION SOCIETY

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Abstract. The theoretical features of rational organization of management accounting of intangible assets at the enterprise are considered. It is proved that the effective organization of management accounting of intangible assets is realized based on the optimization of the flow of accounting documents. This requires a change in the element of accounting methods. Thus, the study suggests ways to improve the accounting of intangible assets in the enterprise. The ways to optimize the movement of accounting documents for intangible assets are identified. The flow diagram of primary accounting documents between divisions of the enterprise on operations of intangible assets on the basis of the concept of "responsibility centers" and cost pool system is constructed. The movement flow chart of the certificate of the introduction of the intellectual property into economic turnover as a part of intangible assets is presented. It is the rational orderly movement of accounting documents and the implementation of various procedures that affects the effective management system of all resources of the economic entity. Thus, all the developed documents, namely: movement flow charts and accounting records flow diagrams, allow optimizing the accounting process for intangible assets. Their use in the enterprise allows clearly tracing the stages of the document and tracking possible deviations, for the further analysis and elimination of them. To assess the entity's fair value of intangible assets for management accounting purposes, it has been proposed to establish the fair value intangible asset assessment certificate. To increase the relevance and eliminate the asymmetry of accounting information, managers monitor the use of fixed capital in order to make effective decisions about the development of the company.

Keywords: intangible assets, responsibility centers, cost pool system, accounting records flow diagram, fair value.

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Introduction

In addition to material resources, resources that do not have a material form (hereinafter - IA) are used in the economic activity of the enterprise. Especially in the era of the information society, when intangible assets form the value of an enterprise, its business reputation, and brand. The presence of intangible assets in the composition of the enterprise's resources increases its market value and increases investment attractiveness.

Since intangible assets are a rather specific object of accounting, they are a debatable issue of many scientists since, in addition to valuation, such assets are characterized by insufficient classification, separation into the balance sheet and off-balance sheet accounting, depreciation policies, differing degrees of influence on the final financial result of the enterprise, and insufficient market development of such assets compared to work, goods, services or financial instruments markets. The relevance of the above problems and the need to improve the accounting system of IA of an enterprise determined the choice of the research topic.

The aim of the work is to study the organization of accounting for intangible assets of enterprises, as well as the development of specific ways to improve it.

Literature Review

As are a very specific accounting item and a debatable issue for many scientists since such assets are characterized by insufficient classification, separation into the balance sheet and off-balance sheet accounting, valuation, depreciation policy, differing degrees of influence on the final financial result of the enterprise, and insufficient development of the market for such assets compared to work, goods, services or financial instruments markets.

Modern theoretical and practical developments in accounting for intangible assets at the enterprise reflect a thorough understanding of the problems associated with the transformation of the accounting system in the context of the development of society. However, a number of questions on improving the methodology for accounting for intangible assets in enterprises are insufficiently investigated and remain unresolved.

Since IA are a very specific accounting item, one of the most problematic aspects of their accounting is the correct reflection of the assessment. The complexity of the valuation of IA is due to:

1. A variety of intellectual property, each of which must be original under the law (Bryan, D., Rafferty, M., & Wigan, D.; 2017).
2. In different ways of receipt (recognition) of the enterprise.
3. The various forms of practical use in the enterprise (Cañibano, L.; 2018).

The concept of “intangible assets” is quite versatile and is studied by many economists, theorists, accountants, marketers, and the literature has a significant number of approaches to the definition of this rather capacious and broad concept (Li, K. K., & Sloan, R. G. (2017)). Thus, some scientists consider intangible assets as part of the enterprise’s resources as an integral part of non-current funds (Nebel, T., O'Mahony, M., & Saam, M. (2017)), others as intellectual property, some scientists study the field of intangible production. In addition, in separate sources, along with the term “intangible assets”, they use the concept of “intangible resources”, “knowledge assets”, “Intangible factors”, and “intellectual capital”.

Methods

The theoretical and methodological basis of the study are scientific methods based on the dialectical method of cognition and the objective laws of economics. When studying the theoretical aspects of accounting for intangible assets of the enterprise, the documents and accounting registers in form and content are investigated (in order to identify their compliance with existing standards and requirements). In the process of performing the work, traditional methods and techniques of economic analysis of economic activity were used: system analysis (for detailing and dividing the object of study into separate components); synthesis (in order to generalize various aspects of accounting and analysis); analytical calculations (in order to calculate the necessary indicators).

Results

Information on the operations of IA arises at the time of processing the document already at the initial stage and is on the move to registering the impact of such an operation in reports that are generated by processing accounting documents. Therefore, ensuring the orderliness and efficiency of the movement of these documents, which are called as document management, becomes an important stage in the formation of rational accounting.

Untimely submission of relevant information, inadequate analytical processing regarding the actual implementation of operations from a certain stage of the operation of intangible assets reduce the level of reliability of the data. This creates barriers to successful management decisions to continue long-term activities.

Information on transactions of intangible assets arises at the time of execution of the document at the initial stage and is on the move to register the impact of such a transaction in the reports generated by processing accounting documents. Therefore, ensuring the orderliness and efficiency of the movement of these documents through the formation of formal document management (schedule, flow chart) becomes an important step in the formation of rational accounting.

In general, the accounting process is divided into three process stages – initial, current, and final. Accounting processes are divided into partial processes that are formed by the objects of accounting (Table 1). In turn, partial processes are divided into operations.

Table 1. Distribution of accounting transactions with IA by process stages of accounting
(author's development)

Stages of accounting		
Initial stage	Current stage	Final stage
monitoring the receipt, use, and disposal (liquidation) of IA;	registration of data on IA with the help of accounting accounts and display of information about them in accounting documents;	generalization of information in the form of preparation of appropriate reporting forms for IA;
determination and evaluation with the help of monetary and physical measures;	preparation of intermediate consolidated accounting documents of IA;	ensuring the provision of generalized information on IA in the form of reports to internal and external users;
recording relevant information on IA in primary documents.	grouping of data from IA data recording media.	storage of documents created at all process stages of accounting.

The study of the organization of the accounting process in space and time (calculation of the standard number of accounting services, building the organizational structure of accounting, staffing) allows making effective management decisions to optimize the costs of organizing accounting.

Perspectives for further research in this field of knowledge are: improving the distribution methodology among functional groups of accounting specialists, building a network model of accounting operations, and the like.

Partial processes are divided into separate stages at which primary, current, and final accounting operations are carried out. Stages of accounting are the basis of the accounting process on the basis of rationing.

Accounting operations for the content are divided into technical, logical, analytical, creative, organizational, and auxiliary. In terms of content, accounting operations are divided into technical, logical, analytical, creative, organizational, and auxiliary. The grouping of accounting operations by content is shown in Table 2.

Table 2. Separation of accounting transactions with IA by content
(author's development)

No	Stages of accounting	Type of transaction by content	Content of the operation
1.	Receipts of IA	Technical	Fixation of information in primary documents.
		Logical	Arrangement of input data arrays.
		Analytical	Valuation of IA.
		Organizational	Confirmation of receipt of IA on the enterprise.
2.	Depreciation of IA	Technical	Entering information into relevant documents.
		Analytical	Depreciation calculation.
		Organizational	Control over the correctness of the calculation.
3.	Inventory of IA	Creative	Choice of depreciation method.
		Technical	Execution of the order on the inventory commission.
		Logical	Data ordering.
3.	Inventory of IA	Analytical	Actual verification, detection and correction of accounting errors.
		Organizational	Confirmation of the commission's conclusions.
		Auxiliary	Record keeping.
4.	Disposal (liquidation) of IA	Technical	Display of information in primary documents.
		Logical	Preparation of documents for disposal.
		Analytical	Calculation of liquidation value.
		Organizational	Control over the correctness of calculations.

According to the results of the study, the following conclusion can be made: operations that are different in content can be present at several stages at once since accounting operations only in

that case will perform their functions to ensure the accuracy and reliability of information when they are used comprehensively, in close interdependence with each other.

According to the considered flows of accounting information for accounting for intangible assets, a significant cycle of movement is carried out from the moment of receipt of the object and the formation of a document management schedule. However, the risk of inconsistency and inaccuracy in a large array of documents increases. In turn, the discovered deficiency causes complexity in the activities of the enterprise and the adoption of appropriate decisions.

To introduce further optimization of the documentation of accounting processes of intangible assets, the stages of movement at the level of enterprise units can be reflected.

Any type of activity is associated with working with documents that can be formed both at the enterprise itself and come from contractors. Each of these documents must be accepted, processed, executed, and transferred to the archive. The movement of all documents in the enterprise is called document management.

Since this process is an important and integral part of accounting, it should be regulated. To achieve this goal, the document management schedule and flow chart are formed.

However, there is no unified form, therefore, an economic entity has the right to create these documents depending on the purpose of the activity, such as the organizational structure of management and the like. The main advantage of creating the document management schedule is the ability to carry out operational control over the entire set of accounting procedures in order to provide complete, reliable, and relevant management information.

The scheduling method allows establishing a logical connection between the various stages of work with certain types of documents in the enterprise, to trace the sequence of such accounting work and its content. Such visualization of information data simplifies their perception and allows quickly identifying the presence of double spending of time on the same operation.

In addition to the document management schedule, the so-called flow charts of the movement of the primary documents are important for the rational use of working time.

They are compiled on the basis of the developed document management schedule in any form since their typical form is not fixed at the legislative level, so the user can independently develop it based on its information needs and the perception of information.

The use of the flow charts helps to reflect the organization of the algorithm for the formation, verification, approval, processing, and transfer to the archive of the accounting document at the end of the existence of the intangible asset of the enterprise. Thus, the time spent on the formation of the document is minimized. The flow chart also shows the movement of the primary accounting document in order to optimize the accounting process.

Thus, for greater clarity, it is possible to display flow charts of the movement of the certificate of the introduction of the intellectual property into economic turnover as part of intangible assets (form No. HA-1) (Table 3).

Through the formation of the flow chart, the movement of accounting documents on the main component of the organization's assets is accelerated, the level of control, mechanization, and automation is increased and the necessary information is obtained to make further decisions on such objects in accounting.

With the rapid development of information technology, the visual display of document movement in the enterprise can be created using special batch programs such as Microsoft Office Visio. This software product allows separating by means of "pools" separate structural divisions that considerably simplifies the analysis of the resulted information.

The use of this software product helps to increase the level of automation, minimize material costs, ensure the rational location of departments, determine the sequence of movement of intangible assets, and ensure the avoidance of cyclical document processing in a particular workplace.

Form No. HA-1 is used by enterprises, institutions, and organizations, regardless of the form of ownership, to register operations on the introduction of the intellectual property into economic turnover as part of intangible assets.

Table 3. Movement flow chart of the certificate of the introduction of the intellectual property into economic turnover as part of intangible assets (form No. HA-1) (author's development)

position	executive person					
	capitalization commission		manager	chief accountant	intangible asset accountant	archive
	head	members				
Creation of an order on the establishment of a commission for the acceptance of an object			★			
Approval of the order			★			
Overview and feature description	★	★				
Registration of the act	★	★				
Signature act				★		
Verification of the act				★		
Approval of an act			★	★		
Transmission Act for Processing					★	
Entering information in the inventory card of the object					★	
Reflection of operations on accounts					★	
Fill Inventory					★	
Transfer to archive						★
Archive removal after expiration of storage periods						★

The formed flow diagram of intangible asset accounting documents is presented in Figure 1.

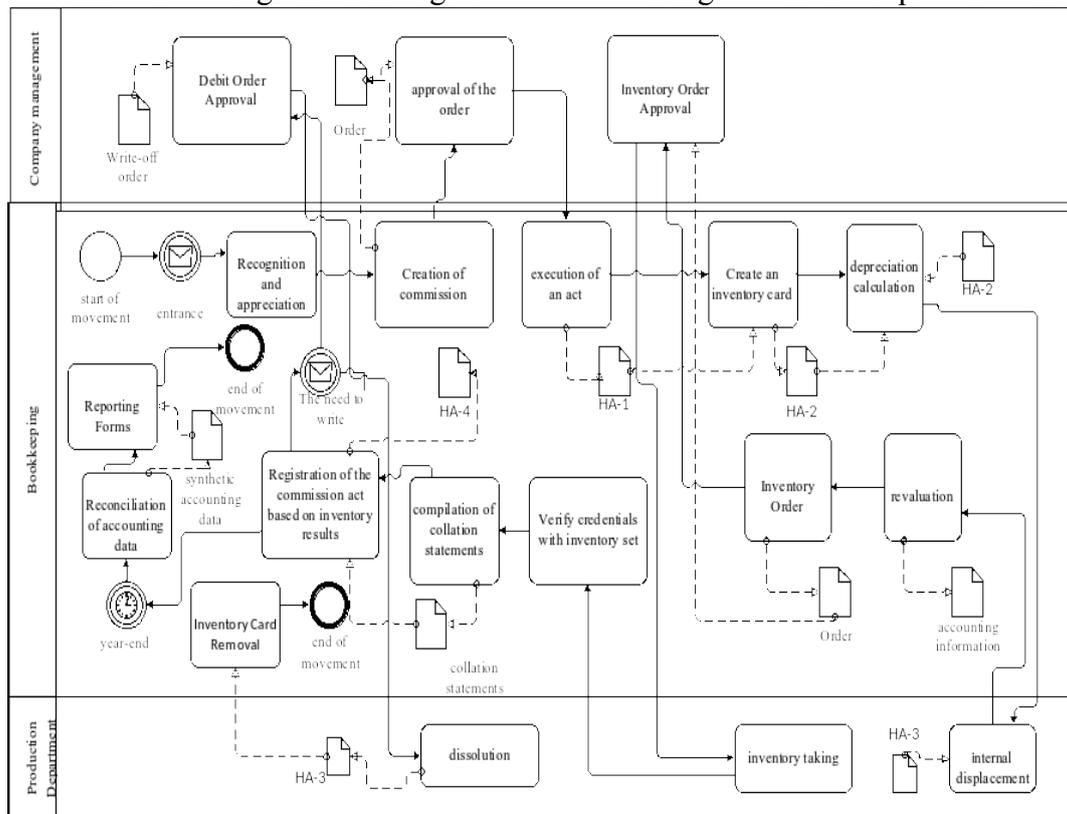


Figure 1. Flow diagram of accounting documents for accounting of intangible assets between divisions of the enterprise on the basis of the concept of "responsibility centers" and the cost pool system (author's development)

Notes: HA-1 - Certificate of the introduction of the intellectual property into economic turnover as part of intangible assets; HA-2 - inventory card of accounting of the intellectual property a part of intangible assets; HA-3 - Certificate of disposal (liquidation) of the intellectual property as part of intangible assets; HA-4 - Inventory of intellectual properties as part of intangible assets.

The certificate is drawn up in one copy for each individual object on the basis of technical, scientific and technical, and other documentation (license agreement, copyright agreement, patent, etc.), signed by the chairman and members of the commission, the person responsible for accepting the right to intellectual property. The certificate is approved by the chief accountant and the head of the enterprise.

Inventory card of accounting of intellectual property as part of intangible assets (form No.HA-2) is used for analytical accounting of intellectual property, as well as for analytical accounting of a group of similar, in terms of purpose and conditions, use of objects received in one calendar month and to one person responsible for their use.

Form No. HA-3 is used for registration of disposal of intellectual property as part of intangible assets upon their write-off (liquidation). The certificate is drawn up in duplicate by a commission appointed by the head of the enterprise. This certificate is approved by the chief accountant and the head of the enterprise.

The inventory of intellectual properties as part of intangible assets (form No. HA-4) is made in one copy for registration of inventory data separately for each location of intellectual property and for each person responsible for the use of intellectual properties.

Therefore, the implementation of the effective organization of accounting for intangible assets in the enterprise is quite labor-intensive work, which requires a solid base of theoretical and methodological knowledge and skills, as well as a large amount of time. Therefore, when forming it, a lot of effort should be made, starting from the calculation of the number of accounting and division, which is engaged in intangible assets, and ending with the development of information flows by creating flow charts or using other programs. The implementation of this will improve the efficiency of accounting and the level of automation in the enterprise.

Discussion

One of the most problematic aspects of IA accounting is the correctness of their valuation in accounting. Due to the lack of tangible physical form of such assets, it is much more difficult to estimate their value than any other objects.

If the company can reliably assess the IA objects, it will receive a number of benefits: balancing the accounting of all assets of the enterprise; optimization of the ratio of assets, as well as their structure; increasing the market value of the enterprise; accounting for the full value of IA in the merger or acquisition of the enterprise; control of the amount of depreciation deductions. Therefore, it is necessary to focus on innovative approaches in the valuation of these assets (Thum-Thysen, A., et al. (2017)) in order to borrow their experience and improve the accounting of IA in enterprises.

Since the market economy conditions require economic entities to measure IA at fair value, and all primary documents have standardized forms, the fair value intangible asset assessment certificate has been developed to improve the management accounting process for IA valuation transactions, which is presented in Table 4.

Table 4. Fair value intangible asset assessment certificate (author's development)

Object information			Fair value components					Real value of IA, USD	
Name	Group / Type Proof of ownership The market price of a similar asset in the market, USD	Document of title	Market price of a similar asset in the market, USD	Costs incurred by the company, USD					
				#1	#2	#3	#4		#5
Integrated microcircuit	Right to industrial property	Patent No 50218	20 000	-	-	300	-	1 200	22 000

Notes: # 1 - staff salaries; # 2 - deductions from staff salaries; # 3 - services of third parties; # 4 - depreciation costs; # 5 – experts' services.

The peculiarity of this certificate is that it is unified for use in the case when the enterprise independently conducted the valuation of IA at fair value, as well as in the case of the services of an expert appraiser

Conclusion

Information about the business transaction is in the information space of the enterprise in the movement from the moment of formation of the primary document to the reflection of the impact of the business transaction in the reporting, which is provided by the movement of accounting documents at the stages of its processing.

It is the rational orderly movement of accounting documents and the implementation of various procedures affect the effective management system of all resources of the economic entity.

Thus, all the developed documents, namely: movement flow charts and accounting records flow diagrams, allow optimizing the accounting process for intangible assets. Their use in the enterprise allows clearly tracing the stages of the document and tracking possible deviations, for the further analysis and elimination of them.

Equally important is the proper organization of the accounting service, especially in the regulatory number of such employees, as their insufficient number will lead to the poor performance of their duties and uncover of all aspects of accounting processes, and their excessive - to overstate costs and, accordingly, non-rational use of labor and material resources.

Perspectives for further research in the system of accounting for intangible assets include the development of a technical card of working accounts, accumulated flow chart of primary documents with the specification of time and performance of certain work by responsible persons in the units of responsibility centers.

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