The study is devoted to the features of the fashion industry transformation into a sustainable ecological ecosystem. The sociocultural sphere of the fashion industry was chosen for analysis, since this sphere directly depends on the public's attitude to the fashion industry cyclical model of functioning. The relevance of the choice is confirmed by the lag in the sociocultural factors study from the results of technological, artistic, aesthetic and environmental aspects research. The problem is exacerbated by the lack of a single center for managing the socio-cultural sphere in a heterogeneous environment of the ecosystem. The purpose of the study is to find ways to regulate the fashion industry socio-cultural sphere in the conditions of a common control center absence.

The concept of regulation the fashion industry socio-cultural sphere was proposed based on synthesis the digital and humanitarian technologies in the process of its transformation into a sustainable ecological ecosystem. Regulation implemented by generation of stimulating impacts on the independent participants of the cyclic process in order to coordinate their behavior for achieving the common goals of the system. For the formation of influences, humanitarian technologies were chosen that able to influence on the behavior of the process operators. The list of digital humanities curricula of iSchool educational network was chosen as a data source. To create incentives, a techno-humanitarian complex was formed, consisting of filtered and harmonized digital humanities and ecological fashion design. It is shown that this complex is able to influence on the socio-cultural components of the fashion industry innovative potential by stimulating of the ecosystem subjects behavior. The possibility of implementing the proposed concept demonstrated by developing a functional model of fashion industry techno-socio-cultural system with the participation of the techno-humanitarian complex

Keywords: fashion industry, innovation potential, influence factors, digital humanities, techno-humanitarian complex

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SYNTHESIS OF DIGITAL AND HUMANITARIAN TECHNOLOGIES IN THE PROBLEMS OF MANAGING THE FASHION INDUSTRY TRANSFORMATION PROCESSES

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1. Introduction

The global nature of economic and socio-cultural life transformational processes, caused by the recent year's cataclysms and crises, requires a conceptual understanding of social reality. Specifying the sphere and optimal choice of the research concept will help to reduce the complexity of solving a number of multilateral problems generated by the transformation of all life aspects. The problems of fashion industry transforming from operation in unstable linear model of into a sustainable environmentally friendly ecosystem are characterized by the growing attention of researchers. The environmental and social consequences of existing production and consumption systems created one of the most difficult problems of civilization – the problem of transition the industries to sustainable development [1]. This problem is also relevant for the fashion industry, which, due to the excessive use of resources and high environmental impact, is recognized as economically and environmentally unsustainable [2–4].

An integral comprehension of the surrounding world development trajectory is assumed effective only within the framework of a multidimensional approach to the functioning laws analysis "in the historical, cultural, social, political and theoretical contexts" [5]. The transformation of the fashion industry is under the influence of technological, aesthetic, economic, environmental and socio-cultural factors against the backdrop of breakthrough aspects of digitalization. Therefore, understanding its development requires a multidisciplinary approach.

The anticipatory development of fiber synthesis technologies and materials reprocessing in relation to the socio-cultural and administrative-organizational problems of the cyclic model functioning was create the asymmetry in the level of these problems knowledge. Digitalization of business processes, automation of textiles and clothing production operations additional enhance the predominance of technological results. The deficiency of knowledge and experience in managing of fashion industry socio-cultural and behavioral spheres complicates a multidisciplinary approach to study and creates barriers to managing its transformation processes. This skew can be leveled by intensifying the analysis of socio-cultural and organizational-behavioral influence factors on the fashion industry sustainable development, which actualizes these areas of research.

In the context of manufacturing industries digital transformation and the convergence of new generation digital platforms [6], it is important to cognize the deep connection between digitalization and the processes of sociocultural life. Understanding this relationship is necessary to solve the more specific problem of harmonizing the efforts of autonomous parties into a coherent whole in the digital innovation ecosystem. As a connecting axis for information systems development, the sociotechnical perspective forms a purposeful basis for the

concept of synthesis the digital and humanitarian technologies in the tasks of economic and sociocultural sphere sustainable development. This concept promotes the expansion of the digitalization influence zone on the transformational processes of all life areas and initiates the evolutionary transformation of information systems into techno-sociocultural systems [7, 8]. An analysis of the digital and humanitarian technologies synthesis prospects to harmonize the functioning of relatively independent fashion industry components contributes to solving the urgent problem of managing its transformation into a sustainable ecological ecosystem.

2. Literature review and problem statement

The intensive publications flow on the topic of the fashion industry transition to a circular model of functioning reflects several approaches to the implementation of a closed cycle. Article [1] describes the slow fashion trends that the cyclical model proposes as an alternative to fast fashion. The slow fashion business model is described. The descriptively-qualitative nature of the presentation does not affect the mechanisms of management the cyclic model supply chain. The role of digitalization in management of information between interaction process independent participants is not shown.

Article [4] provides a general overview of requirements to the fashion design cyclical model and describes the practice of providing business support services in the cyclical model. Variations on ways to reuse clothing are presented, including the second-hand market, model rental, and model-as-a-service.

The discussion of the features of cross-culturalism within the framework of the International Encyclopedia of Social and Behavioral Sciences [5] provides the information that should be taken into account during a planning of multidisciplinary approach to the problems of fashion industry ecosystem transforming. Since reality is socially constructed, knowledge does not become useful for application in certain socio-cultural environment if it is not placed into a historical, cultural, social, political and theoretical context. In addition, "The fragmentation of knowledge across disciplines is far more serious that the fragmentation of knowledge within them, although the latter is a problem as well" [5]. That is, for the implementation of a multidisciplinary approach and the procedure for the digital and humanitarian technologies synthesis an interdisciplinary defragmentation is necessary, including the harmonization of terminology and mutually complementary harmonization of functionality.

The work [9] discusses the approach to solving the key problems of the fashion industry transition to environmentally friendly production. In the proposed approach, the problems of a social and managerial nature transformation are considered at the formulation level without analyzing the causes of their occurrence and solution methods.

The article [10] by means of a systematic review characterizes the drivers, barriers, practices and indicators of the circular economy sustainable operation in the textile and clothing industry. A conceptual model of a cyclic system was built based on the definition of the relationship between these concepts. The problems of introducing a circular economy in the fashion industry are formulated, but ways to overcome these problems are not indicated.

The article [11] presents the results of fashion trends study with a cyclicality emphasis. The impact of the circular economy sustainability principles on the fashion world perception by new generations of consumers is analyzed. Based on the survey results, the behavior of students is described in relation to new fashion trends. The article does not consider the management issues the companies participating in the cyclical process within ecosystem.

The study [12] is devoted to the analysis of used clothes supply chain organization in the cyclic model. On the example of a Swedish fashion retailer, the possibilities orchestrating of a fashion business cyclic model resources for supply chain management are described. Orchestration is understood as the coordination different fragments of cyclic supply chain resources and the coordination of actions within the ecosystem of independent companies.

Article [13] describes alternative forms realization of fashion products cyclic supply chains. The most radical is the cradle-to-cradle approach based on fiber-to-fiber processing. Another approach is based on the main features of cyclical thinking - lengthening using a fashion product cycle in time, expanding and intensifying its use. This direction is represented by circular, sustainable and slow fashion. In sustainable fashion, textiles and clothing are maintained at the high quality throughout their life cycle [14].

Articles [13, 14] presents an overview of the circular economy in a general way. The nexus between the circular economy and fashion are described; the leading role of fashion design in the closed chain of creating a fashion product is characterized. The overview tone of topics [14] presentation made it possible to fulfill a comparative analysis between the linear and circular economy, outline the essence of cyclical thinking, and highlight the role of digital innovation in the value chain of a fashion product. However, this broad coverage of the industry sustainable functioning is not focused at a deeper consideration of the interaction problems among various participants in the cyclical process.

Based on the analysis of works [1, 4, 9–11, 13, 14], it can be concluded that the greatest interest researchers manifested to the extending of products life cycle recycling technologies, and new business formulas for the fashion industry cyclic model. The least researched are the issues of socio-cultural essence and organizational-administrative direction. The considered research results are not enough to form the influence factors on the socio-cultural and organizational-administrative components to achieve the sustainability of fashion industry ecosystem.

The results of research [12] make it possible to fill out partially this gap. A study on the cyclical ecosystem resources orchestration showed the ability to manage cyclical consumer goods, offerings, supply chain operations, and partnership development using the influences, which owned by a fashion retail company.

The possibilities for coordinating resources and actions within the ecosystem of independent companies described in the article do not cover all the factors influencing the sustainability of the fashion industry ecosystem.

Besides, to a large number of publications devoted to the problems of fashion industry transition to a circular model functioning, a significant number of works are devoted to the phenomenon in fashion design digitalization.

The article [15] "Big data and models of digital fashion design" considers the features of the fashion products full life cycle stages in the framework of the sustainable fashion model. However, in the results of research the role of the designer and the expansion of digital design tools under the influence of virtualization are not characterized.

The study [16] considers universal, interoperable and evaluative sustainable design utilities aimed at minimizing the negative impact of the cyclic process on the environment, but does not analyze their contribution to the expansion of digital design tools.

The work [17] describes a model for managing the fashion industry transformation into a sustainable ecosystem based on balancing the components of its innovative potential. This model implements a more complete consideration of the features of the transformation. Comprehensive coverage of the problem is achieved by representing all influences by six groups of factors selected on the basis of the same nature: these are art-aesthetic, economic, environmental, technological, socio-cultural and administrative groups of factors. The set of the groups was determined based by the decomposition on relatively independent components the part of critical factors totality of ecosystem stability. The EU committee formulated these critical factors in the form of a recommendation [17]. The absence of a complete set of sufficient factors does not change the architecture of the functional management model. Adding a new factor to the group of critical factors is accompanied by its decomposition into elements that are added to the six groups of innovation potential, which does not expand the structure of the model.

Despite the comprehensive consideration of factors in the composition of fashion industry innovative potential, this work does not reveal the mechanisms the influence of each group to innovative potential balance.

In connection with the above-stated fact of the research results thematic "skew" of the technological areas in relation to sociocultural and behavioral problems, it is the particular interest to study the possibilities of influencing on the fashion industry sociocultural sphere and the corresponding components of its innovative potential.

The analysis of literary sources did not reveal any publications on the results of managing the socio-cultural sphere of the fashion industry cyclic ecosystem. Information on individual factors of influence is not enough to build a concept for regulating this component of the ecosystem innovation potential.

The problem is that the socio-cultural and behavioral fashion industry spheres depend on many independent actors and the conditions that shape public opinion. Complicating the problem is the lack of a decision-making center. Even within the framework of a local association of enterprises, it is quite difficult to organize a common control center for the socio-cultural component of the cyclic model innovative potential. With high probability it is more expedient instead of direct control of the ecosystem socio-cultural component find way and means for purposeful influence on subjects - the cyclic process participants. Such influence can be implemented by means of social media communications. Another form of action is to stimulate the achievement global goals of the cyclical ecosystem by coordinating the actions of its significant actors. One of the approaches to generating stimulating impacts can be a synthesis of digital and humanitarian technologies. The effectiveness of such synthesis based on the combination of high functionality, flexibility and scalability of digitalization with the experience of humanitarian technologies in shaping public opinion.

3. The aim and objectives of the study

The aim of the study is to develop a concept of the fashion industry socio-cultural sphere regulation based on the synthesis digital and humanitarian technologies in the process of its transformation into a sustainable ecological ecosystem. This will improve the management of the fashion industry sustainable development by influencing on its socio-cultural sphere in the way of stimulating the coordinated functioning of ecosystem components.

To achieve the goals set, it is supposed to solve the following tasks:

– to characterize the features of the fashion industry transformational processes;

– to describe the digitalization trends of the socio-cultural sphere with the definition of the role and features of digital humanities as an independent functional area;

– to evaluate the composition of wide profile digital humanities disciplines with selection disciplines for participation in the managing transformational processes under criterion of the possibility influencing to the fashion industry socio-cultural sphere;

– to characterize the techno-humanitarian complex as the result of synthesis digital humanities disciplines and ecological fashion design;

– to determine the features of implementation the concept of the fashion industry socio-cultural sphere regulation using the techno-humanitarian complex.

4. Materials and methods of research

4. 1. Object and hypothesis of the study

The object of the study is the fashion industry in the process of its transformation into a sustainable environmentally friendly ecosystem.

The study of the fashion industry sustainable development problems is based on the assumption that the management of its transformation is realized by balancing relatively independent components of the fashion industry innovative potential. An additional condition is aimed at rationalizing resources, that is, the balance to be managed by redistributing (without increasing consumption) the total resources of the ecosystem. These assumptions, as well as the further development of the analysis scenario, are based on the results of the study [17].

The hypothesis of the study is that as a result of the synthesis of digital and humanitarian technologies with ecological fashion design, a techno-humanitarian complex can be formed that can influence to the regulation of the socio-cultural component of the fashion industry innovative potential.

The base of sources includes resolutions and recommendations from commissions and working groups of international organizations [2, 3], as well as the results of work [18] and research by the iSchool Educational Programs Committee [19].

4. 2. Research methods

In the absence of a common control center for the elements of the fashion industry ecosystem, the possibilities of influencing its socio-cultural sphere are based on the formation of public opinion and creation the stimulating actions on cyclical chain participants. The formation of public attitudes to the phenomena of socio-cultural life is carried out with the use of humanitarian technologies. Taking into account the complex nature of the problem of coordinating the functioning of significant subjects, the actions for incentives generation were chosen based on the synthesis of digital and humanitarian technologies. One of the approved by practice results of digital and humanitarian technologies synthesis is digital hu-

manities, which originated and develops as a phenomenon of humanization the digitalization processes in the socio-cultural sphere. Therefore, the search for opportunities to influence the socio-cultural sphere of the fashion industry is carried out by the method of selecting digital humanities (DH).

For the selection of DH disciplines, two works [18, 19] were chosen as sources of primary data. The composition of the DH for the sociocultural sphere of the fashion industry was filtered from the list of training programs taken from the results of the iSchool committee research [19]. Selective filtering of disciplines was carried out based on their functional competencies compliance with the fashion design and the socio-cultural component of fashion industry innovative potential.

The assessment possibilities of the techno-humanitarian complex as a generator of influences on the socio-cultural components of the fashion industry innovative potential are carried out in three steps. On the first step for each of DH components, the functional possibilities of influencing the fashion industry socio-cultural sphere are determined. Then the features of this components mutual harmonization with fashion design are determined, including the harmonization of terminology and competencies to eliminate interdisciplinary fragmentation. Further, the abilities of the joint action of this pair on the target object are analyzed.

5. Results of the search concept of regulation the fashion industry socio-cultural sphere based on the synthesis of digital and humanitarian technologies

5. 1. Features of the fashion industry transformational processes

To the motivating factors influencing the transformation of the economic and socio-cultural sphere, it is customary to attribute threats to peaceful existence, as well as energy and raw material crises. Another driving mechanism of transformation was the trend of digitalization of the economic, socio-cultural and everyday aspects of the society life [17].

The trajectory of the fashion industry evolution, the emergence of which is associated with the development of fashion as a social phenomenon, was synchronized with the socio-economic and cultural stages of Western Europe development until the middle of the twentieth century. The globalization processes have enriched this nexus the influence traditions of East. Despite its youth, thanks to commercial efficiency, the fashion industry has rapidly become a multi-billion dollar sector of the economy, including the production and realization of goods and services. Since commercial effectiveness requires the formation of a positive attitude towards goods and services from potential consumers, in the course of its development, the fashion industry increasingly relies on advertising, media communication and branding.

The transition to mass production stimulated the development of the forecasting theory and the fashion trends analyzing practice, aimed at compensating for the inertia of the serial products creating chain. The development of modern fashion industry product range and design is based not on adjusting to existing needs, but on forecasting and planning art-design projects, which has determined the role of innovative fashion design as a key element in creating models of fashion-product.

Throughout history, technological advances have influenced the nature of fashion production. The first industrial revolution contributed to the mechanization of fashion production. The Second Industrial Revolution accelerated the mass production of fashionable clothing through the electrification of the technological manufacturing base; the third contributed to the automation of technological operations by means of electronics and informatization [20].

The economic model of the fashion industry functioning, which was formed during the period of technological rise, is extensive. The product value chain of this "linear" model is "designing/modeling - production - sale - operation - disposal" is focused on accelerating production with a shortening of the life cycle and increasing the consumption of fashion products. In a post-industrial society the function of the fashion industry as a marker of person social status, implemented by meant of costume, is hypertrophied into an instrument of influence on social relations through the imposition on the user of conditions for the consumption of goods. The post-industrial overconsumption economy promoted the development of fast fashion, based on the strategy of quickly updating models of fashion-product in sync with fashion trends and offering them at an affordable price. Using the social ambitions of users, corporations stimulate a high level of consumption.

While in the past few years of crises, epidemics and cataclysms financial markets have shown significant fluctuations, large fashion companies are increasing their output. According to a report by Interbrand [21], the average value of the 100 strongest global brands in 2022 increased by 16 % compared to 2021 and exceeded $3 trillion in total. This indicates not only an increase the volume of production, but also the growing contribution of the company's brand as an attribute of leadership in shaping the value of fashion products. It also confirms the importance of the public's attitude role to the phenomenon of the market popularity of fashion market players in order to increase the commercial efficiency of the business.

Despite record growth in global brand volumes and value, precisely this growth, based on a linear model of work and overconsumption of products, threatens the sustainability of the fashion industry. Due to environmental issues and high resource intensity and dependence, the fashion industry faces the risk of unsustainable development [1]. Prestigious academic publications and digital media news sites describe scenarios for the destruction of the planet by fast fashion due to high levels of resource consumption, pollution and waste [20].

The fashion industry went through several stages of development during the three industrial revolutions. On the eve of the transition to Industry 4.0 it has risen to the peak of environmental problems. The solution of environmental problems with the achievement of sustainable development is to change the linear model functioning to a cyclic one by transforming fashion industry into a sustainable ecological ecosystem. The trend of transformation along with the trend of fashion industry digitalization is underlie this research problem.

In a high-tech digital environment, the problems of selling innovative goods and services come to the front plan along with environmental safety. However, due to the disruptive nature of innovation, high tech can lead development trajectories of industries to become unsustainable. Digital innovation can both contribute to sustainable development and cause unsustainability when it is not clear which path progress will take. Therefore, the transition of industries to sustainable development is considered one of the most difficult problems. In response to threats to sustainable development, circular economies are pushing the boundaries of environmental and economic sustainability by shifting to new models of functioning within sociotechnical ecosystems.

The results of the study [20, 22] showed that Industry 4.0 contributes to the further development of digital technologies and tools of the fashion industry, which creates a fertile basis for improving customer relationships. Industry 4.0 resources have had a positive impact on apparel design and manufacturing, offering advancements in industries related to sustainable manufacturing [22].

The transformation of the fashion industry into Fashion Industry 4.0 creates conditions for the formation of new cultural landmarks. Parallel with the resources rational use concept this milestone oriented at the acceleration of social innovations aimed at harmonizing a person with the outside world. It is assumed that the social innovations of the cyclical model are able to overcome the imbalance between technical, economic and socially significant innovations. In this way, balancing the processes of population social adaptation with the achievements of high technologies can contribute to the perception of a new philosophy of rational clothing consumption.

The traditional structure the linear model of fashion industry market can be simplistically represented by textile industry enterprises, the segment of the final fashion product manufacturers (clothing, knitwear, jewelry and perfume industries), trade and auxiliary segments [17]. Due to the negative impact that the fashion industry produces on the environment, it is at the peak of environmental problems that require urgent changes [23]. The transformation of the fashion industry into a sustainable environmentally friendly ecosystem based on a circular economy implies a change in all links in the value chain of fashion products, including a change in the philosophy of clothing consumption.

The ecosystem of the fashion industry circular model is complicated by the development of a network of additional participants. A simplified structure of the circular ecosystem model, illustrating the features of the organization of the cyclic process, is presented in Fig. 1. The cyclic model additionally includes local and global retailers, municipal services, as well as a number of commercial companies such as brokerage, sorting, logistic and other specialized companies [24].

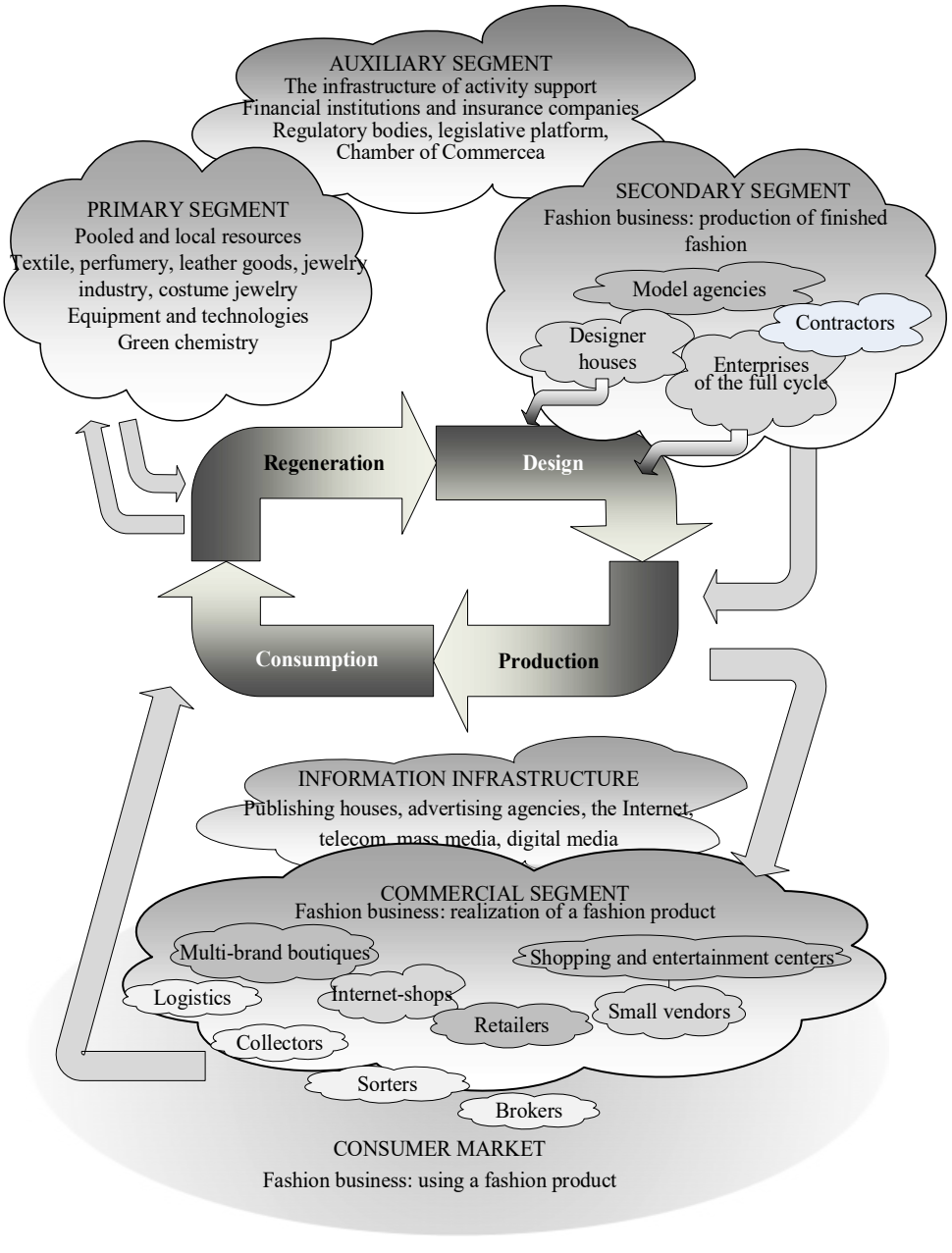

Fig. 1. Simplified structure of fashion industry ecosystem circular mode with an illustration of the features of closed cycle processes organization

The four basic segments of the fashion industry market – the production of textile materials, the manufacture of fashion products, trade, as well as financial, legal and information support, as a part of the cyclical model have undergone certain changes.

In the textile segment, a source of secondary raw materials was added to the traditional suppliers, and sorting, assembly and logistics companies of the secondary market appeared in the auxiliary segment. A feature of the cyclic model is the inclusion of consumers as resource providers in active participants in the value chain of a fashion product. In the ready-to-wear fashion segment, the former "full-cycle enterprises" no longer fit this category. Closing the output of the linear process to the input of product chain changed the understanding of the full production cycle. In the linear model, the production cycle was understood as the set of design development and mass production of fashion goods at one enterprise. The

closed cycle model absorbed the former "full cycle enterprises". In these new conditions, their closed process has become one of the links in a larger cyclical process.

An analysis of the fashion industry heterogeneous ecosystem structure allows concluding about the importance of the coordinated action of all participants in the cyclical value chain.

It can be noted that the model involves many independent subjects of different nature. These entities are interconnected by the requirements of the cycle continuity. But they motivated by their own goals and interests. Therefore, the effective functioning of such an ecosystem, where there is no common control center, requires additional initiatives and efforts to synchronize the activities of participants.

One of the important requirements for fashion industry transformation is a change in the concept of clothing consumption. Unlike the traditional "production-use-disposal" cycle, in a circular economy, the resources of the life cycle of a fashion product are used for the longest possible time, and at the end of use, they are redirected to create new products [6]. These requirements transform traditional fashion design into strategic fashion design with the expansion of a systematic approach to socio-cultural aspects.

On the way of the fashion industry transition to a cyclical concept of functioning, new trends, new forms of organization of the fashion business and types of services are emerging. Forms of fashion business based on the reuse of fashion products include the sale of second-hand products and the rental of products [25, 26].

The new concept of providing services "product as a service" involves the constant maintenance of a fashion product without stopping its operation support.

The development of new services is constrained by a number of social, organizational and administrative barriers. Sociocultural barriers are associated with the formation of public opinion regarding the new concept of rational clothing consumption. The administrative-behavioral barriers are associated with the interaction between different participants in the cyclic process.

In the digital environment, these problems can be solved based on the communication capabilities of social networks. Cloud technologies, service virtualization and their implementation on new generation digital platforms eliminate the problems of technical implementation of access to services.

A significant factor influencing the social aspects of fashion trends is customer satisfaction with high-tech services. Services based on virtualization or augmentation reality, such as a virtual fitting room, try on a digital product model [15], designer-consumer tandem, virtual styling and shopping management increase customer satisfaction and increase the positive experience of using the cyclic concept.

The cyclical model implies the organization of the consensual functioning of the textile, clothing and retail segments within an integrated ecosystem in which consumers play the role of suppliers of raw materials. An analysis of the problems of transformational processes in the fashion industry showed that the organization of a cyclical process in local ecosystem is often spontaneous, bringing together independent players without a single decision-making center. The desire to achieve the own interests of the participants in the cycle leads to suboptimal functioning of the ecosystem. The sustainable functioning of such systems with the achievement of a given performance indicator can be solved by the organization of sociotechnical systems based on a common digital platform.

It is known that design is traditionally responsible for harmonizing human needs with the surrounding reality. Thanks to this functionality, in the conditions of culture transformation, design becomes a carrier of homeostatic potential, which allows it to influence the sustainable development of the fashion industry. Fashion design in the circular ecosystem is evolving into Fashion Ecodesign with a lead role by reaffirming its key functionality in the creation process of fashion value. Ecodesign is defined as "a design process that takes into account the impact of a product on the environment throughout its entire life cycle" [27]. New business formulas and high-tech sustainable fashion services stimulate the digitalization of the ecodesign tools, turning it into an innovative digital fashion ecodesign with homeostatic potential. Therefore, within the cyclic model, such design can be used as a mediator of influences on the participant's behavior and as a modulator for the orchestration the components of the socio-technical system for managing the fashion products supply chains.

Since the solution to the complex problem of fashion industry transformation is at the starting position, the successful results of the transformation practice can only be observed by the example of large companies from the top 100 global brands or individual activity local groups. Such groups can arise within the framework the activities of small and medium-sized business communities that can form an autonomous sustainable ecosystem.

To facilitate the transformation and sharing of results, GRI (global standards for sustainability impacts) has developed reporting standards [28]. For more than 25 years, this company has been implementing the best global practices in demonstrating the responsibility of companies for their impact on the environment, the economy and people. The GRI standards enable any organization to understand and communicate its impact on the economy, the environment and people in a credible manner.

Not all companies transparently disclose their progress in reducing their environmental impact. Therefore, reports created according to GRI standards receive the advantage of trust. There are reports that individual brands, such as H&M and Zara, do not disclose the percentage of recycled textiles included in their "green" collections. Their value chain is not completely closed because used fabrics are not fully recycled into new garments [29].

The study [29] is devoted to the analysis the results of closed cycle model application by the largest companies in the fast fashion industry. Despite negative reviews, H&M was one of the first global fashion retailers, who was implemented sustainability measures in its value chain. The most visible contribution to the circular economy is made by the H&M solution in the packaging, distribution and retail phase. Segments of the value chain – fiber and material processing, textile and material production make a moderate contribution to circularity. The H&M 2020 Sustainability Report does not provide details on circular product design or the use of circular models by its customers. H&M has focused on projects and initiatives mainly related to the packaging and retailing, post-consumer collection and recycling stages. The research projects were mainly related to the processing of fibers and materials.

Comparative results of the study [29] show that the fashion industry does not have a single cycle model, and the implementation of closed cycle models by large fashion retailers does not allow generalization.

5. 2. Definition of the role and features of digital humanities as an independent functional area

The expansion influence zone of the digitalization on the socio-cultural sphere has changed the nature of human and social communications, which as a result has affected the formation of a new way of life. If at the initial stage the functionality of digitalization was limited by the properties of digital tools, then at the basic level, digital "instrumental" operations began to be associated with familiar everyday procedures, turning innovative actions into traditional ones. In the course of further progress in digitalization, the transfer of high technologies to sociocultural areas gradually turns their innovative activity into a convergent culture of synthesis of science, technology, culture and art.

Because of the transfer of information technologies to the social environment, the innovative potential of digitalization has been realized in the form of new relationships between themselves and society, which has given rise to new forms of innovation. "Digital transformation is now ubiquitous and poses significant, untried and new challenges for their innovative programs, strategies and practices" [30].

The digitalization of the sociocultural sphere has stimulated the further transformation of sociotechnical systems into techno-sociocultural systems, where humanitarian methods, approaches and services are implemented on high-tech digital platforms.

In the digital environment of techno-sociocultural systems, due to the emergence of the synthesis of science, arts and technologies, the influence zones of culture traditional components are expanding. Because of interaction, the disciplines of different nature new disciplines and multidisciplinary directions are emerging with unique properties. Such disciplinary differentiation significantly expands the number of traditional areas of scientific and technical activity.

Under the digitalization of the sociocultural sphere, the variety of traditional, modernized and new alternative areas of sociocultural activity is constantly expanding. The analysis and classification of these areas is an unresolved problem, the solution of which involves dynamic real-time updating.

In the course of humanization, the processes of socio-cultural sphere digitalization, originally represented by the use of computational methods in humanitarian research, are reshaped into digital humanities DH. As a broad interdisciplinary area of activity, DH is represented by the theory and practice of mutual technology transfer. This means both the use of digital technologies in the humanities and the involvement of theories, methods and approaches of the humanities for a systematic study the phenomenon of digitalization and culture in general [19].

The uncertainty of the thematic scope and status of digital humanities as a scientific direction is the result of the constant expansion of its topics and areas of influence. In the study [18], the authors conclude that DH should be considered as an independent interdisciplinary scientific and practical direction, closely related to computational linguistics and informatics.

5. 3. Assessment of the digital humanities composition of wide profile with selection of disciplines for participation in the tasks of managing transformational processes

To assess the boundaries of the DH thematic space and identify new areas of research are used the results of report iSchool Committee on digital humanities curricula [19]. This source was chosen for primary data due to the wide scope of information relevant to DH. In [19] 426 descriptions of DH courses, consisting of 1694 terms, were collected and analyzed. In order to define characteristic topics in the DH cross-disciplinary analysis, "Field of Study", coded as humanities or digital, was chosen as an independent variable, and "Theme Prevalence" was a function of this variable.

The composition of the training courses disciplines indicates that digital humanities covers both traditional and new alternative areas that have emerged as a result of the synthesis of science, arts and technologies in the context of digitalization. This makes it possible to group all disciplines in the scope of DH into clusters based on belonging to socio-cultural, humanitarian and information areas.

The set of disciplines of the socio-cultural and humanitarian group, together with the instrumental-informational disciplines, represents a list that can be considered as the initial stage of a multi-level classification of DH disciplines.

In order to simplify the structure of the list, groups of sociocultural and humanitarian disciplines are combined into a common group of sociocultural disciplines. A minimized list of DH disciplines in the socio-cultural sphere of the fashion industry in the composition of groups socio-cultural and instrumental-informational areas was obtained as a result of filtering the list of curricula from the DH committee of iSchool [19]. Filtering was carried out based on functional-competencies compliance of DH disciplines with digital eco-design and components of fashion industry socio-cultural sphere.

The group of fashion industry sociocultural disciplines DH includes:

– digital media;
– digital art and production;
– public relations;
– history of cultural heritage problems.

Group of instrumental-informational disciplines DH of the fashion industry socio-cultural sphere:

– technologies and tools of digital humanities;
– interactive data visualization;
– design and evaluation of human-computer interfaces;
– web applications.

5. 4. Techno-humanitarian complex based of the synthesis of digital humanities and ecological fashion design

5. 4. 1. Orchestration capabilities of the techno-humanitarian complex in the tasks of stabilizing the fashion industry ecosystem

To regulate the socio-cultural sphere of the fashion industry, a method of influencing the behavior of cyclic chain operators was chosen. The essence of the method is to generate incentives aimed at matching the actions significant actors of cyclic ecosystem to achieve its global goals.

In the discourse of the socio-cultural sphere of the fashion industry, stimulating impacts should first be aimed at creating a positive attitude among customers towards a fundamental change in the managing strategy of their own wardrobe. Incentives should also help to coordinate the actions of participants in the cyclical chain.

Within the framework of the cyclical model, a rational strategy for building an individual's own wardrobe is to optimize the selection of its composition elements for extending the life of clothing products. The perception of this strategy by users is possible only if formation by them a philosophy of careful attitude to the consumption of resources. It should

be noted that the formation of public attitudes towards the phenomena of socio-cultural life belongs to the traditional sphere of humanitarian technologies application. Based on the complex nature the problem of matching ecosystem subjects' actions, in order to generate incentives, in addition to elements of humanitarian technologies, elements of a technological nature should be involved.

In this twin nexus, the humanitarian technologies are responsible for the behavior of subjects and the formation of public opinion, while technological components are aimed at the physical implementation of impacts.

Taking into account the advantages of digitalization, it is advisable to introduce incentive generators based on the synthesis of digital and humanitarian technologies into the techno-socio-cultural environment of the digital humanities (DH). In order for the synthesis of digital and humanitarian technologies has become an effective tool for solving sociocultural problems, their mutual harmonization with overcoming interdisciplinary fragmentation is needed.

Since design is aimed at harmonizing human needs with the surrounding reality, in the task of synthesizing digital and humanitarian technologies, it seems to be the most appropriate integrator of these disciplines. A harmonized set of digital innovative fashion design and a specially selected set of DH disciplines can be considered as a techno-humanitarian complex aimed at solving the socio-cultural problems of the fashion industry.

The answer to the question of how the disciplines of the techno-humanitarian complex interact with the components of the innovative potential of the fashion industry should be sought for each target component.

The assessment of techno-humanitarian complex possibilities as a generator of influences on the socio-cultural components of the fashion industry innovative potential is carried out in several steps.

For each component of both the group of socio-cultural and instrumental-informational disciplines DH, its influencing functional capabilities of the target objects are determined. The target objects are the socio-cultural component of fashion industry innovative potential. Then the features of mutual harmonization of this component with fashion design are determined, including the harmonization of terminology and competencies to eliminate interdisciplinary fragmentation. Further, the abilities of the joint action of this pair on the target objects are analyzed.

A distinctive feature the techno-humanitarian complex of fashion industry socio-cultural sphere from a simple set of humanitarian disciplines and design is their mutual harmonization. This harmonization eliminates the interdisciplinary fragmentation of components and promotes the manifestation of a synergistic effect and emergence. The synergy of combining disciplines into a techno-humanitarian complex is manifested in the possibility of a more effective impact on the innovative potential balancing than their total influence. Emergence consists in the formation of new properties of influence that were not achieved as a result of influences on the innovative potential of individual factors.

The orchestration the processes of the cyclic ecosystem functioning model is usually understood as the coordination resources of various cyclical supply chains and the coordination the actions of independent companies. The orchestration of the techno-humanitarian complex lies in the mutual harmonization of the DH disciplines with each other and with fashion design. Achieved in this way coordination of the techno-humanitarian complex resources contributes to the optimization of its influence on balancing the components of the fashion industry innovative potential.

The elements of the socio-cultural component of the fashion industry innovative potential include "designer-consumer tandem" and "marketing and advertising" [17]. They are the target elements, which should be influenced by the disciplines of the techno-humanitarian complex. These elements are derived from a necessary but not sufficient set of ecosystem sustainability criteria, so they do not represent a complete list of possible components. However, they have significant potential to influence the formation of consumer attitudes towards the cyclical model.

Innovative ecological fashion design is a necessary, but not sufficient component of the transformational toolkit [17]. Therefore, both its direct and indirect influence on the harmonization the disciplines of the fashion industry techno-humanitarian complex should be considered.

Social issues include:

– attraction of public opinion to the model of rational consumption;

– formation of customers attitudes towards the reuse of resources;

– harmonization of the tastes and mentality of individuals with new approaches to the rational formation of the wardrobe;

– organization of targeted sociological impacts on the focus groups of consumers;

– education of social civic responsibility for the irrational use of resources;

– formation of an optimal balance between traditions and innovations, between modern creativity and the use of cultural heritage.

"Tandem designer-consumer" as a direction of activity is the result of a new type service development. The potential influence of the "designer-consumer tandem" component on the fashion industry socio-cultural sphere lies in the ability of this service to have a direct impact on the client's positive attitude towards the new wardrobe formation strategy. A positive influence on the user's attitude to circular fashion is formed as a result of its creative contact with the service provider in the process of jointly creating an attractive image of the client by means of a costume. Thanks to the professionalism of a fashion designer, customer satisfaction can be more complete than when buying ready-to-wear products without the participation of an image-maker.

"Tandem designer-consumer" can provide:

– direct impact on attracting public opinion to the rational consumption model;

– direct influence on the formation of attitudes towards the reuse of resources;

– indirect influence on the harmonization of the tastes and mentality of citizens with new approaches to the rational formation of the wardrobe.

The "Marketing and Advertising" component is assigned to the socio-cultural group due to the ability of the direct influence of new high-tech marketing and advertising tools on the positive attitude of customers towards the new wardrobe formation strategy in terms of sustainable fashion trends.

The Marketing and Advertising component aims to provide:

–direct impact on consumer focus groups;

– indirect influence on the education of social civic responsibility for the irrational use of resources.

5. 4. 2. Sociocultural disciplines of the fashion industry's techno-humanitarian complex

Digital media have a significant and ever-growing potential for socio-cultural influence, which is realized through a wide range of digital communication channels. In particular, they represent effective information channels of marketing communications in social networks on the Internet.

Digital art and production reflect the new possibilities for designers in the digital environment of immersive AR/VR/3D technologies. The influence factor of digital art has a combined artistic, aesthetic, social and technological nature.

Public relations influence the formation of a positive attitude of consumers towards the concepts of slow fashion and sustainable consumption. The influence factor has a social nature.

The history of cultural heritage issues influences the formation of an optimal balance between tradition and innovation, between modern creativity and the use of traditions and cultural heritage.

Factors of influence socio-cultural disciplines of the techno-humanitarian complex on the fashion industry innovative potential are presented in Table 1.

The results the analysis of innovative design influence factors on mutual harmonization with the fashion industry socio-cultural disciplines DH are shown in Table 2.

Table 1 columns reflect of the socio-cultural component of the fashion industry innovation potential, the role of which is played by "Tandem designer-consumer" and "Marketing and advertising".

Table 1 rows present the socio-cultural disciplines of the techno-humanitarian complex and the types of their influence ("direct" and "indirect") on the innovation potential of the fashion industry.

Cells of the Table 1 demonstrate the results of the influence of sociocultural disciplines on the relevant sociocultural component of the fashion industry innovation potential.

Table 2 columns reflect nature the impact of innovative eco-design on mutual harmonization with socio-cultural disciplines DH of the fashion industry.

Table 2 rows represent the socio-cultural disciplines of the techno-humanitarian complex and the types of their influence on mutual harmonization.

Table 2 cells demonstrate the results of mutual harmonization of innovative eco-design with socio-cultural disciplines DH of the fashion industry.

Table 1

Factors of influence socio-cultural disciplines of the techno-humanitarian complex on the fashion industry innovative potential

Sociocultural discipline	Components / Type	The sociocultural component of the innovation potential of the fashion industry	
		Designer-consumer tandem	Marketing and advertising
Digital media	Direct	Involvement of public opinion in the model of rational consumption	Organization of targeted sociological influences on focus groups of consumers
	Indirect	Harmonization of tastes and mentality of citizens with new approaches to the rational formation of the wardrobe	Education of social civic responsibility for irrational use of resources
Digital art and production	Direct	Harmonization of tastes and mentality of citizens with new approaches to the rational formation of the wardrobe	Organization of targeted sociological influences on focus groups of consumers
	Indirect	Promoting the development of "designer-consumer" interaction in creating a personal image in virtual space	Promoting the development of "designer-consumer" interaction in creating a personal image in virtual space
Public relations	Direct	Education of social civic responsibility for irrational use of resources	Organization of targeted sociological influences on focus groups of consumers
	Indirect	Formation of attitude towards reuse of resources	Education of social civic responsibility for irrational use of resources
History of cultural heritage problems	Direct	Forming a balance between traditions and innovations, between creativity and cultural heritage	Organization of targeted sociological influences on focus groups of consumers
	Indirect	Harmonization of tastes and mentality of citizens with new approaches to the rational formation of the wardrobe	Education of social civic responsibility for irrational use of resources

Table 2

Factors the influence of innovative eco-design on mutual harmonization with fashion industry socio-cultural disciplines DH

Socio-cultural disciplines	Factors the influence of innovative eco-design		
	Nature / Type	Time-limited impact	Permanent effect
Digital media	Direct	Harmonization of terminology and competencies	Publication eco-collections
	Indirect	Harmonization of the balance of traditions and innovations	Design of targeted publications
Digital art and production	Direct	Harmonization of subjects of creative directions	Collaborate in the exhibition theme
	Indirect	Target installations in an immersive environment AR/VR/3D	Target installations in an immersive environment AR/VR/3D
Public relations	Direct	Harmonization of topics	Harmonization topics of public events
	Indirect	Education of social civic responsibility for irrational use of resources	Education of social civic responsibility for irrational use of resources
History of cultural heritage problems	Direct	Harmonization of topics	Harmonization topics of public events
	Indirect	A balance of tradition and innovation	Reconstruction of historical costume

5. 4. 3. Instrumental-informational disciplines of the techno-humanitarian complex of the fashion industry socio-cultural sphere

Digital humanities technologies and tools provide specialized digital tools to serve the social challenges of transforming the fashion industry ecosystem. Such problems include the tasks of searching, processing, storing, synchronizing, distributing and using information, as well as administering a common digital platform.

Interactive data visualization is a specialized software for visualizing data on the processes of fashion industry cyclic model functioning.

The design and evaluation of human-computer interfaces is responsible for the interaction between human personnel and transformation management systems. This direction has an impact on the effectiveness of control over the fashion industry ecosystem functioning.

The web applications division is responsible for the development and implementation of innovative digital services on a digital platform. This direction has an impact on the effectiveness of the fashion industry transformational processes.

Factors the influence of instrumental-information disciplines of the techno-humanitarian complex on the fashion industry innovative potential are presented in Table 3.

The results of the analysis influence of innovative ecodesign on mutual harmonization with instrumental-informational disciplines DH of the fashion industry are given in Table 4.

Table 3 columns represent the socio-cultural component of the fashion industry innovative potential.

Table 3 rows represent the instrumental-information disciplines of the techno-humanitarian complex and the types of their influence on the fashion industry innovative potential.

Table 3 cells show the results influence of instrumental-informational disciplines on the corresponding socio-cultural component of the fashion industry innovative potential.

Table 4 columns represent the nature of the innovative ecodesign impact on mutual harmonization with the instrumental-informational disciplines DH of fashion industry.

Table 3

Factors the influence of instrumental-information disciplines of the techno-humanitarian complex on the fashion industry innovative potential

Instrumental- informational disciplines	Components / Type	The sociocultural component of the innovation potential of the fashion industry	
		Designer-consumer tandem	Marketing and advertising
Technologies and tools of digital humanitarianism	Direct	Organization of user reference and information systems of service services	Collection and processing of statistical data based on the results of targeted sociological influences on focus groups of consumers
	Indirect	Development of civil response sites for irrational use resources	Design and content development of marketing and advertising sites in the environment AR/VR/3D
Interactive data visualization	Direct	Development of interactive systems of "designer-consumer" interaction in creating a personal image in virtual space	Development of the design and content of sites with interactive functions for choosing and renting clothing models with the possibility of virtual fitting
	Indirect	Development of interactive systems of interaction with users to create a personal image	Visualization of data based on the results of targeted sociological influences on focus groups of consumers
Design and evaluation of human-computer interfaces	Direct	Organization of "designer-consumer tandem" interfaces	Organization of visual marketing and virtual trade interfaces
	Indirect	Organization of virtual personal accounts of users	Organization of interfaces of targeted sociological influences on the basis of social networks
Web applications	Direct	Development of utilities for the organization of "product as a service" services	Development of service utilities in the environment AR/VR/3D
	Indirect	Development of websites providing online services	Organization of collection and disposal systems of fashion products

Table 4

Factors influence of innovative ecodesign on mutual harmonization with the fashion industry instrumental-informational disciplines DH

Instrumental-informational disciplines	Factors the influence of innovative eco-design		
	Nature / Type	Time-limited impact	Permanent effect
Technologies and tools of digital humanitarianism	Direct	Harmonization of terminology and competencies	Updating the composition of functions and services
	Indirect	Development tools of immersive technologies AR/VR/3D	Development of additive 3D printing technologies
Interactive data visualization	Direct	Harmonization of terminology and competencies	Interactive visualization of remote services
	Indirect	Update of visualization algorithms	Search for topics for visualization
Design and evaluation of human-computer interfaces	Direct	Harmonization of terminology and competencies	Interfaces of personal offices
	Indirect	Harmonization of parameters of the "designer-AI" tandem	Monitoring the balance of traditions and innovations
Web applications	Direct	Harmonization of terminology and competencies	Improvement of virtual fitting room, magic mirror, etc. services
	Indirect	Updating algorithms of web applications	Development of web applications of cyclic model services

The rows of Table 4 represent the instrumental-information disciplines of the techno-humanitarian complex and the types of their impact on mutual harmonization.

The cells of Table 4 demonstrate the results of mutual harmonization of innovative ecodesign with instrumental-informational disciplines DH of fashion industry.

The results of the analysis the possibility of techno-humanitarian complex orchestration and the factors of influence its components on the socio-cultural sphere of fashion industry innovative potential indicate the expediency of its use to regulate this sphere.

5. 5. Features of implementation the concept of fashion industry socio-cultural sphere regulation using the techno-humanitarian complex

5. 5. 1. Principles regulation of the fashion industry socio-cultural sphere based on the techno-humanitarian complex

Taking into account the features of fashion industry cyclic model functioning, the concept of its socio-cultural sphere regulation can be formulated as follows: the conception regulation of the fashion industry socio-cultural sphere consists in influencing the socio-cultural components of its innovative potential by stimulating actions to forming` public opinion and the behavior of ecosystem operators to achieve its sustainability.

The first principle of the concept is based on the assumption that the management of the fashion industry transformation is realized by balancing six relatively independent components of the innovative potential of the fashion industry [17]. The principle lies in the independence the management of innovation potential each component based on algorithms adapted to the conditions of this component.

The second principle is a consequence of the problems organizing the centralized management of the fashion industry social sphere. This sphere depends on the attitude of customers to the new concept of rational wardrobe formation and on the actions of independent operators of the cyclical chain. The independence of operators is relative, since, on the one hand, each of them seeks to act in its own interests. On the other hand, all operators are restrained in their choice of actions by the global goals of the ecosystem, which they must support and which they must not contradict. The second principle of regulating the sustainability of the fashion industry transformational processes is to replace centralized management with distributed stimulating influences. In this case, the common control center is replaced by the center for generating stimulating impacts. Instead of organizing a single control center to regulate the innovative potential of the fashion industry socio-cultural sphere, the principle of influencing public opinion and the behavior of subjects - participants in the cyclic process was chosen. This influence in the form of targeted actions is intended to coordinate the actions of significant ecosystem actors in order to achieve its global goals.

Based on the complex sociocultural nature of the problem coordinating the functioning of significant ecosystem subjects, a synthesis of digital and humanitarian technologies was chosen to generate incentives. This synthesis is implemented in the form of a harmonized set of specially selected disciplines DH and digital ecological fashion design. A harmonized set of digital innovative fashion design with a complex of socio-cultural and instrumental-informational disciplines DH has formed a techno-humanitarian complex that can influence the socio-cultural component of the innovative potential of the fashion industry.

5. 5. 2. Functional mode regulation of the fashion industry sociocultural sphere based on the techno-socio-cultural system

The digitalization of the socio-cultural sphere stimulated the formation of complex socio-technical systems, in which the achievements of information technologies are used to solve social problems [8]. The expansion of the information technologies influence zone on the humanitarian sphere contributed to the further complication of sociotechnical systems. The results of progress in solving a wide range of sociocultural problems include the formation of techno-socio-cultural systems, where humanitarian methods, approaches and services are implemented based on new generation high-tech digital platforms.

Sociotechnical and techno-sociocultural systems are a set of interacting subjects and objects of different nature, the distinguishing feature of which is the absence of a single decision-making center. The second feature of techno-sociocultural heterogeneous systems is the lack of strong linking the individual goals of the system components to the "common benefit". If the components have limited communication capabilities and functioning based on local information, system performance is often significantly reduced. Therefore, the stability and performance of such systems depends on the harmonization of decisions making by interacting entities [31].

It is obvious that the improvement in the performance characteristics of a system with decentralized control can be achieved by the organization of a central operator with the right to dictate the requirements and procedures for each user. In this case, for the optimal behavior of the operator, a decision-making center is still needed. Since techno-socio-cultural systems consist of relatively independent components with limited communication capabilities, the implementation of a decision center to optimize the characteristics of such systems by controlling the actions of each participant is often impossible.

To solve the problems of improving the performance of systems with decentralized control, the concept of a multi-agent system was proposed, in which each agent relatively independently interacts with the infrastructure. Coordination of the actions of independent agents is implemented by creating a centralized mechanism for generating incentives. This mechanism determines the deviation of the current characteristics of the system from the given ones and forms a corrective influence in the form of generating incentives. Unlike centralized control, these incentives do not directly control the functioning of agents, but stimulate them in the direction of harmonizing activities in accordance with the overall goal of the system. Agents can be independent ecosystem operators, strategic facilities such as factories or trade entities, as well as agents based on artificial intelligence or automated systems.

The described picture coincides with the situation typical for the cyclical model of the fashion industry. Therefore, for its transformation, it is advisable to use the ideas the regulation of the effective functioning of techno-sociocultural systems.

In order to use the concept of a multi-agent system presented in [31], the techno-humanitarian complex should be chosen as the mechanism for generating stimulating effects.

The role of agents of the socio-cultural system can be assigned to relatively independent operators, which can be the

subjects of all segments of ecosystem structure of the fashion industry circular model, presented in Fig. 1. Taking into account the features of organization the fashion industry closed cycle, a special role in harmonizing the actions of all participants assigned to smart agents that are able to realize the influence on the behavior of other agents and the socio-cultural component of the innovative potential of the fashion industry. Smart agents are selected from both fashion designers and designer-consumer tandem service providers. In the future, the role of smart agents in a multi-agent techno-sociocultural system is drifting towards the tandems "designer–AI" and "AI" based on neural networks. Taking into account the specifics of the fashion industry, a simplified structural diagram the management of fashion industry transformational processes based on a multi-agent techno-sociocultural system can be represented as follows (Fig. 2).

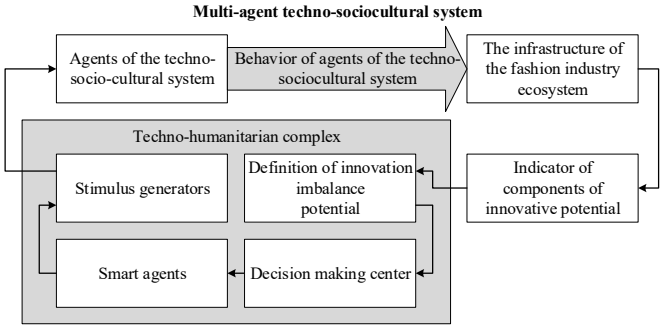

Fig. 2. A simplified structural diagram the management of fashion industry transformational processes based on a multi-agent techno-socio-cultural system

Note: developed by the author based on materials [31]

The cyclic model involves many independent subjects of different nature, interconnected by the requirements of the continuity of the cycle, but motivated by their own goals and interests. Therefore, the effective functioning of such an ecosystem, where there is no single control center, requires additional initiatives and efforts to synchronize the activities of participants.

The functional model for managing the transformational processes of the fashion industry based on the techno-sociocultural system using the techno-humanitarian complex is shown in Fig. 3. The image and functionality of the structural elements of the model, including the model of the innovative potential of the fashion industry, are borrowed from [17]. It is assumed that a fashion designer, based on monitoring the balanced triangle of the effectiveness of the design process, is able to determine the discrepancy between the indicators of the technological, social and socio-cultural nature of the innovative potential of the fashion industry. Therefore, together with the efficiency triangle utility, it forms a center for analyzing process deviations from the norm.

Analyzing the imbalance of innovative potential, the analysis center transmits information about the imbalance to the components of the techno-humanitarian complex, which generates incentives for harmonization. These incentives influence the behavior of smart agents in the fashion industry ecosystem.

Digital media, under the influence of incentives, form a positive attitude of users towards the cyclical concept, which affects the activation of "designer-consumer tandem" services. Under their influence, the socio-cultural component of the innovation potential is strengthened, which is usually a weak link in the ecosystem. This is the regulatory influence of the techno-humanitarian complex on balancing the innovative potential of the fashion industry.

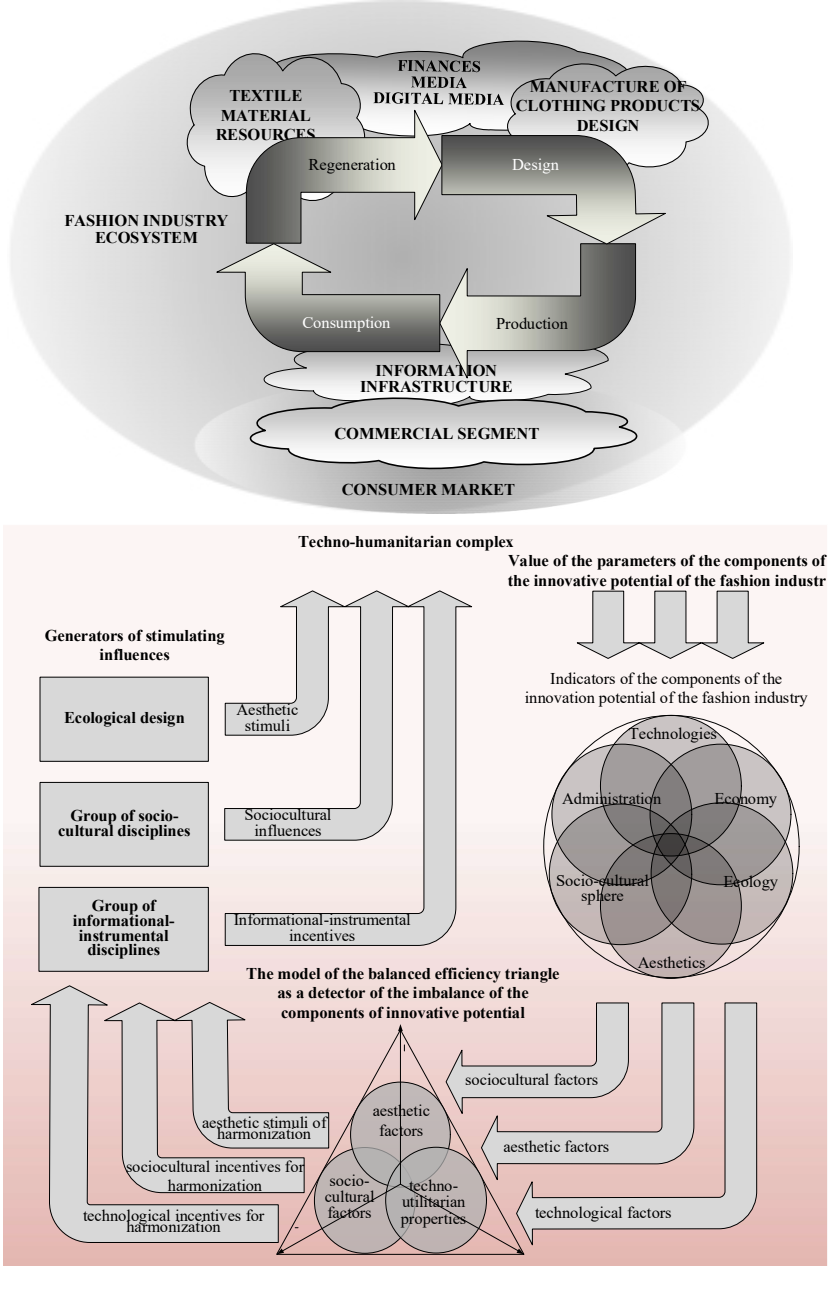

Fig. 3. The functional model for managing the transformational processes of the fashion industry based on the techno-sociocultural system using the techno-humanitarian complex

6. Discussion the results of the search for the concept of regulation of the fashion industry transformational processes

Analysis problems of fashion industry transformation revealed the complexity and multidisciplinary of closed loop processes (Fig. 1). Difficulties in organizing centralized management of the social sphere of the fashion industry have become the reason for replacing the principle of centralized management with the principle of decentralized management of independent operator's local resources with the regulation of their behavior by means of incentives. This principle assumes the replacement of the control center by the center of generation of stimulating influences.

The effectiveness of the regulation of the socio-cultural sphere of the fashion industry, first, depends on the incentives composition and the mechanisms of their influence on the behavior of independent subjects, participating of the cycle. The sociotechnical perspective of the fashion industry sustainable development involves taking advantage of the synthesis digital and humanitarian technologies. A feature of the proposed concept of fashion industry sociocultural sphere regulation is the use of already tested results of such a synthesis, which are the disciplines of DH. A set of disciplines DH, which, together with ecological fashion design, constituted a techno-humanitarian complex of a harmonized group factors influencing the socio-cultural components of the fashion industry innovative potential, was chosen as agents' behavior stimulators.

The possibilities of orchestration of the techno-humanitarian complex in the tasks of stabilizing the fashion industry ecosystem are confirmed by the analysis of how the complex of DH disciplines of the techno-humanitarian complex harmoniously affects the socio-cultural sphere of the fashion industry (Table 1–4).

In the selection process, it was taken into account that in order to manage the fashion industry sociocultural sphere, disciplines are needed that can effectively influence such social characteristics as the formation of public opinion and user preferences. Such disciplines should be sufficiently known, with extensive operating experience and a developed apparatus of functioning. These disciplines fall into the educational programs of promising educational institutions of the new generation.

Therefore, the list of academic disciplines in digital humanities of the iSchool educational network was chosen as the source of data for selecting effective factors of influence.

The disadvantage of this approach is that the permanent problem of vocational training in the context of technological progress is to outpace new technological advances compared to their introduction into educational programs. Transformation processes and digitalization of the fashion industry place new demands on fashion designers, the list of which contains information on current trends in this area. Against the backdrop of total digitalization, existing sets of digital competencies are rapidly losing relevance, so the competency requirements from recruiting agencies more accurately reflect the real relevance of subjects. The disadvantage formulated above is partially corrected by a comparative analysis of the content of training programs with the real requirements for the competencies of designers, taken from the statistics of recruiting agencies.

It is known that the problems of increasing the efficiency of functioning of heterogeneous systems without a single control center are solved within the framework of multi-agent techno-sociocultural systems by stimulating the behavior of independent operators. Therefore, the potential of the impact of the techno-humanitarian complex on the socio-cultural components of the fashion industry innovative potential is effectively realized within the framework of the concept of the techno-sociocultural system. In contrast to the considered publications [1, 4, 9–14], the approach proposed in this work is aimed at effectively solving the sociocultural problems of the fashion industry transformation on the platform of the techno-sociocultural system. This approach is implemented by the method of purposeful formation of the behavior of significant ecosystem subjects with the introduction of a techno-humanitarian complex as a generator of influences.

The possibility of using the techno-humanitarian complex to regulate the socio-cultural component of transformational processes was demonstrated by developing a functional model of the techno-socio-cultural system of the fashion industry (Fig. 2, 3). The control loop of this system closes on the infrastructure of the fashion industry ecosystem. It consists of an indicator of the state of the ecosystem innovative potential, a center for analyzing deviations from a given state of the system, and a center for generating behavioral impacts represented by the combination of the designer with the utility triangle of design efficiency. The techno-humanitarian complex was used as a center for generating incentives (Fig. 3).

The limitations of the work results lie in the consideration of an incomplete set of influences that govern the balancing of the innovative potential of the fashion industry. A comprehensive analysis of ecosystem sustainability involves consideration of six groups of pressure factors, of which only one group has been considered. However, it can be assumed that the relative independence of influencers groups allows consideration of their participation in the management of the sustainable state of the fashion industry independently of others.

Despite the limitations and shortcomings, the results of the study allow solving the important problem of managing the socio-cultural component of the fashion industry innovative potential. Therefore, the results of the work can be used in the practice of integrated management of the transformation processes of the ecosystem. The orchestration of the techno-humanitarian complex makes it possible to effectively generate influences of a socio-cultural nature to stimulate the synchronization of agents' behavior. Coordination of the participant's behavior in the functioning of the ecosystem contributes to the achievement of its sustainable development, which is the global goal of managing the transformation of the fashion industry ecosystem.

Social innovations of the synthesis of digital and humanitarian technologies within the framework of the techno-humanitarian complex are able to compensate the imbalance between techno-economic and socially significant innovations. In this way, it is possible to balance the achievement of high technologies with the social adaptation processes of the public to change the philosophy of clothing consumption.

Prospects for further research can be determined based on the considered limitations. Of interest is the analysis of managing the sustainable state of the fashion industry using all six groups of factors of artistic, aesthetic, technological, environmental, economic, socio-cultural and administrative-organizational nature. Despite the relative independence of groups of factors influencing the innovation potential of the

ecosystem, one of the directions for further research can be aimed at harmonizing their interaction in order to optimize the impact on the sustainable development of the system. Such a consideration of the organization of the fashion industry ecosystem management within the framework of the techno-sociocultural system can contribute both to solving the problems of sustainability of the fashion industry and to the development of the concept of techno-sociocultural systems.

7. Conclusions

1. The features of the transformational processes of society are described. One of the important requirements for the transformation of the fashion industry is a change in the concept of clothing consumption. From the excessive use of fashion products in pursuit of fluctuations in fashion trends, it is supposed to move to the rational construction of the wardrobe. These requirements transform traditional fashion design into strategic design with the expansion of a systematic approach to sociocultural aspects. It is shown that the homeostatic potential of innovative fashion design can be used to optimize the processes of transformation of the fashion industry into a sustainable ecosystem.

2. Trends in the digitalization of the sociocultural sphere have stimulated the further transformation of sociotechnical systems into techno-sociocultural systems, where humanitarian methods, approaches and services are implemented on high-tech digital platforms. The synthesis of digital and humanitarian technologies has led to the humanization of the digitalization processes of the socio-cultural sphere, as a result of which digital humanities was born and is actively developing as an independent direction. It is shown that some disciplines of digital humanities are able to influence the regulation of the innovative potential of the fashion industry. Therefore, they were chosen to create a techno-humanitarian complex within the framework of the concept of regulating the socio-cultural sphere of the fashion industry.

3. An assessment was made of the composition of a wide profile the digital humanities disciplines, based on which the selection of individual disciplines was made according to the criterion of the possibility of influencing the socio-cultural sphere of the fashion industry. The selected disciplines are formed into groups of socio-cultural and instrumental-informational disciplines DH as components of the formation of influences within the framework of the concept of regulating the innovative potential of the fashion industry.

4. The factors of fashion design influence of on mutual harmonization with the components of the disciplines of digital humanities in the socio-cultural sphere of the fashion industry are determined. It is shown that the selected socio-cultural and instrumental-informational disciplines of digital humanities, together with innovative fashion design, constitute a techno-humanitarian complex. The possibility of orchestrating the components of the techno-humanitarian complex is demonstrated by analyzing the features of mutual harmonization of each component with fashion design, including the harmonization of terminology and competencies to eliminate interdisciplinary fragmentation. The results of the analysis of the influence factors of the techno-humanitarian complex on the socio-cultural components of the innovative potential of the fashion industry indicate the expediency of its use to regulate the socio-cultural sphere of the fashion industry.

5. The features and principles of regulation of the fashion industry socio-cultural sphere based on the synthesis of digital and humanitarian technologies are characterized. The concept of regulation of the fashion industry socio-cultural sphere is formulated, based on the influence of stimulating actions on its socio-cultural component. It is shown that a distinctive feature of the proposed approach, taking into account the difficulties of implementing the control center, is its replacement by regulating the behavior of operators of the cyclic model by stimulating influences. A techno-humanitarian complex is used as a generator of influences, effectively realizing its functionality within the framework of the concept of a techno-sociocultural system.

It is noted that the requirements for the implementation of the proposed concept coincide with the possibilities of functioning of techno-sociocultural systems. The possibility of using the techno-humanitarian complex to influence the sociocultural component of the fashion industry is demonstrated by developing a functional model for regulating the transformation processes of the fashion industry based on the techno-sociocultural system.

Conflict of interest

The authors declare that there is no conflict of interest regarding this study, including financial, personal nature, authorship or other nature that could affect the research and its results presented in this article.

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Data availability

The manuscript has no associated data.

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