CONCURRENT ENGINEERING AND SEARCH BASED APPLICATIONS FOR 3D BIG DATA

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Abstract. The imminent development of all European companies competitiveness will be firmly connected to their capacity to conceive innovative products. In the last years, clients demand started to be higher and more complex. Because of that, managing products development processes have become a necessity. Product development processes need to be proficient and flexible: reduced complexity and more concentrated on competence. The EXALEAD solution transform large volumes of heterogeneous, multi-source data into real-time information intelligence to help users improve business processes and gain competitive advantage. EXALEAD enables organizations to gather and enrich Big Data to deliver that information in the process of integrated product development and allows customers to fully manage product programs, from 3D design to traceability of changes, cost, quality and issue analytics. Concurrent or Simultaneous Engineering is one of the fundamental approaches that meet the challenges mentioned above. By definition, Concurrent Engineering represents a standardized approach to integrated product improvement which accentuates and gives priority to the customer expectations level. Moreover, it combines the beliefs of the teamwork and confidence in a way in which the decision-making process is consensual, even from the beginning of the product life cycle.

Keywords: competitiveness, innovative products, competence, concurrent engineering, product life cycle

1. Introduction

Big Data is a great amount of imprecise data spread in a variety of formats which is generated from different sources with high-speed. Lately, Big Data and 3D printing technologies is a new area of research and have been identified as types of technologies that will launch the fourth industrial revolution [1].

With the introduction of Industry 4.0, also known as the fourth industrial revolution, the customers' needs have considerably risen as the tendency consists in augmented and wireless connected machines, intelligent platforms for production supervision, IoT networks, cloud computing and big sensor networks. In order to satisfy these elaborate requirements, concurrent and simultaneous engineering has emerged among many companies from European Union [2].

At the moment, multiple efforts are taking place for exchanging classic, sequential engineering with concurrent engineering. This process aims to reduce production time by integrating different

processes, such as design engineering, manufacturing, management, maintenance and marketing [3]. In order to achieve a systematic manner of designing and manufacturing a specific product, all of its life cycle elements should be taken into consideration, from conception to final results, assuring a cooperative, collaborative, simultaneous and engineering work environment [4].

On the other hand, from the perspective of the European Space Agency, Competition Engineering is "a systematic approach to integrated product development that emphasizes the response to customer expectations. It incorporates the values of teamwork, trust and sharing in such a way that the decision-making process is by consensus, implying taking into account all the perspectives from the beginning of the product life cycle in parallel" [5]. They also believe that the concurrent engineering concept is based on five main components: a process, a multidisciplinary team, an integrated design model, a facility and a software infrastructure [6].

The main difference between concurrent engineering and standard procedures, consists of approach of the design, meaning that, even if the production process is in an early phase, the engineering team has a suggested design of the product [7]. Continuing on this idea, another advantage is the possibility of having a price and quality reference since the designing step [8]. To sustain this ideas, Figure 1 shows the stages of concurrent engineering in comparison to sequential engineering, the advantages and disadvantages of each method.

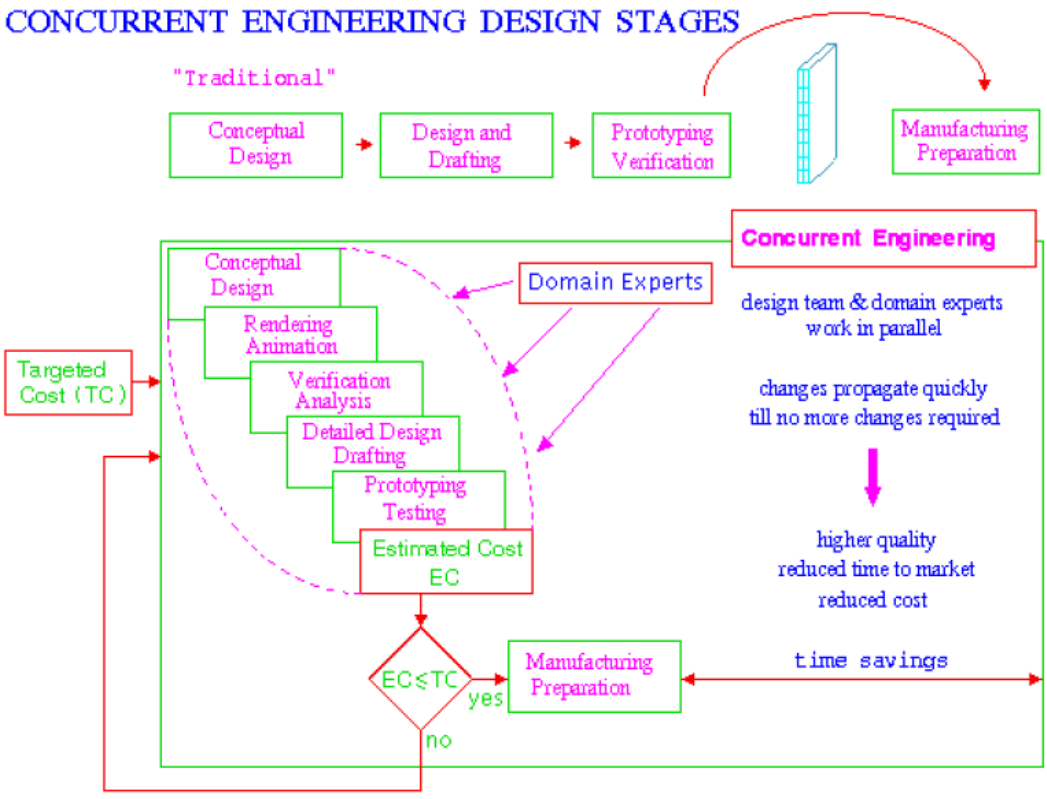

Figure 1. Concurrent engineering stages [5]

Besides this, concurrent engineering consists of an expert team which deals with the entire production process from the initial idea of the product to the final step merchandizing. This team is

formed with the help of design, engineering and manufacturing expertise. The diversity of the team using concurrent engineering concept is described in Figure 2.

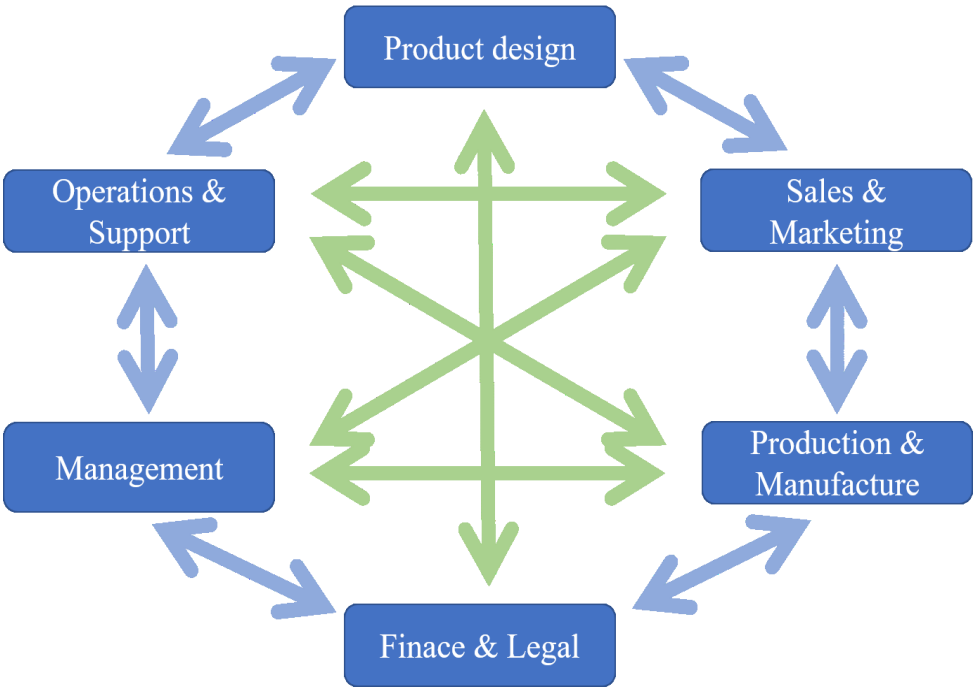

Figure 2. Diversity of concurrent engineering team

The rest of the paper is organized as follows: Section II presents an overview of the concurrent engineering features and the concept itself. Section III and IV describes and shows experimental results performed with ENOVIA and EXALEAD, two different solutions, which can be interconnected in order to allow the administration of the documents within a company and that permits sharing documents with members of the company to improve the concurrent engineering concept. Section V concludes the paper.

2. Related Work

Concurrent engineering represents a concept widely used in areas of electrical engineering, IT, aerospace, telecommunications, product manufacturing, etc. We will further present a couple of different use cases of concurrent engineering.

Firstly, paper "Achieving a More Electric Aircraft: a comparative study between the concurrent and traditional engineering models" [5] displays the process of concurrent engineering implemented in the development of an electric motor within a small electric aircraft. The main advantage is that all production stages, including study, design, production, marketing, operation and dismantling, are done in one step, contract to the sequential execution of traditional engineering. Thus, the price of the product is lower and the manufacturing process is less time consuming. The authors emphasize the need of concurrent engineering at an economic level. Due to the complex projects that

companies need to achieve, this concept gives them the opportunity to have improved quality of the products, durability and lower fabrication costs.

The second case of concurrent engineering application is presented in [6] where the authors discussed about an important part regarding the achievement of collaborative work in concurrent engineering accomplished by interconnecting the numerical simulations with the electromechanical design, main parts of the products realization at optimal operating parameters, reducing the time and costs of execution. Furthermore, the concurrent engineering approach requires solving interdependent problems about stationary and magnetic-stationary electric field including problems of materials strength.

The article [4] presents Concurrent or Simultaneous Engineering as one of the key concepts that can satisfy the necessity of managing product development processes. These processes need to be more effective and efficient in order to reduce complexity. In addition, all companies need to understand that competitiveness will be more and more defined through their ability to adapt to a new market structure, so all of them will have to introduce the new global concept of concurrent engineering which is based on a competing engineering team responsible for the entire product life cycle.

3. ENOVIA

ENOVIA unlocks a different area of opportunities to the companies in order to provide ultimate products and business novelties which has the scope of creating unique experiences for the customers. ENOVIA offers a large spectrum of technical and business applications and in that way enables customers to safely work together and improve together to develop and execute an effective plan, which has the following features: flexibility, permits the continuous optimization, real-time tracking and conformity with standards and regulations to change market opportunities into marketplace advantages.

Powered by the 3DEXPERIENCE® platform, ENOVIA enables stakeholders to contribute to the economic development. Even though mid-sized enterprises (SMEs) share comparative needs as bigger organizations and comprehend the significance of Product Lifecycle Management (PLM), certain worries are existing regarding the implementation of PLM, including the restricted IT assets for administration and training, etc.

The ENOVIA platform provides a collaborative framework for any function within a company. The platform is designed from an application that provides an interface, which can be configured easily, named Business Process Services (BPS). BPS creates a working environment for applications, facilitating collaboration between internal and external users (for example, providers), while maintaining control over access to content. It also provides metrics reporting capability to evaluate performance considering the content of the product.

The following pictures present several functionalities used in ENOVIA applications, which permits the content management and collaboration between team members.

ENOVIA envelope comprises different products, which can be categorized by function, by having various user roles in a company, as follows:

- **Governance** enables organizations to dispatch undertaking wide new item presentations on-schedule and on budget.
- **Global Sourcing** permits organizations to utilize the supply chain abilities all through the item lifecycle and make their providers an indispensable piece of item improvement.
- **IP Lifecycle Management** removes pricey item advancement mistakes by empowering improved cross functional product design, producing outlining and accomplishment simulation.
- **Unified Live Collaboration** enables organizations to deploy item lifecycle techniques over the all organization by giving a single view perspective on IP over all business procedures areas, effective cooperative process administrative abilities and an SOA that incorporates with other endeavour framework.

Each function is additionally separated into orders that incorporate items focused on upgrading a client`s competitiveness. These items might be sent together as a major aspect of a solitary ENOVIA framework or independently.

Subsequently, the functionalities used in the ENOVIA applications, which permit the content management, as well as the collaboration with other company members. Figure 3 illustrates the interface of the ENOVIA platform.

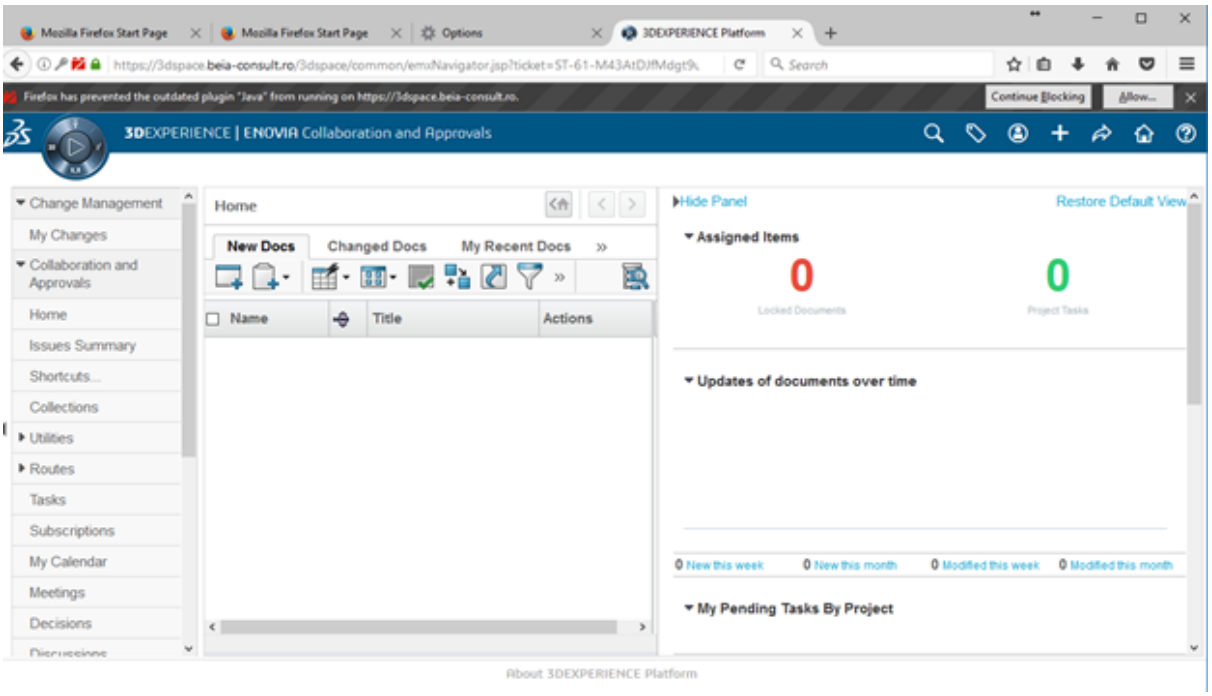

Figure 3. ENOVIA platform interface

The documents can be managed in a workspace and users can allow other users access to certain documents from the workspace. ENOVIA has the following functionality: templates already

existing in the platform can be used when starting a new workspace. Thus, new templates can be easily created. Another functionality of the platform is the organization of meetings (Meetings), which can be structured in a workspace. The accomplishment of a new "meeting" is shown in Figure 4.

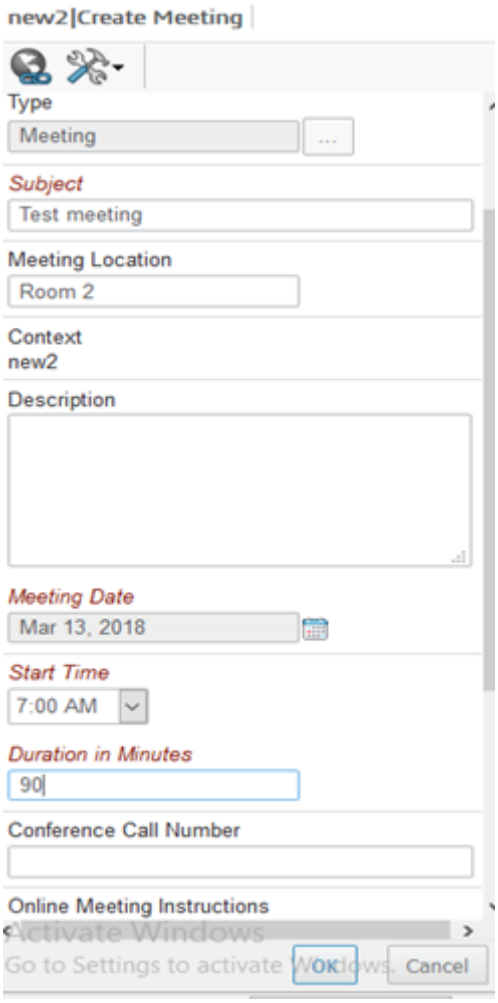

Figure 4. Accomplishment of a new meeting

In the meeting, users can also add an agenda, can assign decisions, tasks, and after finishing creating the meeting, it can be switch to "Complete" mode.

ENOVIA also allows the integration of the ExaleadCloudView search engine, its interface being shown in Figure 5.

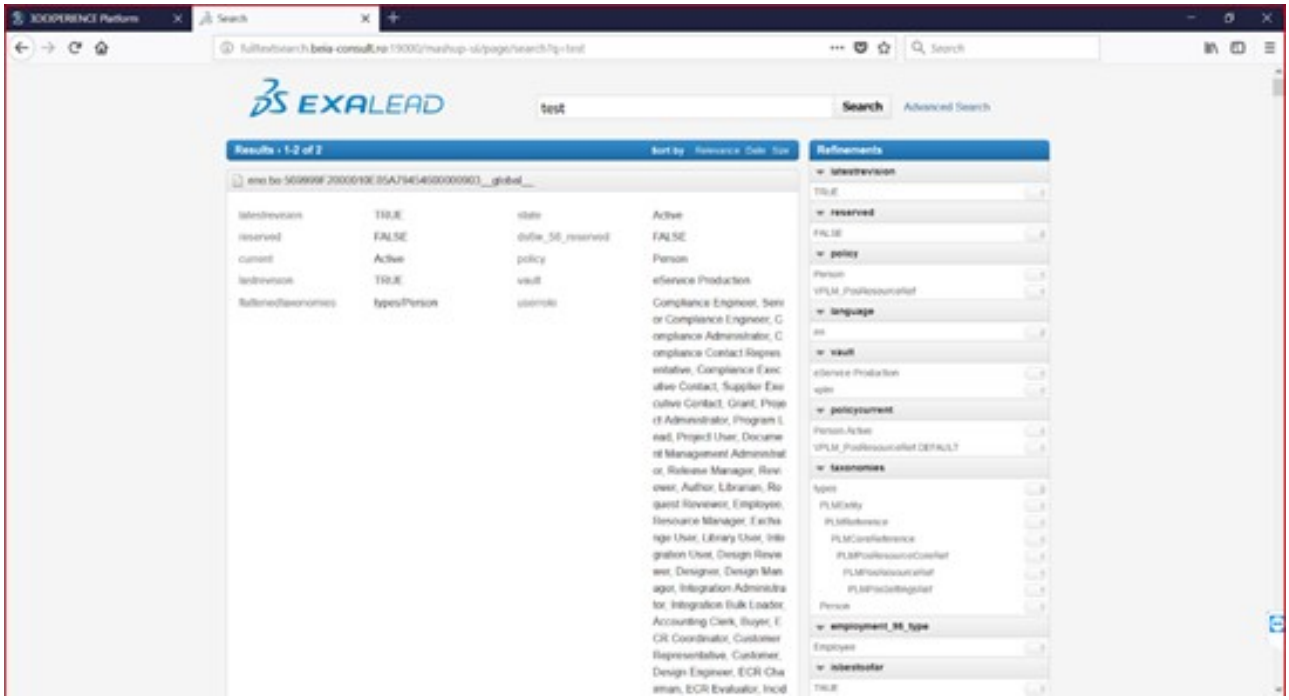

Figure 5. ExaleadCloudView interface

At the same time, EXALEAD offers the Common Document Model (CDM) solution that allows managing documents and files and also sharing them with other members in different applications. Objects can be contained in the form of documents and files associated with them. Documents serve as a container object for files.

4. EXALEAD

EXALEAD represents one of the most powerful search-based applications [9] being a tool that allows organizations to store Big Data, and that also offers the precise information searched by the user. Exalead CloudView uses advanced semantic to bring the structure and the meaning of previously unused data.

This tool represents one of the most dominant semantic motors as it enables associations to gather Big Data, either inside or externally, structured or unstructured, and to convey this data to explicit clients that are keen on the point. This arrangement intends to change a high quantity of information into a significant, clever, continuous data which will improve the business processes [10].

A solution integrated within the 3D Experience Platform is EXALEAD OnePart that enables a company to administer and surveill the implementation of its policy. The software, that presents a user-friendly interface, was installed on a Virtual Machine. Exalead OnePart tool has the features of reusing 3D parts, drawings or test results in an organisation by suggesting the components that match the author or the material, as in the example from Figure 6.

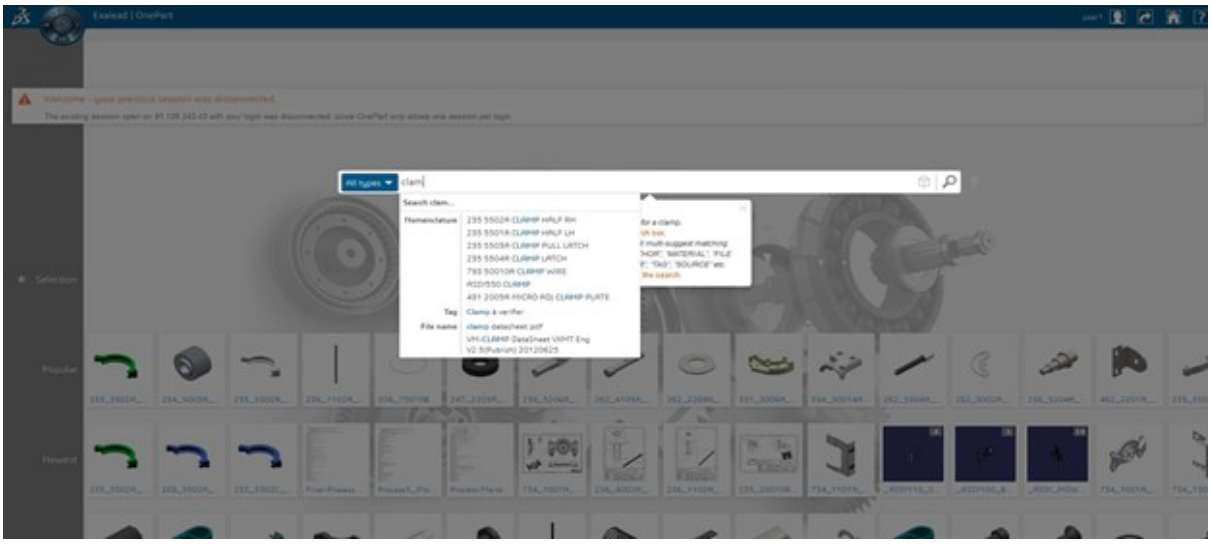

Figure 6. Search of a component based on its name

It shows some facets that can be utilized to filter the search. Also, it can detect parts that might have issues. When a part from the database is selected, a preview with its attributes will be shown. Moreover, a comparison between the selected components and their reference is presented, highlighting in red the ones which are different. Through EXALEAD One Part, which can compare the costs, the best alternative solution can be chosen.

By using users' interrogation, text searches were performed. Furthermore, 3D mechanical related searches found parts based on different types of characteristics, such as holes. The data can be better understood, and the reports can be more easily labeled by the users, through the use of diagrams.

Another solution offered by EXALEAD is the CloudView platform, which utilizes modern semantic techniques to fetch structure, significance and availability to beforehand unused or under-used data in the novel hybrid company and Web data cloud. CloudView gathers information from whatsoever source, in any format, and changes it into organized, universal, contextualized building blocks of business data which can be investigated and questioned straightforwardly, or utilized as the establishment for another type of lean, innovative data access applications, its interface being shown in Figure 7.

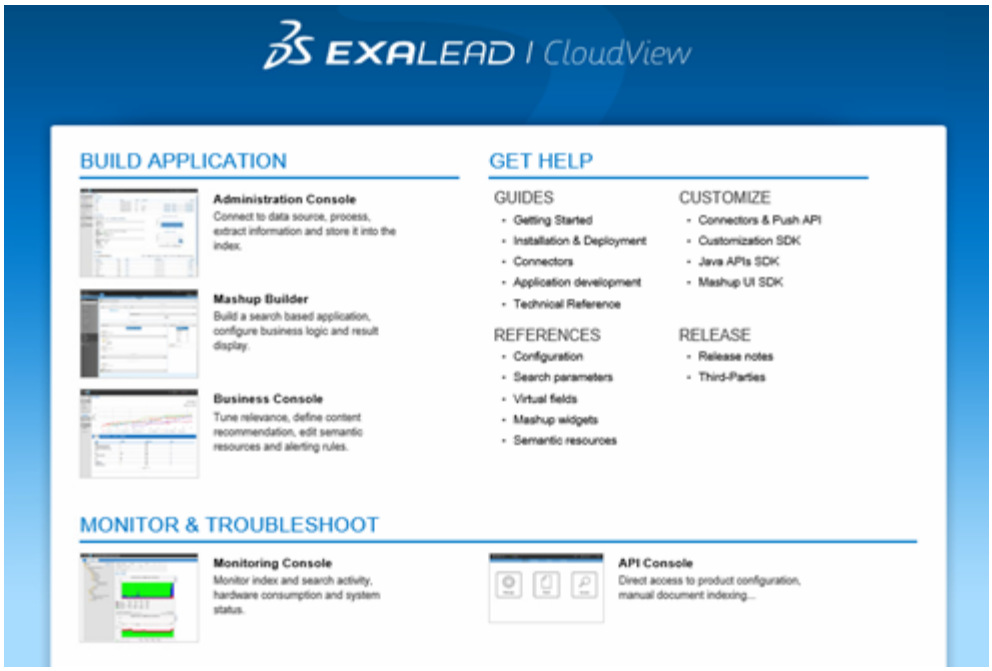

Figure 7. Exalead CloudView interface

EXALEAD empowers companies to satisfy needs for in-context, precisely conveyed Web and Big Data information, comprised, categorized and simple to reach [11].

5. CONCLUSIONS

Big data isn`t just an advertising stratagem utilized by system suppliers, representing a substantial component of the digital marketplace, and will profit businesses of all dimensions. Organizations should learn how to accept and assimilate it. Moreover, concurrent engineering, more precisely, the Big Data within PLM, with the IoT-based products, represents an opportunity to change the way businesses are leaded.

References

1. Bhadani, A., Jothimani, D. (2016), Big data: Challenges, opportunities and realities, In Singh, M.K., & Kumar, D.G. (Eds.), Effective Big Data Management and Opportunities for Implementation (pp. 1-24), Pennsylvania, USA, IGI Global.
2. Özüdoğru, A. Göksu & Ergün, Esra & Ammari, Djihane & Students, & Görener, Ali. (2018). HOW INDUSTRY 4.0 CHANGES BUSINESS: A COMMERCIAL PERSPECTIVE. 4. 84-95.
3. Gabriela, IOSIF & Iordache, Iulian & Stoica, Victor & Ana-Maria, Luchian & Emil, COSTEA & Suciu, George & Victor, SUCIU. (2018). Achieving a More Electric Aircraft: a comparative study between the concurrent and traditional engineering models. INCAS BULLETIN. 10. 221-228. 10.13111/2066-8201.2018.10.1.19.
4. Tomescu, Traian, Tomescu, Tudor, Țigău, Viorel, Avioane cu motoare electrice și avioane solare, Buletinul AGIR no. 2/2015 (April-June), pp. 115-117.
5. https://www.esa.int/Our_Activities/Space_Engineering_Technology/CDF/What_is_concurrent_engineering
6. Iosif G., Iordache I., Suciu G., Concurrent or simultaneous engineering – the way to development, ICPCCAI (International Conference on Power, Computer, Communications and Artificial Intelligence), 2019.

7. Gabriela, IOSIF & Iordache, Iulian & Stoica, Victor & Ana-Maria, Luchian & Emil, COSTEA & Suciu, George & Victor, SUCIU. (2018). Achieving a More Electric Aircraft: a comparative study between the concurrent and traditional engineering models. INCAS BULLETIN. 10. 221-228. 10.13111/2066-8201.2018.10.1.19.
8. Tanase, Nicolae & Iosif, Gabriela & Nedelcu, Adrian & Iordache, Iulian & Ana-Maria, Luchian & Suciu, George & Suciu, Victor & Costea, Emil. (2017). CONCURRENT ENGINEERING APPLICATION IN MICROSYSTEM TECHNOLOGY.
9. Systèmes, D. (2019). 3DEXPERIENCE platform.
10. Suciu G., Pasat A., Bezdedeanu L., Iordache I., Iosif G., Costea E., concurrent engineering and fast-mapping/crowd-mapping using IoT, Big Data and Cloud Computing, CEAS 2017, October 2017, Bucharest.
11. A practical guide to Big Data,: Opportunities, Challenges & Tools, 2012 https://www.3ds.com/fileadmin/Products/Exalead/PDF/whitepapers/exalead_practical-guide-to-bigdata-whitepaper-en.pdf