iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: XII Month of publication: December 2021

DOI: https://doi.org/10.22214/ijraset.2021.39324

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

A analytics study Mapping Study of Collaborative business intelligence and self-service

Tanmayee Tushar Parbat[1], Honey Jain[2], Rohan Benhal[3], Sajeeda Shikalgar[4]
[1, 2]*B.E IT, Pune*
[3]*BBA IT, Pune*
[4]*Guide, Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra, India*

Abstract: Self-service Business Intelligence (SSBI) is an emerging topic for many companies. Casual users should be enabled to independently build their own analyses and reports. This accelerates and simplifies the decision-making processes. Although recent studies began to discuss parts of a self-service environment, none of these present a comprehensive architecture. Following a design science research approach, this study proposes a new self-service oriented BI architecture in order to address this gap. Starting from an in-depth literature review, an initial model was developed and improved by qualitative data analysis from interviews with 18 BI and IT specialists form companies across different industries. The proposed architecture model demonstrates the interaction between introduced self-service elements with each other and with traditional BI components. For example, we look at the integration of collaboration rooms and a self-learning knowledge database that aims to be a source for a report recommender.
Keywords: Business Intelligence, Big Data, Architecture, Self-Service, Analytics

I. INTRODUCTION

The use of Business Intelligence (BI) has been widely implemented across organizations for the past 20 years, Information Technology (IT) departments of various companies generally provide their company's employees and managers with the BI reports they request. The IT department is responsible for making sure that the BI reports are focused on a management strategy that supports long-term decision making and at the same time displays up-to-date and correct information (Böhringer, Gluchowski, Kurze, & Schieder, 2010). The current problem with this request-delivery process is that once a report is requested it can take up to several months for the IT department to create the report (Lennerholt, van Laere, & Söderström, 2018). This results in decisions being made too slow or too late. This way of providing reports is very inefficient for the managers and their decision-making process. With the development of this area, however, the possibilities of managers creating their own BI reports are becoming increasingly realistic by using tools such as Tableau, Power BI, Birst and QlikView (Howson, et al., 2018). However, these tools keep evolving and are ever changing, an in-depth analysis of these tools could, therefore, become obsolete the moment it is published. Besides the possibilities employees have to create BI reports themselves, the growing number of public big data sets is another influence. As big data is available to the public (McAfee & Brynjolfsson, 2012), managers are able to use their company data and combine this with external data sources themselves to perform custom analysis. The use of these tools in combination with external data sources can have a large impact on decisions made by the managers. With the possibilities of creating BI reports and using external data sources, the room for misuse or errors increases as the managers need to have knowledge on how to extract, transform and load (ETL process) the external non-company data properly and combine this data with the internal company data. In order to correctly align the IT department's long-term scope on decision making and the employee's ability to combine internal and external data themselves, several Self-Service Business Intelligence (SSBI) solutions have been proposed in order to prevent the misuse or mistakes. Unfortunately, a lot of organizations still struggle to ensure a lower response time and maintain a focus on long-term vision. This can be caused due to the huge gap between the amount of quantitative and qualitative research done on SSBI (Bani Hani, Tona, & Carlsson, 2018). Currently, around 95% of IT departments aim to invest in SSBI before 2020 while only one-third seems to successfully implement SSBI (Lennerholt, van Laere, & Söderström, 2018), this shows the importance of providing a solution to this challenge. This thesis proposes a solution to the challenge of long-term decision support by theoretically combining several SSBI research areas to support users for a holistic qualitative approach to SSBI. This approach looks at the entire process between data acquisition to analysis and decision making support.

The goal of this approach is twofold: It has to first provide an aggregation of current research and combine several aspects into a holistic theoretical framework, and secondly provide insight for business practitioners to structure their SSBI environment. This thesis is therefore meant for two target groups. The first targeted group are IT managers and employeesresponsible for structuring their organizations SSBI environment to (1) Understand the current frameworks and their aspects for providing SSBI to their organization, (2) Gain inspiration on what to improve or add within their SSBI environment and (3) Gain insight in what is required for an SSBI environment to provide long-term decision support. The second targeted group are academics in the field of Business Intelligence to (1) Gain insight on how several SSBI aspects can be combined together, (2) Gain knowledge on the different SSBI areas and (3) Gain insight on current research done in the field of SSBI.

II. RESEARCH DESIGN AND METHODS

In order to ensure methodological rigor, this study utilizes design science research as the underlying methodology as it is well suited for the development of an architecture. Mainly we were guided by the Design Science Research Model (DSRM) proposed by [8]. Figure 1 shows the phases and the steps that were carried out. Using a literature review based on Webster and Watson, relevant BI and big data architecture models were discussed and a research gap was identified [9]. In the next step ("Objectives definition") SSBI literature was analyzed and demands from practice were included. With these insights a conceptual model was developed. Open semi-structured interviews helped to improve the model in the "design & development" phase.

Table 1: Interviewed experts

Job Group	*Expert Number*
Business consultant	1-3
SAP consultant	4-8
BI application developer	9-13
IT manager	14-18

The demonstration and evaluation phase of the original Peffers et al. model was summarized with an applicability check [11]. A focus group consisting of eleven researchers and a group consisting of twelve practitioners discussed the model with regard to whether it adds value for research and practice and whether it can specifically help in the implementation of SSBI.

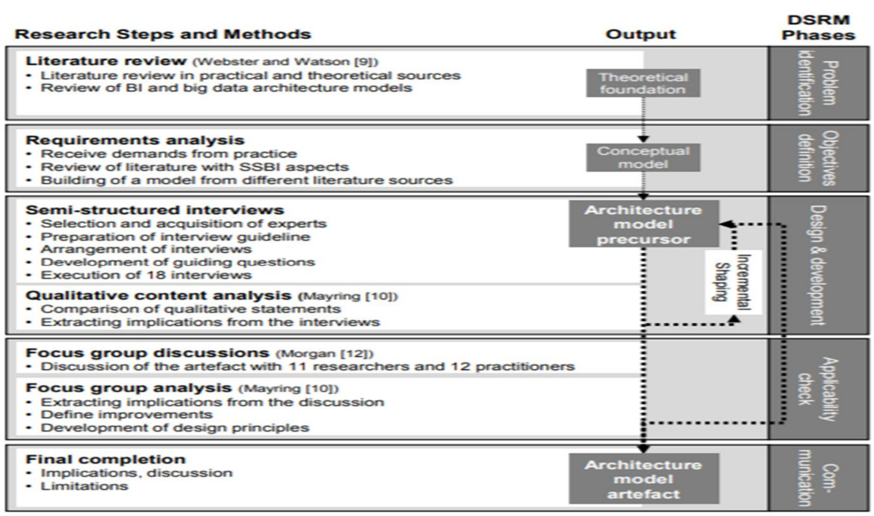


Figure 1: Research design based on [8]

This research method makes a free discussion about the problems and requirements of SSBI possible. Eighteen experts from different industries were interviewed (see table 1). Each expert had at least two years of experience with BI and on average, they had ten years. The interviews lasted on average one hour. The interviews were transcribed and analyzed by categorizing the main statements. Mayring's method makes qualitative statements comparable by analyzing the frequency in which they were mentioned [10]. The improvements were incorporated and the changed model was shown to the experts again. The new improvements were implemented in the next step.

III. PROPOSED SELF-SERVICE SUPPORTING ARCHITECTURE

A. Status Quo and Problem Identification

To identify the status quo of the SSBI research, a literature search was done in the AISeL, ScienceDirect, IEEEXplore, ACM and Emerald database. It was extended to include practitioner resources. Whitepapers by the BeyeNETWORK, The Data Warehousing Institute (TDWI), and Gartner were analyzed. The search keywords we used contained: "Self-Service" in combination with "BI", "Business Intelligence", "Big Data", "Architecture" and "Analytics." The publication dates ranged from 2005 to the present. The search resulted in 1,258 potentially relevant articles. They were reviewed by title and unsuitable papers were eliminated. If the title did not make a clear decision possible, the abstract, the introduction, and the conclusion were consulted. After that a forward and backward search in the most relevant papers was conducted. This included non-academic literature like whitepapers. Forty articles were deemed highly relevant for the development of the model. The literature review identified eight different BI or big data architecture models. Phillips-Wren et al. propose a big data analytics architecture model based on different other models [4]. The authors analyze existing BI/big data literature and describe a new user group they call data scientists. In the field of data processing infrastructures, Phillips-Wren et al. focus on the use of Hadoop clusters as a solution for big data use cases. Another model proposes a service orientation character for a BI architecture [13]. They developed a BI architecture model that shows how this service character is implemented and which elements are necessary.

Table 2: Overview SSBI literature

SSBI aspects	*Description*	*Sources*
Governance and guidelines	Changes in governance and guidelines for the realization of SSBI	[21-26]
Individual BI usage	Concepts which support an individual BI usage	[5-7], [28-30]
Social media elements	Social media elements in a BI environment	[31-32]
Collaboration	Cooperation in the creation of reports or queries	[5], [25], [27], [33-35]
Knowledge database	Database which saves construction and usage of reports and analyses; also examination of analysis paths	[36-41]

A combination of these elements with comprehensive BI/big data analytics architecture is still missing.

Table 3: Improvements through expert interviews

Model layer	*Description*	*Sources*
Preparation	Multiple data access methods added; added direct access without using a storage system	Experts 1, 5, 7, 11, 13
Storage and analysis infrastructure	Generalization of the storage and analysis infrastructure into three tiers	Experts 1, 3, 6, 15-16
Presentation	Enterprise social networks added, skills added	Experts 4, 11
Knowledge database	Feedback loop added, development of the different use cases of the knowledge database	Experts 2, 4, 12, 15, 16
Governance	Order of the governance aspects according to by the experts mentioned importance	All experts had influence

In the following, the focus will be on the architecture itself, the implementation of collaboration rooms, and a self-learning knowledge database. The collaboration rooms can then be connected with existing enterprise social media systems. After developing a first model with the findings from literature the model was improved through expert interviews. The following table 3 shows some of the major changes caused by the expert interviews.

IV. MODEL OVERVIEW

In the following, the final model developed with the help of expert interviews is explained. Inspired by existing BI/big data analytics architecture models, the aim is to describe the whole process from the data sources through to the presentation of information. Big data is defined as “a phenomenon characterized by an ongoing increase in volume, variety, velocity, and veracity of data that requires advanced techniques and technologies to capture, store, distribute, manage, and analyze these data.” [12] This is the reason for the need of an advanced technical infrastructure. The changed technical infrastructure leads to a more complex data access for users which effects the possibilities of SSBI and the need to discuss the entire BI process from the source systems to the presentation of the data. On the left side of the model are the data sources. The data sources are separated into internal and external sources. The data origin shown in Figure 2 are examples of those sources. The next step in data processing is the preparation of the data. Three different ways of accessing data exist. The first one is a direct access tunnel for analysis, where a special integration or caching of the data is not necessary. Second, direct access for real-time analysis is shown. The third method is a classic ETL process. But this process is extended by the possibility of performing an EL(T) process [13]. EL(T) stands for “extract”, “load” and an optional “transform” process. This takes into account that in some big data analysis there can be a need for raw data that is not transformed. Different data access methods have to be taken into account for realizing SSBI.

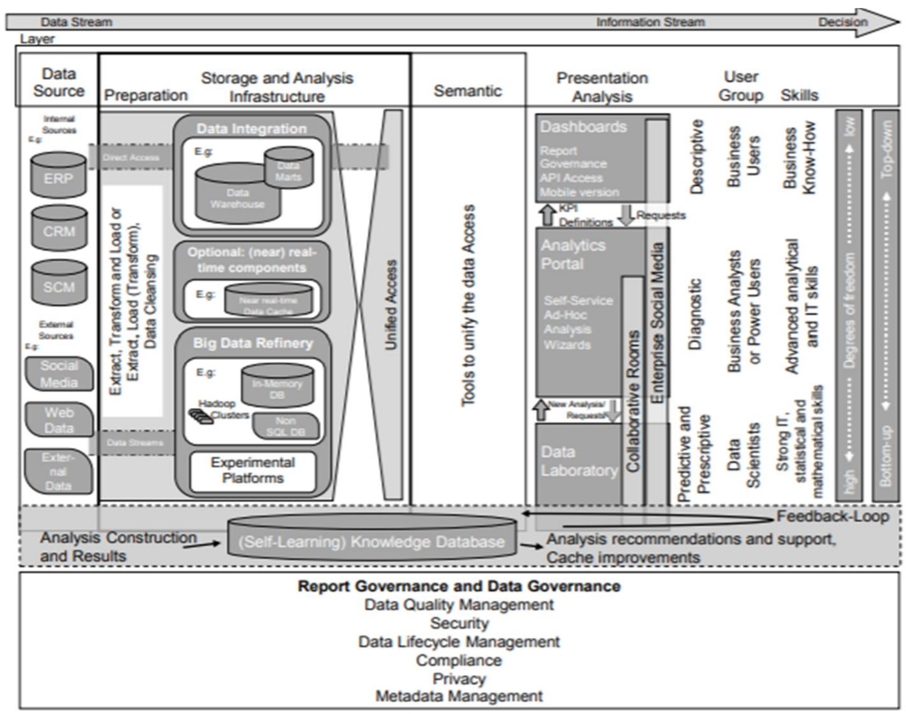


Figure 2: Proposed architecture model

This is especially important for data scientists, who need access to raw data. In the proposed model, the storage and analysis infrastructure layer consists of two main and one optional tier. An element for data integration is necessary in every BI or big data environment. The job can be done with a classic data warehouse, but other technologies can take on this job, such as in-memory databases or Hadoop clusters. The other tier is the “big data refinery.” This element ensures the necessary infrastructure for big data analysis and includes “experimental platforms.” These platforms are essential for the data scientist user group. They need possibilities for experiments where data from different sources can be staged, merged, and analyzed [14]. The last tier consists of optional elements that could be necessary for a real-time BI realization, such as data caches [15]. To simplify access to data across multiple systems, there is the semantic layer which also includes the mapping layer described in [16]. It realizes a unified access to the different storage systems and an easier access to the data for users with low technical skills. A possible embodiment of the semantic layer could be a service oriented architecture. A service oriented BI architecture is described in the work by Pospiech and Felden [13].

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue XII Dec 2021- Available at www.ijraset.com

A. Collaboration Rooms

The “collaboration room” architectural component is a platform where a direct cooperation from users of the analytics portal and the data laboratory is possible. Users of the same portal can cooperate while working on the same platform. Also, users of the analytics platform can give feedback for analyses performed by data scientists. Business analysts can also ask for special sub-parts of their analysis to be built by data scientists. It is important for the process that the collaboration history is saved. Today most collaboration communication is done by email. The problem is that only the people involved have access to the origin story of a decision-making process. A collaboration platform can replace email communication. [15] Figure 3 shows proposed classes of a collaboration room environment. It represents the different user groups and the related platforms. Business users and analysts can create requests for a new report or analysis. Business analysts can also ask for help with the construction of a report. The collaboration can take place inside a user group or business analysts can make requests to data scientists. These requests are connected to one or more reports. Every report belongs to a workspace. This is the main room where the collaboration can take place. Inside a workspace it is possible to create several communication rooms. One-on-one and group discussions are possible. The workspaces in conjunction with the communication rooms provide the opportunity for discussing reports, creating different report versions, and conducting experiments. All these elements support the collaboration between the different user groups of the BI/big data analytics architecture.

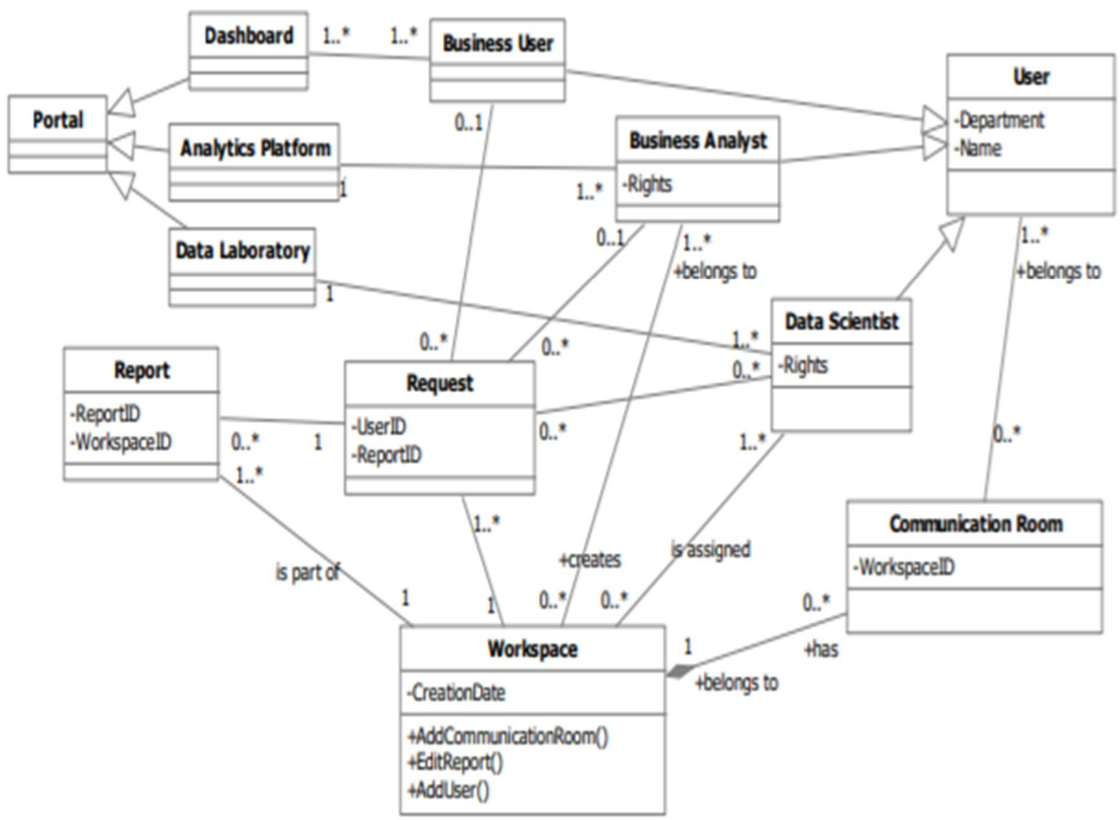


Figure 3: Collaboration environment conceptual class chart

V. CONCLUSION

The developed model shows significant progress in relation to other proposals [4], [16]. It is extended especially with regard to SSBI. The ideas result from both practical and academic literature and in particular from interviews with experts. A focus group discussion was used to check the practicability of the model. The new model represents a universal BI / big data analytics reference model. It can be seen as a guideline for companies, who can evaluate their existing architecture with the aim of improving their SSBI or big data analytics capabilities. It takes different user groups and their different demands into account in a BI/big data analytics architecture. Collaboration rooms and a (self-learning) knowledge database are presented as additional supporting elements. Discussions with practitioners have shown that these elements have great potential to support SSBI because they make implicit knowledge of BI users usable. In further research the applicability should be reviewed by various companies.

REFERENCES

[1] Antignac, T., Scandariato, R., & Schneider, G. (2016). A Privacy-Aware Conceptual Model for Handling Personal Data. International Symposium on Leveraging Applications of Formal Methods, Verification and Validation, 942-957. Retrieved from https://eugdpr.org/

[2] Baars, H., & Kemper, H.-G. (2008). Management Support with Structured and Unstructured Data - An Integrated Business Intelligence Framework. Information Systems Management, 132-148.

[3] Bani Hani, I., Deniz, S., & Carlsson, S. (2017). Enabling Organizational Agility Through Self-Service Business Intelligence: the case of a digital marketplace. Pacific Asia Conference on Information Systems (pp. 1-13). Langkawi: AIS Electronic Library.

[4] Curran, J. M., & Meuter, M. L. (2005). Self-service technology adoption: comparing three technologies. Journal of Services Marketing, 103 - 113.

[5] Data Governance Institution. (n.d.). Defining Data Governance. Retrieved from Data Governance Institution: http://www.datagovernance.com/defining-data-governance/ DSM. (2018). Bright Science. Brighter Living. Retrieved from DSM: https://www.dsm.com/corporate/about.html

[6] Eckerson, W. (2014). Five steps for delivering Self-Serivce Business Intelligence to Everyone. Information Builders and TechTarget Custom Media. Evelson, B. (2012). The Forrester Wave™: Self-Service Business Intelligence Platforms, Q2 2012.

[7] Cambridge: Forrester Research. Flick, U., von Kardorff, E., & Steinke, I. (2004). A Companion to Qualitative Research. London, Thousand Oaks, New Delhi: Sage Publications. Forrester. (2011). Self-Service: An Essential Capability Of BI. Cambridge: Forrester Consulting.

[8] Gartner. (2018). Business Intelligence (BI). Retrieved from www.gartner.com: https://www.gartner.com/itglossary/business-intelligence-bi/

[9] Howson, C. (2016). Embrace Self-Service Data Preparation Tools for Agility, but Govern to Avoid Data Chaos. Gartner. Howson, C., Sallam, R., Richardson, J., Tapadinhas, J., Idoine, C., & Woodward, A. (2018).

[10] Magic Quadrant for Analytics and Business Intelligence Platforms. Gartner. Ibáñez, L.-D., Mazón, J.-N., & Simperl, E. (2017). Towards Semantic Assessment of Summarizability in Self-service Business Intelligence. Advances in Databases and Information System (pp. 174-185).

[11] Cyprus: Springer International Publishing AG. Imhoff, C., & White, C. (2011). Self-Service Business Intelligence Empowering Users to Generate Insights. TDWI.

[12] Isik, O., Jones, M. C., & Sidorova, A. (2012). Business Intelligence (BI) success and the role of BI capabilities. Intelligent Systems in Accounting, Finance and Management, 161-176. Isik, O., Jones, M. C., & Sidorova, A. (2013). Business intelligence success: The roles of BI capabilities and decision environments. Elsevier - Information & Management, 13-23.

[13] Johannessen, T. V., & Fuglseth, A. M. (2016). Challenges of Self-Service Business Intelligence. Norwegian Conference for IT Use in Organisations. Bergen: Bibsys Open Journal Systems. Joshi, N., & Geracioti, I. (2017, October 31). Turbocharging Analytics at Uber with our Data Science Workbench. Retrieved from Uber Engineering: https://eng.uber.com/dsw/

[14] Medtronic. (2018). About The New Medtronic. Retrieved from Medtronic: http://europe.medtronic.com/xden/about/plc.html

[15] Mertens, M., & Krahn, T. (2012). Knowledge Based Business Intelligence for Business User Information Self-Service. In S. Brüggemann, & C. d'Amato, Collaboration and the Semantic Web: Social Networks, Knowledge Networks, and Knowledge Resources (pp. 271 - 272).

[16] Hershey: Information Science Reference. Ogushi, Y., & Schulz, M. (2016). Self-Service Business Intelligence (SSBI): Categorizing into Dimensions of Interest in Scholarly Literature.

[17] Germany; Japan. Passlick, J., Lebek, B., & Breitner, M. H. (2017). A Self-Service Supporting Business Intelligence and Big Data Analytics Architecture. Proceedings der 13. Internationalen Tagung Wirtschaftsinformatik, (pp. 1126-1140). Switzerland. Pickering, C., & Gupta, M. (2015). \

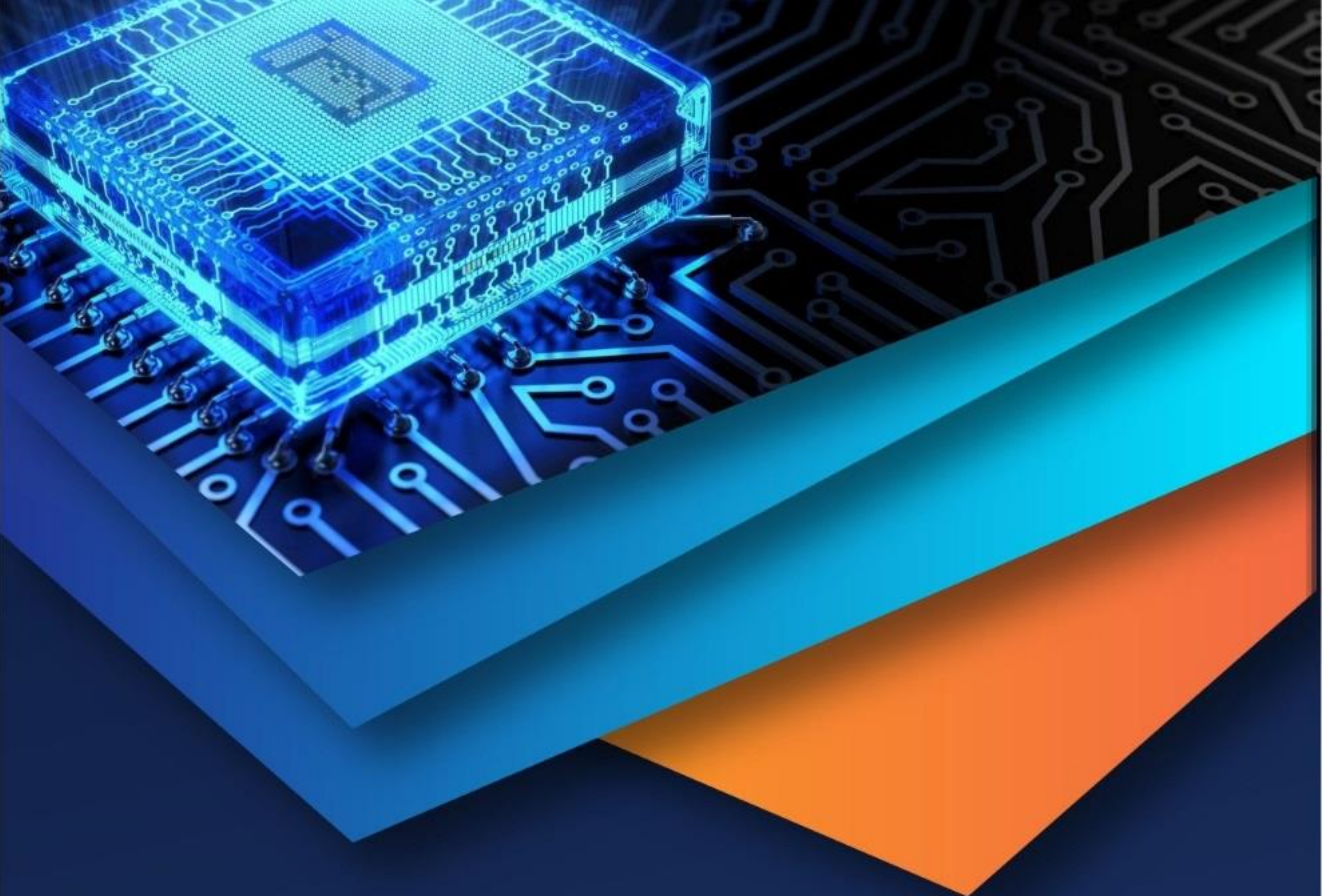
[18] Self Service Business Intelligence (SSBI) for Employee Communications and Collaboration (ECC). Institute of Electrical and Electronics Engineers, 302- 304.

[19] Riggins, F. J., & Klamm, B. K. (2017). Data governance case at KrauseMcMahon LLP in an era of selfservice BI and Big Data. Journal of Accounting Education. Schlesinger, P., & Rahman, N. (2015). Self-Service Business Intelligence Resulting in Disruptive Technology. Journal of Computer Information Systems, 11-21.

[20] Schuff, D., Corral, K., Louis, R. D., & Schymik, G. (2016). Enabling self-service BI: A methodology and a case study for a model management warehouse. Information Systems Frontiers.

[21] Sharda, R., Delen, D., & Turban, E. (2014). Business Intelligence: A Managerial Perspective on Analytics. Edinburgh Gate, Harlow, England: Pearson Education Limited.

[22] Sulaiman, S. (2018). Recommendation-based Business Intelligence Architecture to Empower Self Service Business Users. Multikonferenz Wirtschaftsinformatik, (pp. 95-106). Lüneburg.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY