

Master Data Management role in Agtech

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Abstract- This paper explores the crucial link between Master Data Management (MDM) and Agtech, where MDM serves as a key technological component in the realm of agriculture technology. MDM is fundamentally concerned with the establishment and maintenance of a unified, accurate, and consistent data source within organizations. Conversely, Agtech represents the integration of technology to bolster agricultural practices.

The research investigates how MDM contributes to the advancement of agricultural management and productivity within the Agtech landscape. By ensuring data integrity and reliability, MDM facilitates improved decision-making processes and the seamless integration of technological solutions in agriculture. This paper examines real-world examples of MDM's successful application in Agtech projects, highlighting its tangible benefits, including increased efficiency and sustainability.

In summary, this paper underscores the pivotal role of Master Data Management in augmenting Agtech and fostering positive changes in the agricultural sector. By illuminating the synergy between MDM and Agtech, this research offers valuable insights for stakeholders interested in leveraging technology to enhance agricultural practices and outcomes.

Index Terms- Master Data Management, Data quality, Data Governance, Agtech

I. INTRODUCTION

Master Data Management is concerned with maintaining and creating a consistent, single, accurate, source of essential data in an organization [4]. On the other hand, agtech refers to agriculture technology. It is the application of technology in the enhancement of agriculture. Master data management is employed as a technological element in the enhancement of agricultural management and productivity. It plays a significant role in Agtech by perpetrating the enhancement of a myriad of positive sentiments to the industry.

II. DATA INTEGRATION

One of the key roles that Master Data Management plays in Agtech is data integration. Data is a vital component for any system to run effectively. Agriculture is not an exception as a

system. It relies on data for the right decisions to be made at the right time. In that regard, it is important that data is sourced from different sources to facilitate the effective undertaking of agricultural operations. Given the variations in size and timelines from the different sources of data, they need to be integrated to ensure that the system runs as is desired. Master Data Management ensures that all the sources of data communicate with each other in synchrony [1]. That way, it is presented to the agricultural management in a form that is readily palatable.

There are several sources of data for an agricultural system. One of the key sources is weather stations. There are both private and public weather stations in various jurisdictions. An agricultural system may be in a single area or strewn in different parts. Therefore, it may need to work with data from different weather stations. The data is critical in establishing aspects such as planning for irrigation, propping plants against impending winds, and mulching plants against scotching sunlight. Another source of data is market trends. An agriculture system needs to understand for instance which products are selling well, which ones are in high demand, and which ones have their prices dropped sharply. The information needs to be relayed to the management team early enough for appropriate decision making. Other sources of data for an agriculture system include machinery sensors, political experts, and national census. It is not easy to collect all the information and bring it together on a common platform that gives one solid direction of action. The integration of the data from the different sources is effectively done by Master Data Management [3]. It ensures that the decisions made are informed by dictates of all pertinent sources of data in synchrony.

III. QUALITY OF DATA

Another role that Master Data Management plays in Agtech is enhancing the quality of data. As much as agriculture needs data to run effectively, it does not just need any form of data. It needs high quality data. One of the elements of a good quality of data is that it must be accurate data. Any decision made based on inaccurate data is poised to be faulty and misleading. It is critical that all aspects that are poised to make data inaccurate are detected and eliminated. That is the work of a Master Data Management. It scrutinizes data that is collected from all sources and identifies aspects of inaccuracy automatically. For instance, based on historical facts, it may be impossible to have rainfall above or

below a certain threshold, therefore, the system may be designed such that it detects and highlights any instances in which such thresholds are exceeded for a confirmation to be done to establish authenticity of the data.

Master Data Management is also employed in enhancing the quality of data by undertaking data cleaning. One aspect of data cleaning is eliminating duplications. There are instances where in the process of data collection, a row or column of data may be repeated erroneously. The Master Data Management is effective in detecting such aspects automatically and highlighting them for re-evaluation. Similarly, the system also checks for computational errors in the data [6]. For instance, there are cases where certain formulas are employed to find certain indices or figures of concern. It may be necessary for instance to use a formula to compute water pressure. Other computations may include summation of yields in a month, or average of rainfall in different weeks across a year. In case the calculations are done wrongly, they may lead to wrong decision making. Therefore, the Master Data Management comes in handy in eliminating such flaws.

IV. FARM MANAGEMENT

Master Data Management is also instrumental in Agtech in the sense that it supports farm management. Farming is a complex undertaking that relies on a myriad of factors. There are several stakeholders in the system that make it operate successfully. If any of the factors or stakeholders is overlooked, it is likely to lead to a loss. In that regard, it is important for a rigorous management system to be undertaken.

One of the ways in which Master Data Management ensures effective management in agriculture is facilitating acute human resource management. During the farming process, it is important to ensure that all staff members in the different pertinent departments are managed appropriately. Apart from the actual farmers, there are other staff members such as security guards, plumbers, electricians, veterinarians, managers, drivers, and loaders [7]. It is important to manage the workers appropriately such that there is adequate labor at any given time. They need to have the right contracts, working arrangements, remuneration, training, promotions, and even motivation undertakings. Master Data Management ensures that all management pertaining to human resource in agriculture is undertaken seamlessly.

Master Data Management is also employed in farm management by facilitating a proper management of the production process. Agricultural production needs to be informed by different elements. There needs to be adequate farm inputs to facilitate production of a certain product, but at the same time the prevailing weather conditions should also be supportive [2]. For instance, to prepare the land for the upcoming rainy season, the tractor needs to be in proper functioning condition. Therefore, any challenges with the tractor may need to be resolved in time using the income that the venture receives before the rainy season comes. The Master Data Management serves to create a timeline that ensures there are no delays as far as the agricultural production is concerned.

V. SUPPLY CHAIN

Supply chain optimization is another element of agriculture that is supported by Master Data Management. Agricultural supply chain is a complex element that if not properly managed can easily lead to a loss or total collapse of the venture [8]. The demand in the market should be juxtaposed with the prevailing conditions and available resources to ensure a profitable venture. For instance, a shortage of onions in the market can only be perceived as an opportunity to exploit if the time it takes to grow the products and prevailing weather conditions favor supplying the product before the impending shortage is curtailed by cheap products from other markets. Master Data Management facilitates balancing of the pertinent factors and ensuring effective management.

The supply chain is also concerned with attributes such as warehousing, transportation, and refrigeration. Agricultural production involves some products that are immensely perishable while others are not as perishable. In that regard, as much as the demand for a certain product may exist, it is important to consider how perishable they are, and what distance they may need to travel before reaching their destination. Products such as milk, meat, fruits, and vegetables are highly perishable. They need to reach their points of consumption quickly. In the meantime, they need to be preserved through processes such as refrigeration. It is necessary for instance to have coolers in tracks that ferry milk. On the other hand, products such as cereals, tend to be less perishable [9]. They can be stored in granaries for long as speculations are done for favorable prices in the market before, they are sold. It is not easy to balance between the timelines and available resources for transportation, storage, and preservation. However, Master Data Management ensures that the undertaking is simple and effective.

VI. COMPLIANCE AND REPORTING

The Master Data Management is also essential in ensuring compliance and reporting in agriculture. As is the case with almost all industries, agriculture is a heavily regulated undertaking. Because it is concerned with the production of consumable products such as foods and beverages, it poses a threat of causing a public health crisis if it is left unregulated. Besides it is of interest to national security given that besides its potential threat as a biological weapon, it can be used to cause food insecurity and destabilize a country. In addition, agriculture uses chemical products such as pesticides and fertilizers that can easily pollute the environment. It is of concern to environmentalists since it is a threat to sustainable agriculture. There are also human rights activists who demand that animal rearing is undertaken in a way that guarantees certain rights to the animals [8]. They have successfully rallied the government in different jurisdictions to pass certain laws on animal keeping. As a result, a multiagency approach is used to regulate agricultural undertakings in a country.

It may be a challenge to conform to all the available regulatory requirements in a country. Since there are several existing laws, some of which may be conflicting in different jurisdictions, abiding by each of them may be a daunting task for a farmer. Failure to abide by a law is poised to lead to dire consequences. A farmer may be required to pay large sums of money in damages.

In some cases, the requisite amount may mean closure of the venture. The complex nature of the interconnected laws may also compel a farmer to hire and keep a lawyer on a retainer. It may be an expensive undertaking that in some cases may delay the production process. Consequently, it is a bid reprieve that Master Data Management can be employed in ensuring that a farmer is compliant to available regulations [6]. The system is automated and can detect aspects that go against the available regulations and warn the farmer in good time.

VII. RESEARCH AND DEVELOPMENT

Master Data Management is also instrumental in research and development. The system is responsible for coordinating large volumes of data related to agriculture. It handles data from different sources that is all instrumental for the success of agriculture. The system also handles data over an extended period. It is a robust system that can maintain pertinent data in its original form over time. The data remains accurate and reliable despite the amount of time that has passed. As a result, it is a system that can be used for establishing patterns and trends over time. Inferences regarding patterns of interest can be drawn using the data availed by the system. It can be relied upon in a study that is interested in relating specific variables over time. Based on the Master Data Management, plausible conclusions can be drawn on the way certain variables correlate with each other.

Other than the trends value of the Master Data Management system, it can also be used to manage research on agriculture in general. Plants and animals' growth is a scientific undertaking. Therefore, to enhance the yield and cut on costs, it is necessary for research to be undertaken. Studies may be undertaken on aspects such as trying to find a species variety that does well in a certain altitude, the right soil for a given type of seed, or the most effective natural pesticide in a certain area. Such studies may be time consuming and voluminous in terms of data recording and storage. The Master Data Management serves to make the process easy and less costly [7]. Rather than employing many staff members in a study to engage in the process, the Master Data Management can facilitate the study easily. It is therefore instrumental in presenting effective solutions in the agricultural process. It has facilitated several studies that have led to the discovery of new ways of solving challenges that existed in the agricultural process.

VIII. MARKET INSIGHTS

Master Data Management is also instrumental in agriculture given that it offers market insights. At the end of the day, agriculture is closely intertwined with the target market. Most agricultural undertakings are for commercial purposes. Farmers for instance engage in large scale agriculture with the aim of selling their products to the market. In that regard, it is critical to understand the market fully to ensure the venture remains profitable. A market is a relatively volatile element, considering that it can change sharply within a short period of time. It is affected by factors such as competitors, substitutes, technological changes, the economy, demographic aspects, tastes, and preferences. An agricultural venture is compelled to fully understand the market to produce as desired. In that regard, Master Data Management is effective in ensuring that agricultural ventures have a good understanding of

market trends [9]. It offers invaluable information to the ventures to ensure that they produce just the right number of products to satisfy the demand in the market. It also informs the production methods that can be explored sustainably to keep the cost of production within the expected purchasing price in the market.

IX. AI AND MACHINE LEARNING

Master Data Management also supports agriculture by perpetrating the use of machine learning and artificial intelligence. For the AI systems to function effectively, they need a large volume of data. They must be fed with not only robust data, but it must also be accurate and reliable. In the application of AI in agriculture, the data it must use is particularly data on aspects related to agriculture and its various stakeholders. In that regard, the most befitting source of data for the AI systems to run effectively is Master Data Management. It is integrated with all the pertinent agricultural sentiments that ensures that the systems run effectively. Master Data Management for instance has data on climate, soil types, market forces, research, and agricultural logistics. In that regard, it provides a perfect pool of data that can perpetrate the accurate running of AI systems. In turn, AI can be used by stakeholders in agriculture to make their operations easy [4]. For instance, it can be used for finding the appropriate data to automatically run an agricultural undertaking in a certain area. It can also be used to replace repetitive tasks that are performed by humans such that they are undertaken by machines.

X. DATA SECURITY

Lastly, Master Data Management plays the role of enhancing data security in agricultural applications. The security of data is as important as the accuracy of the data. When one needs to employ the data, they collected and they cannot have access to it, then the data is of no use to them. In that regard, it is critical that data is protected at all costs. Data collection is an expensive undertaking. It takes time and the right expertise to ensure that the right set of data is collected over the desired period. Therefore, once the data is collected, losing it translates to losing money. There are always aggressor stakeholders who may be interested in gaining access to collected data for selfish reasons [5]. For instance, competitors in the market have an interest in understanding factors such as the amount of money that a farmer commits in marketing or producing a certain product so that they can counter it in good time before it is too late. Some may infringe on the available data for purposes of sabotage. They may delete the data or corrupt it just so as to make it unavailable to the farmer. In some cases, data is hijacked and in turn ransom is demanded. In all cases, Master Data Management is effective in ensuring the safety of data.

XI. CONCLUSION

In conclusion, there is no doubt that Master Data Management plays an instrumental role in Agtech. It is responsible for several activities that ensure technology enhances agricultural operations. It has grown to a level where it is largely indispensable in agriculture. Master Data Management plays the roles of data integration, enhancing the quality of data, supporting farm management, enhancing supply chain optimization, ensuring compliance, and reporting in agriculture, facilitating research and development, offering market insights, perpetrating the use of

machine learning and artificial intelligence, and enhancing data security. Therefore, it is responsible for immense gains made over the years in agriculture.

REFERENCES

- [1] Loshin D. (2009). Master data management. Elsevier/Morgan Kaufmann.
- [2] Talburt J. R. & Zhou Y. (2015). Entity information life cycle for big data: master data management and information integration. Elsevier: Morgan Kaufmann.
- [3] Cervo D. & Allen M. (2011). Master data management in practice: achieving true customer mdm. Wiley.
- [4] Graser A. Mandel A. Olaya Ferrero V. Bruy A. & Mearns B. (2017). Qgis : becoming a gis power user : learning path : master data management visualization and spatial analysis techniques in qgis and become a gis power user. Packt Publishing.
- [5] Bonnet P. (2010). Enterprise data governance: reference & master data management semantic modeling. ISTE; Wiley.
- [6] Allen M. & Cervo D. (2015). Multi-domain master data management: advanced mdm and data governance in practice. Morgan Kaufmann.
- [7] Berson A. & Dubov L. (2011). Master data management and data governance (2nd ed.). McGraw-Hill.
- [8] Dreibelbis A. (2008). Enterprise master data management: an soa approach to managing core information. IBM Press/Pearson plc.
- [9] Kanopy Streaming. (2014). Master data management and cloud computing.