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case study of a mining equipment manufacturer

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Publication date:
2017

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Framework for improving spare parts availability using big data analytics: case study of a mining equipment manufacturer

Big data has brought about significant changes to various industries in the last few years, resulting in the expectation that it might transform the way supply chain continues to develop (Waller & Fawcett, 2013). Main characteristics of big data are volume, velocity and variety (Sanders, 2014; Waller & Fawcett, 2013; Wang *et al.*, 2016). But, these qualities alone are not enough to deliver meaningful insights (Sanders, 2014), it is the combination of analytics and big data which provides real value to supply chain decision making (Baines and Lightfoot, 2013). There is a need to better understand the framework for big data management and the benefits which big data can bring (Dutta & Bose, 2015). Especially in big data environment, the managers should have both deep understanding of the business as well as have perspectives on utilizing the data for business decisions (Waller & Fawcett, 2013).

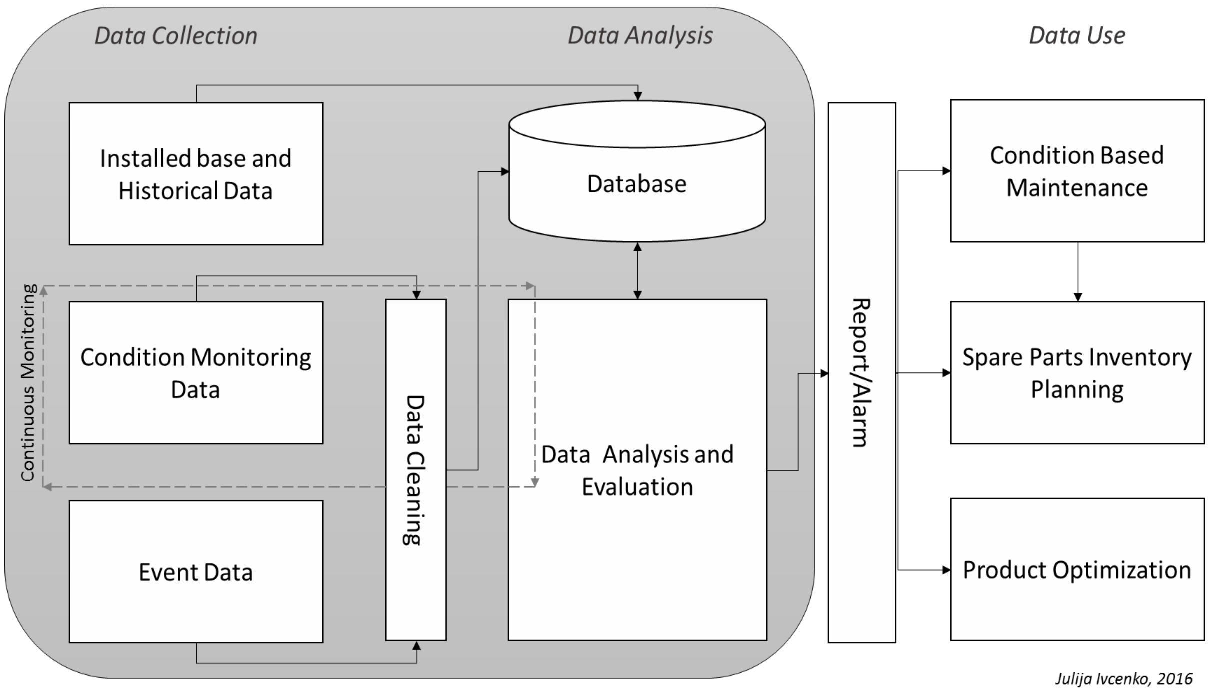
Currently, many manufacturing organisations are moving towards servitization to add greater value for their customers (Johnson and Mena, 2008; Neely, 2008). Timely spare parts provisioning is one key element of the servitized businesses for such companies (Saccani et al., 2014). Providing performance guarantees and hence minimal productivity losses for customers require deeper understanding of failure rates of non-repairable spare parts. Characteristics of such parts are intermittent and erratic demand, large variety, frequent obsolescence (Diaz, 2003), critical to operations (Huiskonen, 2001), and slow moving (Dekker *et al.*, 2013), But, often shortage of historical data makes inventory management of spare parts more complicated (Huiskonen, 2001; Stefanovic, 2015). Hence, big data which can capture the real time usage of such parts has high potential for better failure prediction, spare parts planning and availability and higher productivity for customers. By analyzing such big data, a company will be able to predict when the failure is likely to occur (Baines and Lightfoot, 2013). The appropriate use of big data can reduce unplanned downtimes at manufacturing facilities (Munirathinam & Ramadoss, 2014) and the likelihood of the breakdowns. Remote monitoring technology can be used to capture real time performance of parts (Grubic and Peppard, 2016). While Grubic and Peppard (2016) provide the enablers and barriers of using remote monitoring technology for servitization, there is lack of a comprehensive framework and implementation plan of how companies with large variety of non-repairable spare parts can enhance performance of their service business using big data. This research tries to address this gap with the following objectives:

1. To identify the key parameters for predicting potential failures of spare parts.
2. To outline the data collection and analysis processes for spare parts demand planning.
3. To develop a framework for big data implementation for spare parts planning and identify the benefits which can be derived from it.

A single in-depth case study is an appropriate unit of analysis for the research as dangers of making cross-sectoral generalisations regarding servitization strategies (Johnstone et al., 2009) and more so for big data analytics for servitization which may be highly context-specific.

To fulfill the objectives of this research, we chose a company which has decided to invest in smart-parts to differentiate themselves from the competitors and to improve their service business. Smart-parts is an approach for condition monitoring of parts with technology that users sensors. Any information from the sensors about potential failures can potentially allow the company to improve planning and increase their spare parts availability. However the company faces significant challenges in introducing those smart-parts. One of the challenges is identifying which data should be collected and how to plan the inventory using this data. The other challenge is how to manage the process for big data implementation in the company. As the company had numerous types of spare parts, we decided to focus on three spare parts due to their substantial contribution to the service revenue and since from a customer's point of view these parts are more suitable for data capture by sensors. By studying the characteristics of these parts, the current maintenance and spare parts planning practices, a framework for utilizing big data for spare parts planning in the organization utilizing both historical and real time condition monitoring data is developed.

The parameters for predicting failure are identified for the chosen parts based one literature and knowledge of experts. Then three types of data which should be collected for example installed base data, condition monitoring data and event data are specified and finally some practical considerations for implementation are outlined. This implementation would help improve spare parts planning and consequently improve the performance of the service business. The overall framework is shown below:



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