DATA-DRIVEN SMART MANUFACTURING: CASE STUDY OF WORKFORCE MANAGEMENT PROCESS IN AN ITALIAN LEATHER GOODS COMPANY

Pietroni, Giorgia;
Marconi, Marco

Università degli Studi della Tuscia

ABSTRACT

Digitalization is one of the fundamental pillars of Industry 4.0. Within smart factories, Big Data Analytics systems play a key role in supporting the decision-making process of various stages of business processes. In this context, this research aims to identify solutions able to process large volumes of data from digital business processes with the final goal of adding value to the organisation. More specifically, the research deals with the implementation of a digital manufacturing tool able to digitize the workforce management process. The research has been applied in the case study of an Italian manufacturing company operating in the leather goods sector through the digitalization of the workforce management by a cloud-based platform. The implementation of the tool increases the efficiency of the production process, provides efficient management and integrates workforce data into one system. The implemented tool generates a large volume of data, the final goal is to make data user-friendly to support business decisions. Digitisation provides an exchange of information to support managers to make confident decisions.

Keywords: Industry 4.0, Big data, Digital / Digitised engineering value chains, Workforce Management

Contact:
Pietroni, Giorgia
Università degli Studi della Tuscia
Italy
giorgia.pietroni@unitus.it

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1 INTRODUCTION

Digital transformation is a phenomenon that currently affects all organisations, large or small. It aims to create new digital business models and it refers to the implementation of new digital technologies in any business environment (Maamar, et al., 2021). Digital transformation is a long-term journey, organisations decide to follow this path and change their strategic, management and operational practices in response to factors of continuous technological development. Within a business context, digital transformation must involve all processes and should not be an isolated application of a single business area. From the Industry 4.0 paradigm approach, the evolution of smart factories adopts the following basic design principles: interoperability, interconnection, information transparency, decentralisation, modularity (Hermann, et al., 2016; Sahal, et al., 2020). Therefore, it focuses on the transformational power of digital technologies (Hund, et al., 2021). Digital innovation allows new ways to create value, so for instance services and products can be created and exploited in a different way. Nambisan et al. (2017) suggest that digital innovation 'is the use of digital technology during the innovation process'. The Fourth Industrial Revolution remoulds the way people work, learn, lead, manage, recruit and interact with each other (Da Silva, et al., 2022).

Digital technologies produce large volume of data, which can be combined in new ways to create additional shapes of innovation (Hund, et al., 2021). Data is the driving factor. Indeed, data reflects the performance of the whole organisation. In smart factories, big data analysis plays a key role to achieve higher productivity, product quality, process safety, economic and environmental resilience of production systems (Fang, et al., 2020). One of the main challenges towards the digital transformation enabled by Industry 4.0 is the design and implementation of big data analytics solutions for industry. Big data analytics systems are one of the main drivers of smart factories, to support decision-making in business process steps (Kahveci, et al., 2022). Currently, big data analysis applications are still limited in the context of manufacturing companies. In this context, Data Management mission could support organisations, because the strategy aims the dissemination and understanding of corporate data. Data management born in organisations that recognise value in data in order to become competitive in various fields. Currently, solutions for the efficient management of big data are still a challenge for manufacturing companies (Zhang, et al., 2017).

In this context, this research aims to design a digital workforce management process. The methodology is grounded on a tool that can bring all personnel data into a single system and use it to define an efficient distribution of resources. In addition, the methodology aims to analyse the workforce management data. Therefore, it can support the organisation's decision-making process to gain competitive advantages. This creates a computer architecture that is not only information driven but also able to predict and extract results. The basic concept is that it is possible to derive information from data processing, so it is not only data that makes the difference, but decisions inspired by data processing. The method has been experimented in the case study of an Italian manufacturing company operating in the leather goods sector for the production of luxury bags. The tool generates a large volume of big data, so this study considers the next evolution, the Workforce Analytics. Data analysis is able to process the data according to the logic of Data Visualisation and specific performance indicators with the final goal to obtain value from the data.

After this introduction, the rest of the paper is organized as follows. Section 2 analyses the state of the art. Section 3 explains the design methodology of the digitised workforce management process. Section 4 describes the case study, so the application of a Digital Manufacturing Tool based on the Workforce Management process in an Italian company operating in the leather goods sector. Section 5 shows the results of Data Analytics and Visualization. Section 6 summarizes the outcomes of the study and provides some indications for future developments.

2 STATE OF THE ART

The workforce is the central element around which the entire manufacturing system evolves. The failure to manage human capital may lead inefficiencies that result in consequent deficits for the entire organisation. To obtain an efficient process, human capital management is essential. This leads to the definition of Workforce Management (WFM) that is an organisational system aimed at the efficient use of human resources. Personnel management is a real process that requires specific rules to respect

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all boundary constraints. WFM is about people and requires information characterizing each of them (Battini, et al., 2022).

In the manufacturing context, the variability of workers in terms of experience, productivity and physical ability represents a significant challenge for companies, particularly those with high staff turnover and manual processes with high workload and poor ergonomics (Battini, et al., 2022). Human Resources (HR) management helps companies to make good use of employee databases for the purpose of making the right decisions and improving their operational performance (Berhil, et al., 2019). In order to adapt to Industry 4.0 paradigms, companies should focus on automating HR processes, thus increasing the intelligence and agility of the workforce to improve efficiency, innovation, productivity and consequently save costs (Sivathanu & and Pillai, 2018). The implementation of a Smart HR 4.0 would allow HR employees to play a more strategic role in the overall organisation's progress (Sivathanu & and Pillai, 2018). Emerging technologies such as Internet of Things (IoT), Big Data and Artificial Intelligence (AI) automatise HR processes, building a more efficient and lean team. To support human resources management are available several tools. WFM tools integrate factory requirements with workforce features in order to make workforce management more effective and efficient. In this context, a review article analysing IT solutions already adopted in the human resources sector was examined. According with the research (Berhil, et al., 2019), several IT solutions have been proposed to solve various HR problems. Solutions using artificial intelligence algorithms (Machine Learning, Neural Network, Data Mining) are the most commonly used to solve HR problems. They have 41% utilisation rate, followed by 29% of other analysis methods or simple statistics, 14% of BI, Big Data and Data Warehouse solutions and 16% of simple analysis through software, ERP, frameworks or websites. However, the proposed IT solutions only digitise the workforce process but hardly integrate with other business processes. In this case, the benefit to the organisation is not achieved.

Efficient workforce management through the use of Industry 4.0 enabling technologies includes the concept of Industry 5.0 (Sivathanu & and Pillai, 2018). Industry 5.0 is a business model characterised by cooperation between machines and humans, with the final goal to give added value to production by creating customised products that meet consumers' needs. The goal of Company 5.0 is to use the integrated information systems developed with Industry 4.0 to improve the well-being of the enterprise. In Industry 5.0, people, objects and systems are associated and integrated with each other in a virtual environment in which the results are transferred to the physical environment. The digital transformation enabled by Industry 4.0 generates Big Data, so designing big data analytics solutions for industry is relevant. The implementation of data-driven workflow management simplifies collaboration between multiple devices, business management systems, production lines and more generally through data sharing between business units (Zhang, et al., 2021). Data flows of production machines and other company assets contain important information. However, this data are usually not integrated into higher-level business processes. With the developments of the IoT, a stronger integration of the business process with workflow management is expected. This potentially provides benefits both in the domain of Digital Innovation and in production process management (Janiesch, et al., 2020). Thus, real-time data from IoT devices can directly influence the execution of processes (Seiger, et al., 2022). As manufacturing companies begin to use advanced information technology to carry out their general management, a large volume of data, relating to the various business processes, is produced (Zhang, et al., 2017). According to the theory of the 3Vs (volume, variety and velocity), big data refers to a large volume of multi-sourced, heterogeneous data that are generated during research and development, production, operation and maintenance phases (Zhang, et al., 2017). To be successful in the digital transformation, the data of each business process must follow a series of fundamental steps for correct interpretation: collection, storage, processing and dissemination. Data are identified as assets, as real drivers for the achievement of objectives. Data assets are intangible, durable, easy to copy and transport, dynamic, multifunctional and available for use by many people at the same time. In addition, their use generally creates other data that obviously contributes to enlarge the scale of the problem (Wang, et al., 2022). However, the exploitation of big data is still a challenge for manufacturing companies. AI based on machine learning allows the revolution of human resources employees at different levels: recruitment, training, career management, management within the production process (Battini, et al., 2022). Thanks to artificial intelligence, HR managers can create performance indicators based on the analysis of internal data, compared with the external market data. The results of this analysis make it possible to map existing profiles to the productivity and efficacy of each employee, building a data matrix for each employee (Berhil, et al., 2019).

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3 METHOD: DESIGN OF SMART WORKFORCE MANAGEMENT PROCESS

From the transformations caused by Industry 4.0, it is necessary to understand how its changes affect Human Resources Management (HRM), including the application of digital technologies to their tasks. In this context, the concept of smart human resources management 4.0 is introduced. Considering the importance of the workforce for the success of digital transformation, it is necessary to understand the vision of digital technology towards HRM. In this context, the paper suggests a method for workforce management process design driven by digital transformation.

The objective of the proposed methodology is to design a Smart HR 4.0 process integrated with the company business. It is a process that starts with the digitisation of HR data, uses the information stored in it to be integrated into the different business processes. Digital and integrated workforce management provides benefits to the organisation in terms of: (i) optimisation of work scheduling and staff planning; (ii) identification and solution of inefficiencies, (iii) management of workforce costs, (iv) optimisation of training programmes, (v) reduction of absenteeism rates and (vi) improvement of safety measures for employees.

In this context, the digital tool supports the organisation's decision-making process to obtain competitive advantages. The IT architecture is able, not only to guide information, but also to predict and derive results. However, it is not the data that make the difference but the decisions based on the processing of data from which more information can be derived.

The design methodology of digital workforce management includes three main steps :

1. Workforce Management Process: it consists of the 'core' of transactions representing the functions that are implemented first in the system. It includes the administration of employees, organisation management, and presence records;
2. Talent Management: these functions are focused on the individual. It refers to the individual's single skills; to his or her training courses within the company; to his or her tasks;
3. Workforce Analytics: it provides reporting and analysis options associated with HR, showing hundreds of predefined reports and performance indicators.

3.1 Workforce management process

It is the first phase of the digital transformation process. Indeed, at this stage it is necessary to digitalise all human resources data from multiple sources (data in the cloud, data in the database, paper data).

The Master Data that are requested by the system are the followings: (i) operators' master data, (ii) staff shifts, (iii) time records; (iv) absences; (v) certifications; (vi) medical visits; (vii) layout of production departments. The importance of the data integration phase in WFM process digitisation is highlighted.

With the development of the IoT, smart manufacturing is more and more focused on the collection and use of huge amount of data (Kusiak, 2017). It is clear that in the context of smart manufacturing, the concept of data is particularly important. There are a number of activities in which production data can be included. Thus, the data follows a specific life cycle (Tao, et al., 2018). At the beginning data are created during the production process, there are several sources from which data comes. Once created, they can be collected. At this stage, the data does not have a well-defined and specific structure, so it has no specific meaning. From here the next steps are developed. After the collection of data, they are archived, this is the Data Storage phase. Then comes data processing in which data are processed according to specific purpose guidelines. Next, there is the report visualization and data application phase, in this way, decisions can be reached through real-time data processing.

The data integration phase is the central point in WFM process digitisation. Any software architecture must receive data in order to be able to operate and provide real-time data. The tool enables digitalised data in an ecosystem where data are interconnected. Thus, the great achievement is that the data is no longer in paper format, or within an independent file, but is digitalised. Within this ecosystem, the data is integrated with all other data. Every single piece of data is available to all business users, in real time.

Following the data implementation phase, integrated systems must be managed, monitored and improved.

3.2 Talent management

Talent management incorporates the planning and data analysis phase. After assessing the company's existing workforce, future strategies can be built (identifying potential skills gaps), a workforce

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planning strategy can be designed and implemented to optimise employee performance and allow the HR team to recruit strategically and proactively.
In the field of human resources management, skill refers to the human, technical or social characteristics that an employee must possess in order to perform the job or task. On the other hand, the lack of skills to perform a job is called a skills 'gap'. Companies that advance these skills gaps with proactive moves can gain a strategic benefit in the Industry 5.0 era. However, the prediction of skills gaps is based on the identification of required skills. Therefore, it is required to develop a digital tool to map the current skills (hard skills and soft skills) of all employees in the company.
A workforce management system makes it possible to plan and schedule production resources. The concept of the talent management is the ability to put the right people in the right place at the right time while respecting their security and digitising processes by making them data collectors. The problem of workforce planning is a well-known decision-making problem that refers to the allocation of workers to specific workstations or tasks. The workforce planning and rotation problem is a solution to balance the physical workload and reduce ergonomic risks among workers (Rinaldi, et al., 2022). In planning production lines, workforce management needs to respect two conditions. One refers to the physical abilities of the worker in performing a task. The other considers the worker's cognitive abilities. These two characteristics enable the development of efficient workforce planning (Rinaldi, et al., 2022). The training and professional growth of each worker is an essential part of the correct resource planning. Training is an educational process able to impart knowledge and practices useful to workers for the safety performance of their tasks. This process analysis is central for correct WFM management. Employee training allows the productivity of each worker to be optimised. Training can be implemented through specific learning plans. This results in an increasing level of motivation and satisfaction of each employee, as well as greater efficiency in performing particular tasks related to the training topics.

3.3 Value chain and business intelligence workforce analytics

The information value chain is the process used to derive value from data information and intelligence; it is an important concept focused on how the information of the data can be used. In the Digital Innovation perspective, enterprise research, data mining, data visualization, and infrastructure to help companies make data-driven choices is all within the Big Data Analytics paradigm. Data-driven intelligent production enables: (i) self-organisation by leveraging proactive resources and activity data for intelligent production planning; (ii) self-execution by leveraging a set of production process data for precise control of production resources; and (iii) self-adaptation by leveraging real-time and historical data to assess business performance and proactively adapt to address potential problems.

4 CASE STUDY

4.1 Company background and motivations

The case study relates to a company operating in the leather goods sector for the production of luxury bags. The company produces 400,000 upmarket bags annually. In recent years the company started a new path of improvement to adopt the digitization of many processes. The organization has two operating sites, one in the region of Lazio and the other in the Abruzzo region. There are about 560 employees. Often, interoperability between the two sites is considered. The production processes consists of artisanal/manual operations and high product variability.
A previous Analysis of the business context identified the advantages of using Industry 4.0 paradigms to create gains without altering the artisan vocation of the manufacturing company. A Business Digitalization Roadmap has been defined that suggests, for each business process including the WFM, the implementation of specific Digital Manufacturing tools able to use one or more Industry 4.0 enabling technologies (Pietroni and Marconi, 2022). In this context, the present study analyses how the company applies the proposed workforce digitisation methodology. As the considered products are highly handcrafted, a high degree of experience and manual skill is required at all stages of the process. Consequently, the workforce is the central element. People are the real drivers of digital transformation for the involved company. Therefore, there is a real need to have a tool able to monitor, manage and analyse all the information related to the company's workforce, i.e. its people.

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In the case study, the workforce digitisation methodology was applied starting from the Workforce Management phase. The first phase aims to digitize all human resources data from multiple sources. To identify a tool able to integrate administrative, people and business management information a market analysis was conducted. A cloud - based platform for human resources data digitisation was selected. The workforce management platform provides to put the right person, in the right place, at the right time, thereby increasing efficiency, reducing compliance risks and improving people satisfaction.

4.2 Cloud - based platform

The company digitised the workforce management process through a Cloud-based Platform. It is a web-based SaaS (Software as a Service) platform for workforce management. The tool can be accessed from any device via Internet browser and data connection. It is a software solution that uses machine learning algorithms to optimise WFM. The cloud - based platform is a tool based on Data Integration. It receives information of different typologies and from different sources. In particular, the software must receive data in order to be able to function and provide real-time data as a result. It is a system that has the characteristic of processing a large volume of data to suggest the correct allocation of personnel across production lines. A great peculiarity of this tool is that it has an intuitive and graphic visual aspect. In particular, it is possible to display different pages depending on the data to be visualised, included and/or processed. All this potentially makes it possible to carry out staff management activities more quickly and effectively.

The tool has two operational architectures, which are closely related to each other. One corresponds to the use of a web service and the other to an app service. Thus, the first mode provides for the tool to be installed on a cloud space that allows storage, access, control and analysis of data to reduce costs, increase agility and accelerate innovation. The cloud-based platform and the respective 'cloud space' communicates with the Corporate Private Network. In order to provide this communication, a Virtual Private Network (VPN) is used, which corresponds to a private communication tunnel that offers the necessary security in the transmission of data in general and sensitive data in particular. The architecture includes a PC named 'VPN client', which in this case corresponds to the platform consulting team. This connects to the website, then to the Internet, enters the client's subdomain via the VPN connection and accesses the network perimeter. This corresponds to the company's private network within which the servers that allow the service to operate correctly are located. Thus, the Web Server is the central location that hosts web pages or a website and allows remote clients to access the content material. While the VPN Server corresponds to one of the two ends of the VPN tunnel.

The other operational architecture is an app, the mobile platform to manage and communicate with their Workforce. The App service is installed on the individual smartphones of company employees through which employees can clock in, out and lunch breaks by scanning a QR code made available on tablets in the company. In this way, the mobile platform communicates with the central cloud-based platform to which all information is sent. Through the App, employees can make requests for permits or absences, which can be accepted or rejected by HR staff, without requests on paper forms. All information/communication is managed by the central cloud-based platform available to the management and used by the employee via App.

4.3 Application

The implementation phase of the tool involved the initialization of all graphic pages with their respective master data and operational data. Tests and checks were carried out. After that, any calibrations or corrections are made until the next phase is reached. In fact, when the platform is loaded with data and all the rules, it enters the second phase. This is more ‘daily’ because the instrument works on a regular cycle and because it incorporates a smaller and more constant volume of data each day. The implementation phase achieved a specific tool for the business environment. First of all, graphic pages displaying the company's production lines have been created. The company currently owns 20 production lines. For each one, the specific work shift was defined, the staff was assigned and the layout of the production lines was created. The implementation of the company's production lines into the tool provides integration of the production process and efficiency data. Specific skills have been defined in order to adapt the tool to the business context. The company's production processes refer to cutting, preparation, dyeing and assembly. The cutting phase uses laser cutting machines. Therefore, to work at these stations, skills in using the machines are set. Dyeing, preparation and assembly are manual/handcraft operations. All production process operations have

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been mapped. This allowed the definition of skills to be associated with each operation. A total of 158 specific skills were defined.
Through the tool, within the company context, the following phases have been digitised:

- Planning of production lines: optimisation of employee planning with respect to skills and limitations;
- Skills matrix: dynamic skill matrix based on machine learning algorithms;
- Loan management: real-time and autonomous updating of workers' movements between production departments;
- Knowledge sharing and communication: knowledge sharing within the organisation and real-time communication with production lines;
- Risk management: processing and monitoring of staff risk profile based on OCRA/NIOSH standards;
- Absenteeism analysis: processing and monitoring of leave and holidays;
- Training: worker training and certification management system.

Figure 1 shows the Digital Workforce Management framework implemented in the company context by web-based cloud platform.

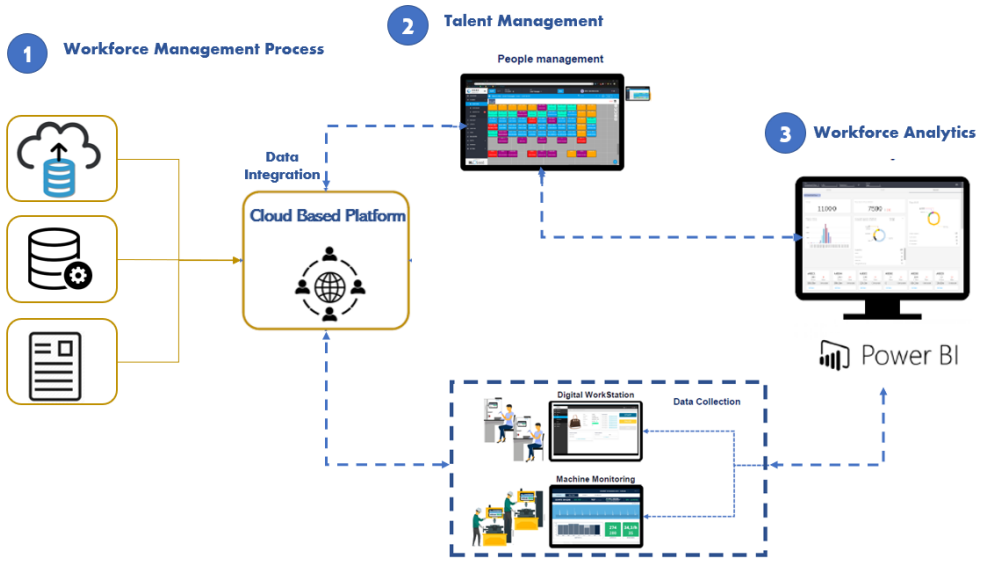

Figure 1. Digital workforce management framework

The implementation of the digital platform provided the testing of proposed methodology for the digitised workforce. All information has been digitised, removing paper documents and enabling the real-time information sharing. The talent management phase was applied with strategic resource planning. The best combination of employees' skills and the skills required by the task and/or location is ensured, the highest possible product quality standard is achieved. The platform produces a lot of data, leading to the Workforce Analytics phase. In this way, all business figures involved in WFM activities can make data-driven decisions, moving in synchrony, as one organism.

5 RESULTS: DATA ANALYTICS AND VISUALIZATION PHASE

Dashboards have been developed to visualise Workforce Management data in a structured way and in real time. The performance dashboards realised targeting different groups of end-users by providing different details of information. Based on the company's needs, dashboards show: (i) staff master data; (ii) dynamic Skill Matrix with specific training KPIs; (iii) absenteeism rate.
Each dashboard is scalable, since it can provide global information down to the individual production department or resource. Figure 2 shows the dynamic HR dashboard extracts, in this case sensitive workers' data have been deleted. Data preparation and transformation was managed through the PowerBI connection tool. PowerBI offers data warehousing functionality, including data preparation, data discovery and interactive dashboards. The cloud-based Platform database is queried by

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connecting to the server via OData, data shaping is performed with queries that create useful and appealing data models, the models created can be used to create real-time visualisations and reports.
Figure 2 shows the dynamic dashboard with specific information. For each dashboard, specific information can be obtained using the appropriate filters, i.e. plant can be selected (Plant 1 or Plant 2). Each user can select one staff resource, filter information according to gender or job description. It is possible to filter information according to location and it is possible to have specific information for each skill. The staff data dashboard gives information on the total number of employees, the percentage distribution of the number of males and females and the average age. A trend gives a clear view of the level of recruitment over the years. The absenteeism section has a timetable to choose a day or a period. This makes it possible to know the number of absentees and the distribution according to the motivation. The dynamic skills matrix dashboard allows to visualise the distribution of resources according to skill levels and the distribution of skills. Data analysis related to HR management required relevant data to measure progress towards a specific result. Workforce analysis allows one to compare the situation of the company against the expected objectives. Dashboards can be used to indicate possible anomalies in the system, such as unusual values. More specifically, the information from the dashboard has been used by the company about specific training courses. For the implementation of a new production process, it was necessary to know the number of resources with "machine stitching" skills. The number found was not sufficient for the production required. Therefore, a specific training course was implemented. Moreover, in daily use the appropriate person to replace an unplanned absence is suggested by the tool. Therefore, it does not need to be managed by the production manager. Through the tool, it was possible to obtain a structured overview of skills and it was possible to provide decisions earlier. Digitisation of data provides a better exchange of information to support business leaders towards informed and confident decision-making. Finally, it improves planning efficiency through real time systems.
To quantitatively assess the positive impacts derived from the implementation of the proposed process, a time index based on internal company data was associated with each activity subject to change. A 75% reduction in time for managing planning processes, a 90% reduction in time for managing communications, and an 80% reduction in time for making data-driven decisions were achieved.
The integration of data into a single digitised system makes it possible to optimise all human resources management processes.

Figure 2. Summary human resources dashboards

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6 DISCUSSION AND CONCLUSIONS

This paper proposed a solution able to process a large volume of data from digitised business processes with the final goal to add value for the company. The case study showed that the tool supporting Workforce Management allows full visibility and control of the staff. Through this, more talented employees can be recruited, developing their potential and skills. This solution makes it possible to align employee engagement with company goals and maximize the impact of training activities. The methodology applied to the case study allows: (i) HR process automation and integration into the overall operations of the company; (ii) real-time access to information with reduction of decision-making time in HR management; (iii) allocation of the right people to the right place at the right time; (iv) support for employees and managers throughout the entire employee life cycle; (v)enablement in managing processes in a collaborative environment; (vi) system integrated with various business processes. The performance dashboards developed allow the capabilities and skills of individual resources to be identified. The real time monitoring and overview offered by the dashboards supports the company leaders in making specific decisions to increase production efficiency.

Digitization open new possibilities, such as virtual teams and smart work, introducing new communication tools, increasing speed and access to information, influencing power structures, and increasing efficiency and standardization. Since this data is related to human resources management, one often has to deal with sensitive data. This is one of the possible barriers to the application of the method. In the case study, actions were considered to ensure access to confidential data only for the staff in charge.

In conclusion, the study achieved two important objectives. Firstly the definition of a method and the implementation of a tool to support human resource management in a highly manufacturing company. The field of Smart HR 4.0 is still developing, this research work gives excellent results for the digital transformation of the human resource management process. Secondly, workforce analytics showed how to obtain value from data generated in production processes. The implemented system increases the efficiency of the production process, enables efficient change management and integrates all workforce data into one system.

The next steps of the proposed methodology allow to: (i) plan and analyse (define a set of data integration and lifecycle requirements; collect business rules and profile the data); (ii) design solutions (design a data integration architecture; map data sources; design data analysis) and (iii) develop (approach visualisation with data visualisation logic). Future developments emerging from this study relate to the extension of research to various business processes. In order to achieve benefits across the business, it would be interesting to integrate all the data from the different business processes. The leather goods company, few months ago, started the implementation of a digital manufacturing tool in the area of performance management to get specific information on manufacturing lines efficiency. In addition, the company operates with a series of Industry 4.0-enabled machines. It would be interesting to analyse the data of each process with the final gaol to implement a business intelligence system able to integrate all data (workforce, production process and machinery). Extending the proposed methodology to the various areas of the business makes it possible to add value to the company. In addition, it could be increasingly demonstrated that analysis and visualization of data to help business leaders and develop methods that improve the design phase of a business model by allowing decisions to be made more easily. Indeed, it is possible to analyze and predict current and future technology needs and optimize the organizational structure of the enterprise.

Companies have a large volume of data that they would like to make the best use of in every decision, interaction and process. Outdated, biased or unintegrated data expose companies to the risk of making decisions solely on the basis of the instincts and experience of their managers, incurring subjective biases, errors and delays in action. Nowadays, moreover, the products and services offered to their customers also produce and consume data, which is crucial for competing and ensuring sustainability. All too often, therefore, data not only does not generate the value it should, but also requires increasing management complexity that risks turning it more into a limitation than an opportunity. The method proposed in the article aims to show how data can be enhanced. The proposed method was applied to the case of a manufacturing company in the leather goods sector, but can be applied to any business context. At present, the method is under development and no quantitative data on the flexibility and scalability of the method are yet available. This will be one of the main developments in the future.

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