Organisational Knowledge Management for Defect Reduction and Sustainable Development in Foundries

Cinzia Giannetti, College of Engineering, Swansea University, Swansea, UK
Meghana R. Ransing, P-Matrix Ltd, Swansea, UK
Rajesh S. Ransing, College of Engineering, Swansea University, Swansea, UK
David C. Bould, College of Engineering, Swansea University, Swansea, UK
David T. Gethin, College of Engineering, Swansea University, Swansea, UK
Johann Sienz, College of Engineering, Swansea University, Swansea, UK

ABSTRACT

Despite many advances in the field of casting technologies the foundry industry still incurs significant losses due to the cost of scrap and rework with adverse effects on profitability and the environment. Approaches such as Six Sigma, DoE, FMEA are used by foundries to address quality issues. However these approaches lack support to manage the heterogeneous knowledge created during process improvement activities. The proposed revision of ISO9001:2015 quality standard puts emphasis on retaining organisational knowledge and its continual use in process improvement (ISO, 2014). In this paper a novel framework for creation, storage and reuse of product specific process knowledge is presented. The framework is reviewed taking into consideration theoretical perspectives of organisational knowledge management as well as addressing the challenges concerning its practical implementation. A knowledge repository concept is introduced to demonstrate how organisational knowledge can be effectively stored and reused for achieving continual process improvement and sustainable development.

Keywords: 7Epsilon, Casting Process, ISO9001:2015, Knowledge Discovery, Knowledge Representation, Process Improvement, Six Sigma, Total Quality Management

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INTRODUCTION

Organisational knowledge is widely considered as a major asset of an enterprise and it is often associated with the ability to innovate and gain competitive advantage. Individual and collective knowledge, if properly managed and reused, can support organisations to fulfil diverse strategic aims such as reduction of costs, improved performances and faster time to market (Lehaney, Clarke, Coales, & Gillian, 2004; Nonaka & Takeuchi, 1995; Yew & Aspinwal, 2004). The formalisation of organisational knowledge management as an established discipline has started in the 1990s with the work of Nonaka & Takeuchi (1995) and since then knowledge management has become an active research area. Several authors have discussed the benefits of knowledge management in modern organisations (Davenport & Prusak, 2000; Lehaney, et al., 2004; Nonaka & Takeuchi, 1995; Yew & Aspinwal, 2004) and described how emerging IT technologies can support knowledge management practices (Kimmerle, Cress, & Held, 2010; Moffett, McAdam, & Parkinson, 2004; O’Dell & Hubert, 2011).

Continual process improvement is an umbrella term that refers to the ongoing effort to improve processes and consequently product and services. ISO9001 is the main quality management tool used by many organisations to achieve compliance to customer requirements and legislation and it requires industries to discover process improvement opportunities on a continual basis. Other initiatives like Six Sigma, Total Quality Management and Lean Manufacturing provide instead some practical tools and methodologies for process improvement. The role that knowledge management plays in the context of continual process improvement has been discussed in several research publications (Anand, Ward, & Tatikonda, 2010; Arendt, 2008; Giannetti et al., 2014a; Roshan, Giannetti, Ransing, & Ransing, 2014). At industrial level the importance of organisational knowledge management in process improvement has been recognised by the ISO quality standard which, in the latest draft version (ISO9001:2015), requires organisations to maintain and provide access to organisational knowledge in addition to data and information (ISO, 2014) (clause 7.1.6). There is a tight link between process improvement and knowledge management. First of all, similarly to knowledge management, continual process improvement activities are driven by a commitment to learning and the desire to avoid making the same mistakes (Arendt, 2008). Furthermore the ability to capture knowledge shared through team based activities plays an important role in the success of continual process improvement activities (Anand, et al., 2010). Last but not least continual process improvement is a source of knowledge creation (Anand, et al., 2010; Roshan, et al., 2014).

Process improvement in foundries is a challenging activity because typically the quality of the final casting is influenced by the interactions of many process variables as well as part specific quality constraint. Despite advances in casting technologies foundries worldwide still incur huge costs due to poor quality. Casting defects not only impact the bottom line but also the environment and hence are becoming an obstacle to the realisation of a more sustainable future. Typically profit margins in foundries are 5-10% with an average rejection rate 4-5%. Hence, even reduction of defects by further 1-2% contributes to its sustainability. A technological and cultural gap in the foundry industry has been identified due to the lack of process knowledge and adequate personnel trained in process control (Roshan, et al., 2014). The shortage of skilled foundry technicians has also been discussed in a recent publication with young generation of engineering workforce lacking problem solving, practical skills and experience necessary to produce quality castings (Murrell & Brown, 2014). Furthermore despite growth perspectives of the global metal casting industry several challenges need to be addressed at managerial level to create greater manufacturing efficiencies and maximise business opportunities (Spada, 2014). In foundries process knowledge is obtained by developing a sound understanding of the process, its subprocesses and the relationships between process.
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