

# **Identifying causes of low productivity in the printing industry**

**Enock Philani Mtshali**

Department of Operations Management  
Tshwane University of Technology, South Africa  
[mtshaliep@gmail.com](mailto:mtshaliep@gmail.com)

**Kgashane Stephen Nyakala**

Department of Operations Management  
Tshwane University of Technology, South Africa  
[nyakalaks@tut.ac.za](mailto:nyakalaks@tut.ac.za)

**Thinandahva Thomas Munyai**

Department of Operations Management  
Tshwane University of Technology, South Africa  
[munyait@tut.ac.za](mailto:munyait@tut.ac.za)

**Kemlall Ramdass**

Department of Mechanical Engineering  
University of South Africa, South Africa  
[ramdacr@unisa.ac.za](mailto:ramdacr@unisa.ac.za)

## **Abstract**

Printing industry is faced increased challenges in relation to digital substitution, lower production rate and late deliveries due to the nature of the manufacturing process. Productivity as a ratio of output to input has a major role to play in defining the business success. This paper focuses on identifying the causes of low productivity and determine the factors for improving productivity in the printing industry. The study adopted a qualitative research approach using open-ended questions to guide semi-structured interviews. The use of compensation practices and operational tools in order to improve productivity is essential for the printing industry to grow. Competitiveness within the industry requires quality and cost effective production both nationally and internationally. Internal factors influencing productivity include human resources, materials, machines, location, layout, finance, management, technology and process management, while external factors include supplier and consumer relationships. The results indicate that numerous factors contribute to the decline of productivity such as a lack of skills, layout, material management, technology, late order placement by customers, late material supply and poor quality material by suppliers together with the use of older machines. This paper is significant in that production managers, supervisors, artisans as well as shop-floor employees can use the findings as an analytic instrument to resolve productivity rate problems, with a view to improve service quality in printing industries.

## **Keywords:**

Productivity, customer satisfaction, process innovation and technology, printing industry

## **1. INTRODUCTION**

The printing industry plays an important role in the national economy, and it is therefore important to identify causes of low productivity to improve them. The printing industry employs approximately 45000 employees with as many as 500 000 dependents and also has an estimated annual turnover of R51 billion (Printing, Print Media and Publishing sector 2014:3). It is further reported across the world as having a high workload (Sunderaraj and Mareeswaran, 2017:4274). This high workload results in long working hours in trying to meet customer expectations thus impacting on labor productivity. McMillan, Rodrik and Verduzco-Gallo (2014:7) argue that developing economies are characterized by large productivity gaps, and dual economy models have typically emphasized productivity differentials between broad sectors of the economy. Traditionally, printing companies are faced with difficulties including raw material wastages and customer dissatisfaction which are results of poor or low productivity within organizations (Habib, Ahsan and Amnin 2013:586).

Shaping business operations in all contexts improves productivity (Kruger, Ramphal and Maritz 2013:34). The printing industry thus also acknowledges the need of improved productivity systems in the quest for achieving global competitiveness (Statistics South Africa 2014/15:1). The use of productivity improvement strategies in the printing industry consequently remains a factor in its competitive edge. The industry is labor intensive, and a thorough investigation is necessary to identify causes of low productivity and identifying areas for further studies (Illie and Ciocoiu 2010:1). There are a number of factors affecting productivity which include internal factors, external factors and process factors. A real life example of a printing organization, Government Printing Works, has been used in this paper to identify the causes of low productivity. The aim of this research is to identify causes of low productivity in a print production environment.

## **2. LITERATURE REVIEW**

### **2.1 Internal Factors**

#### **2.1.1 Human resources**

As the printing industry is labor intensive, it is important to note that the need of knowledge, skills and abilities to maintain a competitive advantage is of great importance (Grossman and Salas 2011:103). Employees who are not well trained have a negative impact on productivity, as training basically improves employee performance (Salas, Wilson, Priest and Guthrie 2006:472-480; Kampelmann and Rycx 2012:3). Such training should be offered with the trainee's interest at heart instead of only during the training program (Brightwell and Grant 2012:2-3). Human beings, in this case employees, are affected by poor working conditions. These cause employees to be unhappy and who therefore do not produce or perform as expected. It is for this reason that management has to keep employees happy to boost productivity (Osei-Poku, Enniful and Boakye-Amponsah 2016:74). A very strong management team is needed to motivate, coach and guide employees with productivity improvement at heart.

Management can also negatively affect productivity through poor management know-how; communication; reward systems; conditions of employment; planning; controlling; organizing; leading and problem solving (Attar, Gupta and Desai 2012:13-14; Caldas, Kim, Haas, Goodrum and Zhang 2014:3). Other poor management practices also rob companies of opportunities for productivity improvement (Caldas, *et al.* 2014:3). For example, lack of communication between management and unions contributes to the decline of productivity, as unions open channels of communication between management and employees (Laroche 2015:156). All management plans and decisions would be easily filtered to employees through a healthy communication channel opened by unions. Figure 1 outlines successful management qualities:



*Figure 1: Management as an input factor, source: Authors, 2018*

### **2.1.2 Material management**

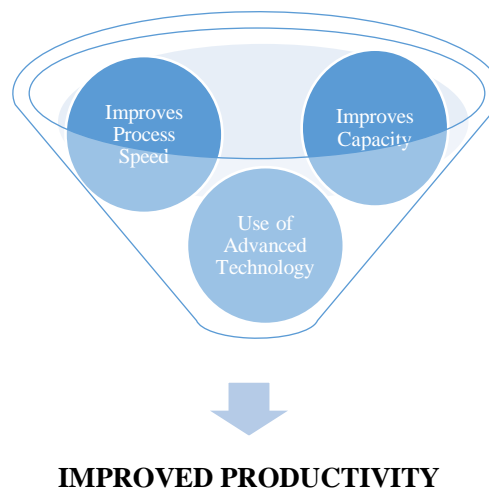
Raw material must be used during manufacturing to produce every end product and is therefore identified as one of the top factors affecting productivity (Attar, *et al* 2012:13). Late arrival or supply or a shortage of material during production and its poor quality contributes to low productivity in many ways (Caldas, *et al* 2014:2). For Government Printing Works, as a security printer, the shortage of material which affects productivity negatively is due to the fact that bespoke material is used, suppliers are also very limited and in some cases are only available from overseas countries (Attar, Gupta and Desai 2012:13). As paper is the material mostly consumed during production, printing houses tend to keep more paper stock to avoid running out during production. This has its own negative effect on productivity due to additional material handling costs it attracts. It also becomes very challenging to get paper to the printing area because of frequent breakdowns of goods elevators. This opens the possibility of running out of paper at the printing room, while the paper store still has enough to cater for the production run. The movement of materials also increases the production cycle and exposes material to possible damage due to handling (El-Namrouty and AbuShaaban 2013:71). The set supply chain rules governing all government departments similarly affect productivity negatively. For a supplier to be chosen, a tender committee must follow due processes. The very same processes can however become unfair to the production process, because some suppliers fail to deliver the right material on time. With a lower grade material, the production process results in a high rate of rejects which contributes to the overall waste (Lundberg and Wallin 2016:1). The storage of raw materials also affects productivity, because every material to get to the printing room needs to be moved which is time consuming.

### **2.1.3 Machines and technology**

The use of older machines in printing houses as a form of financial saving negatively impacts on productivity. This is because older machines need more change-over time and waste raw material during startups, while operators are struggling to get print quality right (Ngwenya, *et al* 2016:2). It is for this reason that manufacturing businesses are adopting the single-minute-exchange of dies (SMED) technique (Kumar and Abuthakeer 2012:167). The use of out-of-line finishing machines negatively impacts production time compared to the inline finishing process. Cycle time gets affected by the work in process caused by this separation of finishing machines from printing machines (Hopp and Spearman 2011:225). Machines are becoming more dependent on the technology available in the modern day. As an example, a firm's process innovation could mean the introduction of technology in the form of modern printing

machines, binding machines and packaging machines (Gunday, Ulusoy, Kilic and Alpkan 2011:2-3). Organizations which underestimate the importance of innovation impact productivity negatively because older products remain in the market (Mohnen and Hall 2013:5-6). Information technology however contributes to innovation through enabling important elements of the production process (Kleis, Chwelos, Ramirez and Cockburn 2012:44).

Today, technology is a very useful tool in the success of any business organization. This is demonstrated through the effects of ease-of-access to information and with communication (Bloom, Garicano, Sadun and Van Reenen 2014:2859). Decisions made by management can be easily communicated using information technology mediums and can therefore be implemented accordingly. The capability to adopt new technologies and adapt them to particular conditions is a crucial first step to improving productivity (Wolf 2006:2). However, a lack of technology upgrades in the equipment in use affects the speed and capacity of the machines (Hopp and Spearman 2011:3). For example, printing machines with automated functions help shorten make-ready time and decrease amount of waste paper due to speed and precision Kipphan (2001).



*Figure 2: Relationship between Technology and Productivity, source: Authors, 2018*

Machines that are not properly maintained contribute to the decline of productivity, as breaking down during production could not be avoided. There is a need for improving the ease of maintaining machines (Stöhr, Kühn, Schwitzky, Schaede, and Kba-giori 2014:5). The presenters of this paper are therefore of the view that a lack of technology advancement negatively affects productivity.

#### **2.1.4 Layout and location**

The arrangement and selection of machines, material handling devices and material transportation routines have an influence on productivity, which could be negative if the arrangement is poor (John, James and Rengaraj 2013:514). The design intent of the factory has a major influence on productivity (Haynes 2008:5). For instance, poor allocation of space either for raw materials storage, work-in-process and finished goods or office space affects productivity (Haynes 2008:2). The logic in establishing the influence of design is achieved by answering the question: Is the space used for its intended design? Processes that are scattered throughout the building due to space limitations contribute to the decline of productivity (Leaman and Bordass 2005:175-176). However, the most disturbing effect of this negatively impacted productivity is the unwanted delay in delivery schedules. This is because Government Printing Works is a security printer, printing mostly security documents. Poor layout therefore not only impacts production processes but also impacts on customers who are not happy when they see processes with too many movements, as they present a security risk.

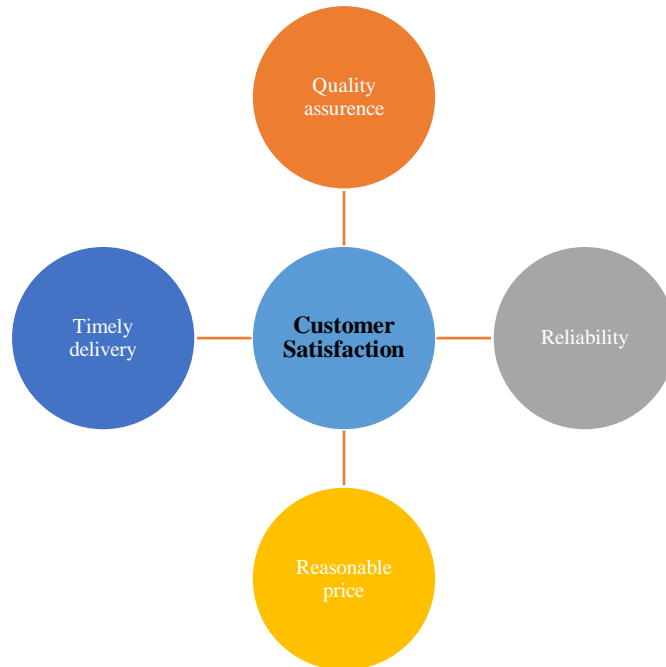
The location of the Government Printing Works at times becomes challenging for reproduction of certain products. This is because of security reasons, whereby customers must bring their orders to the office at Visagie Street, while the actual production takes place at the Bosman Street office. This arrangement creates unnecessary movements of documents which affects productivity negatively (Caliendo, Parro, Rossi-Hansberg and Sarte 2014:3-4). It is therefore important for the printing company to choose a location that is closer to its suppliers and customers. Being centrally located in the city of Tshwane makes it easy for customers to reach Government Printing Works, as most of its customers are national departments based in Pretoria. Delays in material supplies however create errors, compromising the quality of the product, as processes get rushed in order to meet the delivery schedule. The sourcing of material from abroad also has a high negative impact on productivity.

### **2.1.5 Finance**

Finance as an input factor is better understood if dealt with as cost of manufacturing and different types of waste. These costs include material and labor costs and manufacturing overheads. A high rate of waste results in a loss financially which is why waste management must be an undertaking by the Printing Industries Association with the aim of improving waste management performance (Sharma 2017:63). Printing houses are still losing a lot financially, as there is little effort made to look at the implementation of published material and the impact it has on waste production (Sharma 2017:64). This waste is made up of eight (8) different types which are: overproduction, defects, over-processing, inventory, transportation, waiting, motion and skills. According to Lundberg and Wallin (2016:1), the major contributor to overall waste in the printing industry is paper waste due to overproduction and defects. Paper accounts for 30% of production costs and on average, 35% of purchased raw material is scrapped. Paper gets wasted due to over-processing in cases whereby printed material needs to be cut to size and thereafter folded which is part of the finishing process (El-Namrouty and AbuShaaban 2013:70-71). Idle time for employees and or machines due to bottlenecks is described as waiting (El-Namrouty and AbuShaaban 2013:71). Additional inventory contributes to the decline of productivity, since it makes printing plans unsustainable which is why methods to limit this must be devised (Hamerlinski and Pyr'yev 2014:5148). Transportation of materials between work stations also impacts negatively on productivity, because it does not add value but prolongs production cycle time (El-Namrouty and AbuShaaban 2013:71). Unnecessary activities by workers also prevent them from doing their jobs. Such movements include looking for a tool to be used and movements due to poorly designed work stations (El-Namrouty and AbuShaaban 2013:71). Poorly assigned employees additionally result in a skill being wasted.

## **2.2 External Factors**

A major process included in the supplier relationship is sourcing (Krajewski, Ritzman and Malhotra 2010:381). Suppliers can contribute to the decline of an organization's productivity by not being prompt with supplies of material which can cause delays in the production process (Attar, et al. 2012:13). For Government Printing Works, these delays are caused by the fact that bespoke material is used and suppliers of such materials are often found from overseas countries. Customers on the other hand play a vital role in productivity, since they participate actively in creating customized offerings for themselves (Ngo and O'Cass 2013:1134). Goetsch and Davis (2014:11-113) further indicate that an organization's performance is dependent on its reputation which is dependent on the level of customer satisfaction. Customers who constantly change the nature of their products even after placing an order make it difficult to produce and negatively impact productivity. Customer satisfaction takes center stage with every innovation an organization intends implementing. For Government Printing Works to achieve customer satisfaction, printed products must therefore be of a high quality, reliable, sold at reasonable prices and delivered on time.



*Figure 3: Customer satisfaction, Source: Authors, 2018*

### **2.3 Process Factors**

Challenges or bottlenecks due to the use of out of line finishing equipment impact negatively on the overall productivity of any printing house. As an example, the use of two factories to make a product has a further negative impact on productivity as this increases the number of material and staff movements which are not necessary. Quality products are a result of quality processes, therefore the use of quality processes results in good productivity performance (Al-Dujaili 2013:399). It is therefore important to stress the importance of ensuring product quality (Netland and Sanchez 2014:197). Poor maintenance plans contribute also towards poor productivity. For instance, when a stitching machine at a finishing section is broken, an excessive increase in the work process then affects cycle time (Hopp and Spearman 2011:225). The lack of total productive maintenance contributes to the decline of productivity. If this is properly implemented, everybody within the organization will know what to do every time (Wireman 2004:1).

## **3. RESEARCH METHODOLOGY**

This study adopted a qualitative research approach, as this form of inquiry focuses more deeply on words and observations, enabling understanding of the underlying reasons, opinions and motivations of individuals in solving a particular problem (Creswell 2014:25). A sample of eighteen Government Printing Works employees participated in the study, due to the small population of employees. These included senior management, middle management, supervisors and shop floor staff. Open-ended questions were developed and semi-structured interviews used because of their ability to allow the researcher to explore and obtain ideas from the field (De Vos, Strydom, Fouché and Delpont 2012: 196). Content analysis was used to analyze data collected through the interviews (Creswell 2014:87-88). Makhanya (2009:35) suggested that research methodology indicates how the researcher will conduct his/her research and directs focus to tasks such as the development of the study hypotheses where appropriate, definition of the study population and selection of the sample, how data will be collected and the development of the means of measuring study variables.

## **4. RESEARCH FINDINGS AND RESULTS**

Of the respondents interviewed, 61% identified a lack of skilled employees as a contributor to the decline of productivity. Grossman and Salas (2011:103) argued that the need for skills is growing; therefore Government Printing Works must attend to this factor. 50% of the respondents highlighted low morale, while the other 50% indicated poor management styles as causes of low productivity. Employee morale is best improved by a management which takes care of its subordinates by coaching, training, supporting, ensuring conducive working conditions and communication with them (Osei-Poku, *et al* 2016:74). As businesses within the printing industry are not paying the same wages, employees become demotivated. With the low morale of staff, unions are enticing them wrongly while getting more power, as employees tend to rely on them to fix their financial concerns (Bradley, Kim and Tian 2016:2). Unions mostly demand higher wages for their members (Laroche 2015:155). Employees therefore fall for unions' arguments with the hope that they would get improved wages. These demands negatively affect the financial performance of the organization. In particular, smaller businesses within the printing industry are negatively affected by these agreements negotiated by the unions (Bhorat, Goga and Van der Westhuizen 2012:4-5). As for the human resources factor, skill shortages; low morale and poor management styles were found to be the leading sub-factors contributing to the decline of productivity. Figure 4 below represents the impact of human resource sub-factors as per the respondents:

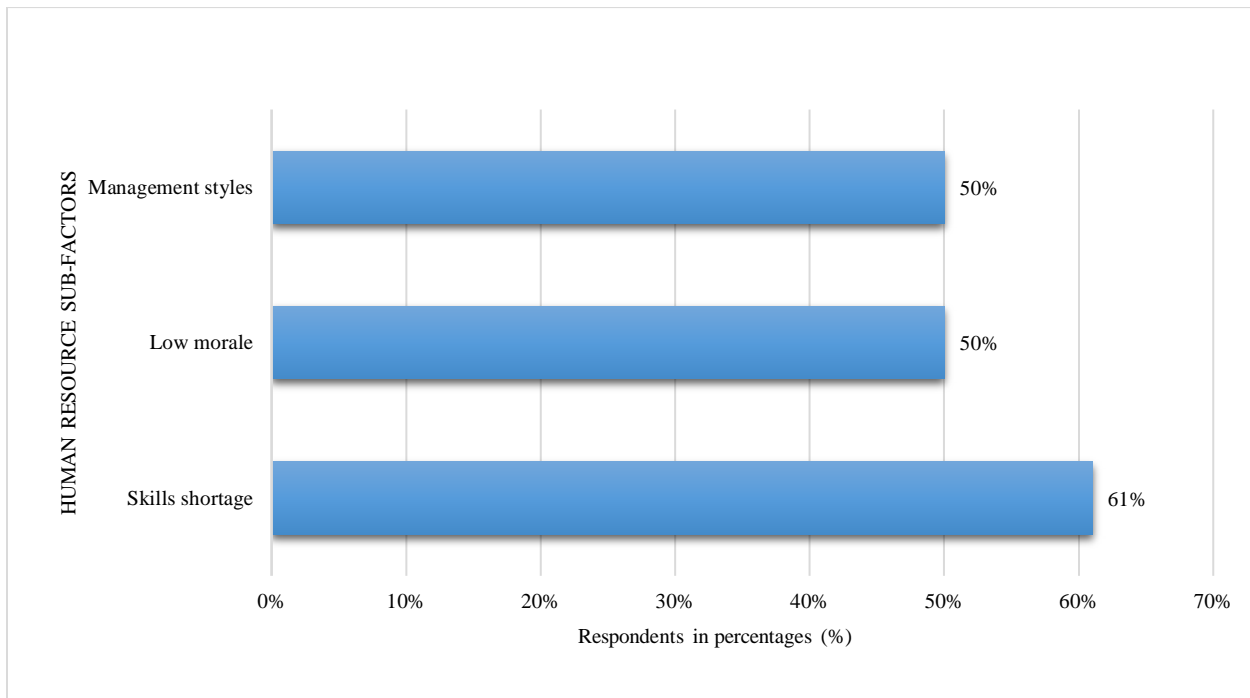


Figure 4: Human resource sub-factors affecting productivity, Source: Authors, 2018.

Material shortage was identified by 89% of the respondents as a major contributor to low productivity (Caldas, *et al* (2014:2). 67% suggested that poor quality of materials caused a decline in productivity. For a security printing company like the Government Printing Works, the use of custom-made materials contributed to the decline of productivity (Attar, *et al* 2012:13). Since material is one of the top ten factors affecting productivity; it was very interesting to find out that respondents were convinced that material was a cause of low productivity. This concurs with the arguments made by Attar, *et al* (2012:13). The other shortages of material at printing work stations as indicated by the respondents were purely due to the excess movements involved in bringing materials to where they are needed which only lengthens the production cycle (El-Namrouy and AbuShaaban 2013:71).

72% of the respondents indicated that the current machines are not technologically advanced. Wolf (2006:2) postulates that the first step to improving productivity is to adopt new technologies and adapt them to particular conditions. This would bring benefits like ease of use which enables operators to use machines, produce high quality products and improve organizations' performance (Yilmaz, Alpkan and Ergun 2005:1348-1349). The adoption of the latest technologies would have afforded the Government Printing Works an opportunity to improve cycle time by combining processes like finishing with printing Hopp and Spearman 2011:225). Old or outdated machines had a significant

negative impact on productivity, as indicated by 72% of the interviewees. Machines that are in a good state of maintenance, positively contribute to quality processes and good productivity (Al-Dujaili 2013:399). Poor maintenance plans however add to the decline of productivity, because the machines are old as well (McKone, Schroeder and Cua 2001:39).

Poor allocation of space for raw materials storage, work-in progress, finished goods or office space affects productivity (Haynes 2008:5). 94% of the respondents believe that layout is a cause of low productivity. Their responses were based on the fact that operations are undertaken in a multi-story building which impedes the bringing together of production processes with an aim of reducing unnecessary movements which cause delays. The proper layout of the machines and work stations reduces costs of production and time taken to produce an item (John, et al 2013:514). The dilemma was associated with design intent of the building (Haynes 2008:2). 72% of the respondents suggested that customers affect productivity negatively when they place their orders late or closer to the expected delivery date which contradicts the arguments presented by (Ngo and O’Cass 2013:1134) that customers play a vital role in promoting productivity. Customers also at times request changes to be made at a very late stage of printing which impacts upon the agreed lead times. The lack of information regarding the processes involved in printing a product as was suggested by respondents proved to be another contributor towards the decline of productivity.

The delays with delivery of materials by suppliers caused material shortages on the shop floor. 89% of the interviewees identified such shortages as one of the causes of low productivity. The Government Printing Works is a security printer; therefore material supply is a challenge because of the high use of specialized material. Suppliers of such material are limited; contributing to late deliveries should the supplier experience malfunctions within their processes. 67% of respondents mentioned that suppliers also provided poor quality material which increased the number of rejects. Using custom made materials also means that the absence of a certain feature results in the material being scrapped. Irrespective of the compensation which the supplier may offer in line with the rejected material, time lost ultimately affects lead time.

Below is figure 5 which shows factors affecting productivity:

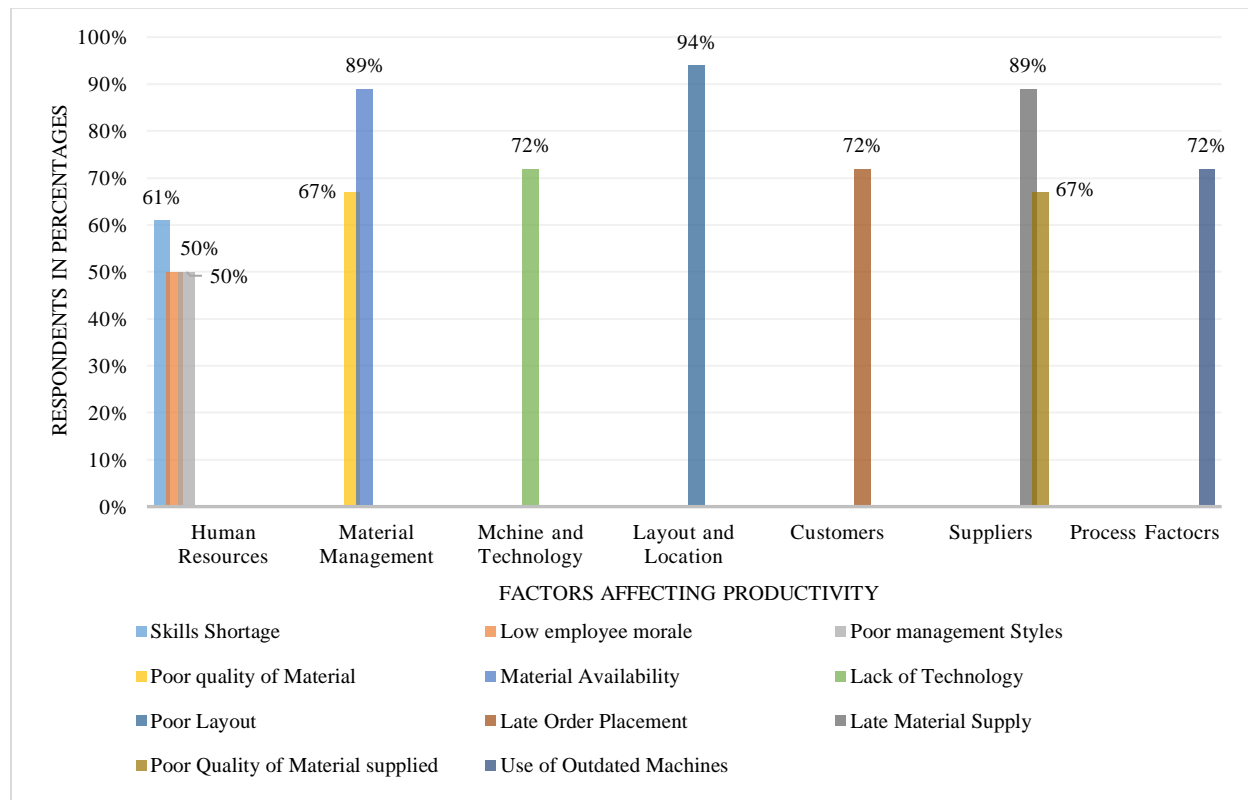


Figure 5: Respondents vs factors affecting productivity, Source: Authors, 2018.



## 5. CONCLUSIONS

The identification of causes of low productivity depends on rich and appropriate data collected. The study identified that human resources factors contributed to the decline of productivity in different ways including the shortages of skills, low morale and poor management styles. As per Osei-Poku, et al (2016:74), Government Printing Works employees' should be motivated to remain productive. Layout, according to the respondents, was the highest contributor to productivity decline and must be resolved urgently. Late material supply and lack of technology upgrades should also be addressed. The use of outdated machines interferes with the quality of the processes leading to a decline of productivity. Therefore upgrading and modifying the current machines would be necessary. The gradual identification of these causes, per division should identify a list of known factors which managers should keep as their focal points for productivity improvement initiatives. For continuous improvement purposes, the Government Printing Works should keep track of these causes and undertake further studies using a different research approach to ensure thorough investigation.

The sample size of this study was a limitation because results could not be generalized to the entire industry. This was because the Government Printing Works is a security printer operating in the industry comprising of security printers and ordinary or non-security printers. Also, the use of a qualitative approach limited the study. It is for these reasons that authors recommend further studies to identify causes of low productivity. The elimination of these causes would improve the financial performance for the Government Printing Works thereby improving the known industry annual turnover of R51 Billion (Printing, Print Media & Publishing Sector 2014:3).

## References

- Ahmed Al-Dujaili, M. A. Study of the relation between types of the quality costs and its impact on productivity and costs: A verification in manufacturing industries. *Total Quality Management & Business Excellence*, 24(3-4), 397-419, 2013.
- Attar, A.A., Gupta, A.K., and Desai, D.B. A study of various factors affecting labor productivity and methods to improve it. *IOSR Journal of Mechanical and Civil Engineering*: 11-14, 2012.
- Bhorat, H., Goga, S., and Van Der Westhuizen, C. Institutional wage effects: Revisiting union and bargaining council wage premia in South Africa. *South African Journal of Economics*, 80(3):400-414, 2012.
- Bloom, N., Garicano, L., Sadun, R., and Van Reenen, J. The distinct effects of information technology and communication technology on firm organization. *Management Science*, 60(12):2859-2885, 2014.
- Bradley, D., Kim, I, and Tian, X. Do unions affect innovation? *Management Science*, 63(7), 2251-2271, 2016.
- Brightwell, A., and Grant, J. Competency-based training: Who benefits? *Postgraduate medical journal*: 1-6, 2012.
- Caldas, C.H., Kim, J.Y., Haas, C.T., Goodrum, P.M., and Zhang, D. Method to assess the level of implementation of productivity practices on industrial projects. *Journal of Construction Engineering and Management*, 141(1):1-9, 2014.
- Caliendo, L., Parro, F., Rossi-Hansberg, E., and Sarte, P.D. The impact of regional and sectoral productivity changes on the US economy. *The Review of Economic Studies*, 2014.
- Creswell, S. *Research design: Qualitative and quantitative approach*. London: Sage Publishers, 2014.
- De Vos, A.S., Strydom, H., Fouché, C.B., and Delpont, C.S.L. *Research at grass roots for the social sciences and human service professions*. 4<sup>th</sup> ed. Pretoria: Van Schaik, 2012.

- El-Namrouty, K.A., and AbuShaaban, M.S. Seven wastes elimination targeted by lean manufacturing. Case study: Gaza Strip manufacturing firms. *International Journal of Economics, Finance and Management Sciences*, 1(2):68-80, 2013.
- Goetsch, D.L., and Davis, S.B. *Quality management for organizational excellence*. Upper Saddle River, NJ: Pearson, 2014.
- Grossman, R., and Salas, E. The transfer of training: What really matters. *International Journal of Training and Development*, 15(2):103-120, 2011.
- Gunday, G., Ulusoy, G., Kilic, K., and Alpkan, L. Effects of innovation types on firm performance. *International Journal of Production Economics*, 133(2):662-676, 2011.
- Habib, M.A., Ahsan, A.N., and Amnin, M.B. Improving productivity of apparel manufacturing system using value stream mapping and production control tools focusing on printing section. *Screening*, 130, (2): 586-592, 2013.
- Hamerliński, J., and Pyr'yev, Y. A method of minimizing paper requirements for offset printing. *Bio Resources*, 9(3):5147-5154, 2014.
- Haynes, B.P. The impact of office comfort on productivity. *Journal of Facilities Management*, 6(1):37-51, 2008.
- Hopp, W.J., and Spearman, M.L. *Factory physics*. Waveland Press, 2011.
- Ilie, G., and Ciocoiu, C.N. Application of fishbone diagram to determine the risk of an event with multiple causes. *Management Research and Practice*, 2(1):1-20, 2010.
- John, B., James, J., and Rengaraj, R.M. Analysis and optimization of plant layout using relative allocation of facilities techniques. *International Journal of Emerging Technology and Advanced Engineering*, 3(8):514-20, 2013.
- Kampelmann, S., and Rycx, F. The impact of educational mismatch on firm productivity: Evidence from linked panel data. *Economics of Education Review*, 31(6):918-931, 2012.
- Kipphan, H. *Handbook of Print Media*, Springer Verlag, Heidelberg/Berlin, 2001.
- Kleis, L., Chwelos, P., Ramirez, R.V., and Cockburn, I. Information technology and intangible output: The impact of IT investment on innovation productivity. *Information Systems Research*, 23(1):42-59, 2012.
- Krajewski, L.J., Ritzman, L.P., and Malhotra, M.K. *Operations management: Processes and supply chains 9<sup>th</sup> ed.* Pearson, Upper Saddle River, New Jersey, 2010.
- Kruger, D., Ramphal, R., and Maritz, M. *Operations management 3<sup>rd</sup> Ed.* Oxford University Press, Southern Africa, 2013.
- Kumar, B.S., and Abuthakeer, S.S. Productivity enhancement by implementing lean tools and techniques in automotive industry. *Annals of the Faculty of Engineering Hunedoara*, 10(1):167, 2012.
- Laroche, P., The impact of unions on workplace financial performance: an empirical study in the French context. *Members-only Library*: 154-169, 2015.
- Leaman, A., and Bordass, W. *Productivity in buildings: The 'killer' variables, in creating the productive workplace*. E and FN Spon, London: 153-180, 2005.
- Lundberg, M., and Wallin, C.M. *Reducing paper waste to improve resource efficiency at a Swedish printing and packaging company*, 2016.

- Makhanya, S.B. *Factors contributing to re-offending amongst youth in conflict with the law in Soweto* (Masters Dissertation, University of Johannesburg), 2009.
- McKone, K. E., Schroeder, R.G., and Cua, K.O. 2001. The impact of total productive maintenance practices on manufacturing performance. *Journal of Operations Management*, 19(1):39-58.
- McMillan, M., Rodrik, D., and Verduzco-Gallo, Í. Globalization, structural change, and productivity growth, with an update on Africa. *World Development*, 63:11-32, 2014.
- Mohnen, P. and Hall, B.H. Innovation and productivity: An update. *Eurasian Business Review*, 3(1):47-65, 2013.
- Netland, T.H., and Sanchez, E. Effects of a production improvement programme on global quality performance: The case of the Volvo Production System. *The TQM Journal*, 26(2):188-201, 2014.
- Ngo, L.V., and O’Cass, A. Innovation and business success: The mediating role of customer participation. *Journal of Business Research*, 66(8):1134-1142, 2013.
- Ngwenya, B., Sibanda, V., and Zana, C. Successful Implementation of Turnaround Strategies in the Manufacturing Sector in Harare, Zimbabwe-Impediments and Challenges Faced. *International Journal of Accounting, Finance and Risk Management*, 1(1):1-10, 2016.
- Osei-Poku, P., Enninful, E.K., and Boakye-Amponsah, A. Motivating employees for effective organizational advancement: The focus on managers of printing industry in the Kumasi metropolis. *British Journal of Education*, 4(5):72-86, 2016.
- Printing, Print Media and Publishing Sector. A profile of the printing, print media and publishing sub-sector. [http://www.fpmseta.org.za/downloads/FPM\\_sub-sector\\_printing\\_print%20media\\_publishing\\_final.pdf](http://www.fpmseta.org.za/downloads/FPM_sub-sector_printing_print%20media_publishing_final.pdf). [Accessed on: 10 May 2017], 2014.
- Salas, E., Wilson, K.A., Priest, H.A., and Guthrie, J.W. *Design, delivery, and evaluation of training systems. Handbook of human factors and ergonomics, 3<sup>rd</sup> Ed.* Pearson, 2006.
- Sharma, M.K. *An innovative technique for wastage minimization in printing industry*, 1(12), 2017.
- Statistics South Africa  
<http://www.statssa.gov.za/publications/P3002/P30022014> [Accessed: 28 April 2017], 2014/2015.
- Stöhr, M.G., Kühn, E., Schwitzky, V.R., Schaede, J.G. and Kba-Giori SA. *Letterpress printing machine*. U.S. Patent 8,726,805, 2014.
- Sunderaraj, R., and Mareeswaran, K. A study on HRM Practices of employees on printing industry in Sivakasi. *International Journal of Engineering Science*: 4271, 2017.
- Wireman, T. *Total productive maintenance* 2<sup>nd</sup> Ed. Industrial Press Inc, New York, 2004.
- Wolf, S. Encouraging innovation and productivity growth in Africa to create decent jobs. *DPRU/TIPS Coherence*: 18-20, 2006.
- Yilmaz, C., Alpkın, L., and Ergun, E. Cultural determinants of customer and learning oriented value systems and their joint effects on firm performance. *Journal of Business Research* 58:1340-1352, 2005.

## **Biographies**

**Enock Philani Mtshali** is an Assistant Director Seasonal Products, Production & Operations Branch. Mr. Mtshali is currently a Master of Technology in Operations Management student at the Tshwane University of Technology, Pretoria. Mr. Mtshali holds a B-Tech: Operations Management degree from the University of South Africa; a National Diploma: Operations Management from the Durban University of Technology and a National Diploma: Rotary Web Offset Machine Minding. Mr. Mtshali also served as a Training Officer, facilitating the training of Apprentices within the printing industry.

**Kgashane Stephen Nyakala** is currently a lecturer in the Operations Management Department at the Tshwane University of Technology. Mr. Nyakala holds a Master of Technology in Operations Management from the University of Johannesburg, South Africa. He has published journal and conference papers. He has taught courses in manufacturing planning systems, project and quality management, entrepreneurship, operations management and innovation for engineers. Mr. Nyakala serves as a SAPICS Fellow and IEOM.

**Thomas Munyai** is lecturer and head of department of Operations Management at Tshwane University of Technology, Pretoria, South Africa. Dr Thomas Munyai is a graduate in DPhil in Engineering Management at the University of Johannesburg and his research focused on the development of a model to empower small businesses to enhance productivity in Gauteng, South Africa. He has 20 years' experience in the manufacturing and food processing industry, as a factory manager, operations manager, product and sales manager, and procurement manager. His professional memberships include the South African Production and Inventory Control Society (SAPICS). His fields of interest are optimization through Lean Six Sigma, work-study, productivity, linear and non-linear modeling, statistics, mathematics, simulation, process mapping modelling, and manufacturing technology.

**Prof Kemplall Ramdass** has worked as a work-study officer, industrial engineer, production/operations manager and skills development facilitator in the clothing and textile industries between 1981 and 1999. He joined the academic profession in 1999 as a lecturer with Technikon South Africa. He later moved to UNISA'S Department of Business Management in 2006 lecturing in operations management, industrial engineering and quality management. He is currently employed at the University of Johannesburg. He has vast experience with regards to continuous improvement methodologies from an industrial engineering, quality and operations management perspective. He is a process, performance and operations specialist with a driving passion for improving production, quality and competitiveness. He has presented papers both nationally and internationally and is a peer reviewer for numerous publications. He is a member of SAIIE, SAIMS and SAIMAS, which are internationally recognized in industrial engineering and management.