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The Impact of ProductionTechnology on Human Capital in the Sugar Cane Farming Business in Eswatini

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ABSTRACT

The study analysed the impact of production technology on human capital in Eswatini's sugar cane industry, based on survey data relating to new technology introduced from 2000 to 2018 by the Royal Swaziland Sugar Corporation (RSSC). Production technology increases productivity and market position, but staff may be negatively affected by automation of operations. 110 employees based at RSSC's sugar cane processing farm in the Lowveld filled in questionnaires which were prepared by the researchers, with the assistance of academics and sugar cane farming experts. 61% of the questionnaires were returned and analysed. Frequencies of occurrences, percentages, cross tabulations and correlations were established using the Statistical Package for Social Sciences (SPSS) Version 20. Results showed that workers had mixed feelings about how the technology impacted them. They acknowledged increased productivity (86%), speed (88%) and well-managed processes (82%). However, the following negative effects were noted:employees got retrenched (58%), no promotions (67%), lost job opportunities (52%) and morale declined (61%). Ironically, staff were happy with the training received (77%) and they remained motivated (75%). It is recommended that management involve staff in decision making processes regarding the implementation of new technology and businesses should always strive to complement government efforts to reduce unemployment.

Keywords: Human Capital, Impact, Production Technology,Sugar can farming, Change management.

1.0 Introduction

The viability of sugar cane farming businesses is under threat from fluctuating international sugar prices. In order to remain viable, enterprises in the sector have adopted the use of technology as a survival strategy because of its ability to increase productivity and contain operational costs(Royal Swaziland Sugar Corporation,2018).Therefore, new technology is initiated due to operational necessity and to meet strategic goals such as market

demand,technological advances,regulatory requirements and replacing obsolete equipment ~~and all this entails making a change~~ (Kloppenborg, Anantatmula & Wells, 2017:3-4). Today's business environment is rapidly changing and the technology revolution has reformed work place conditions at unprecedented ratesand the interaction between humans and machines is changing the nature of work (Smit,2011). On one hand, this is crucial, considering the fact that, at the heart of every organisation is maximisation of productivity which by extension means more goods and services made available to clients and customers. This effectively means more profits for the enterprise(Loi,2015). On the other hand, employment is viewed as a critical indicator of development hence governments are working hard to create opportunities for employment for the citizenry so that they can earn a living (Carr,2014). Predicting the impact of technology is never easy and what held true in the past does not necessarily apply to the future, especially given the dynamics and pace of technological change(Titcomb, 2018).The efficiency in productivity which companies that utilise technology seem to be enjoying can also lead to high unemployment rates because mechanised operations are not less labour intensive (Spector, 2013). This entails the technology is beneficial to the companies and not the nation at large. Therefore, one wonders what the overall effect of using technology is on human capital, and whether technology is indeed replacing humans at work, with machines performing better than humans (Keyens, 1963)

A sugar cane company located in the north-eastern lowveldof the kingdom is one of the largest companies in Eswatini. The company produces two-thirds of the country's sugar, producing 475 000 tonnes of sugar per annum(Royal Swaziland Sugar Corporation, 2018).To minimise costs of production and improve efficiency, the company has introduced the latest technological equipment at different stages of the production process. Thecompany is moving towards manpower rationalisation including a strategic initiative to automate production processes at the factory (Jackson, 2017). In recent years, the company introduced new technologies to their operations. For instance,the Hilo system has replaced the old habit of bundling sugar cane on the ground before being taken for processing. The Internet of Things (IOT) digital transformation for the farm and the factory workshop is expected to leave more junior positions redundant (Jackson, 2017). Additionally, the new system allows for cane to be loaded from the truck and delivered straight to production, which is a more efficient procedure. However, this has eliminated a number of procedures that were previously performed manually (Jackson,2017; Sami, 2017; Collins, 2019).

According to Coombe (2018), the companyhas has introduced huge technological changes across all its departments. For example, in farming inputs, the water management and irrigation system's primary goal is to save water and energy. Thus, the irrigation process is done underground without human intervention and in the process the water does not easily evaporate.RSSC introduced drones,with the primary goal of growing more cane. This is so because, drones make the monitoring of crops and farming activities easier thus leading to improved yields. Out grower illegal activities are monitored and stopped easily, without relying on reports from other workers.The inbound logistics and post-harvest activities are also monitored and managed easily with the help of the IOT, vehicle tracking, the HANA and the

Analytics technology. Finally, in the factory, the primary goal of technology is to bring the plant and business systems closer together to improve yield and profitability. Plant operations are improved, with special focus on responsiveness to problems.

1.2Statement of the problem

Between 1856 and 1915 Fredrick Taylor introduced and advocated the scientific management theory which allowed new types of work organisation to be developed, including the introduction of equipment (technology) among other strategies(Burnes,1992; Brevis &Vrba,2014). Trade unions resisted and rejected Taylor's approaches, arguing that they were designed to replace labour with machines and treated workers like human machines who were told what to do,whento do it and how long to take (Burnes,1992:14). Today, the debate on whether technology negatively impacted human capital rages on.

Eswatini is a struggling developing economy with a high unemployment rate of 26.4 % and the government is proposing to revise corporate tax downwards from the current 27.5% to 12.5% as one way of addressing unemployment and attracting foreign investments(Rijkenberg, 2019). However, the fact that companies in the agriculture sector of Eswatini are introducing technology as a way of improving productivity still attracts the problem that Khumalo and Bimha (2018:1123) referred to as 'the challenge of change'.In the study, while introducing new technology may improve productivity, quality and the market position of the firm,the move tends to contradict the government's goal of creating employment in the short to medium terms. Using advanced technology in production processes leaves the agriculture sector with redundant employees especially the unskilled workers (Frey, 2013). It is not clear how workers in the agriculture sector of Eswatini are impacted by the introduction of new production technology. Therefore, the study sought to identify production technologies that have been introduced at the sugar cane company between the years 2000 and 2018 and determine how workers were impacted by the introduction of technology at the company.

LITERATURE REVIEW

The theory that formed the bed rock of the research and empirical evidence were considered.

2.1Theoretical Framework

The theory underpinning the study isthe three step change management model advocated by Kurt Lewin in the 1950s(Burnes,1992). The model posits that, a successful change project should have three steps:unfreezing the present level, moving to the new level and refreezing the new level (Lewin, 1958).Figure 1 demonstrates how the three step change management model can be operationalised.

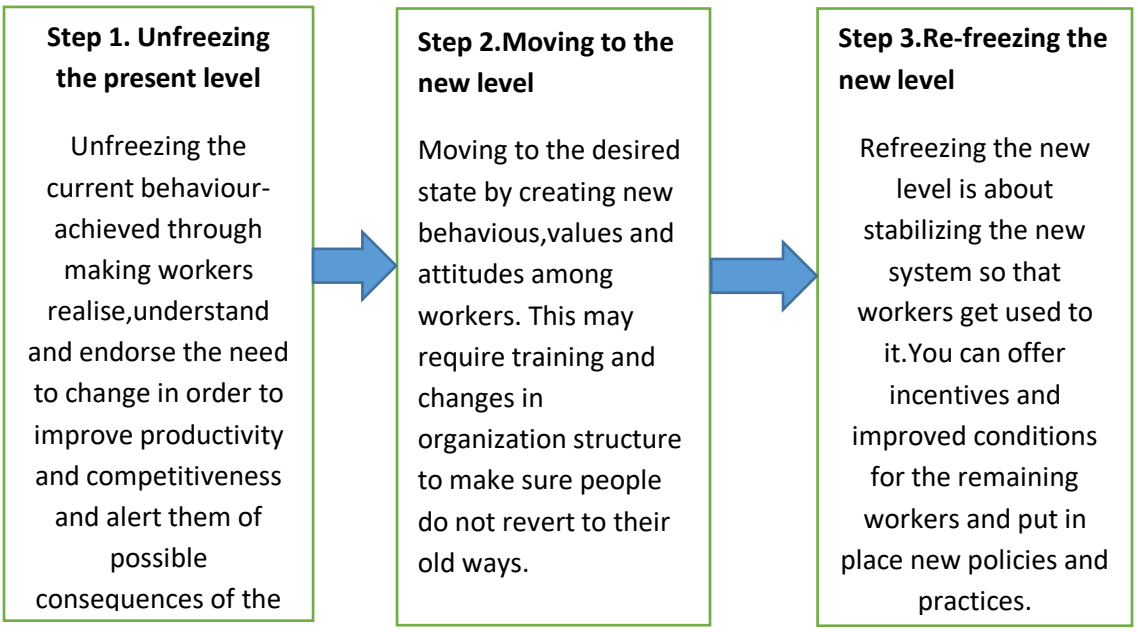

Figure 2.1 Kurt Lewin's three step change management model:Lazenby (2016:167).

For example, when production technology reaches equilibrium, a state where its usefulness is at the lowest ebb, that technology requires to be changed. The situation is described as unfreezing (Burns,1992; Juneja,2019). The unfreezing state is the ripe time for management to engage the workforce about the need for change. If the case for change is communicated well and properly marketed to the workforce it will be accepted with minimum or no resistance (Burnes,1992). At this stage, management must move fast to implement the change(adopting the new technology) while the environment is still conducive for such. This is level two of the three stages. Poor or slow action will allow the situation to relapse because group behaviour may soon revert to previous patterns (Burns,1992:163).Therefore, when introducing change management must consolidate their systems and processes or refreeze them (level three of the model). The refreezing step ensures the changes that have been introduced fit well in the overall strategy and it gives management the results they wanted (Lazenby,2016; Juneja,2019).It must be noted that this is just another temporary equilibrium or stabilisation and it is the reason why change continually takes place(Lewin,1958). Therefore, introducing new technology in a production process resembles the introduction of change. Applying Kurt Lewin's three step change management model is therefore deemed appropriate because the workers may be impacted by either the work or results of such a project (Nicholus & Steyne, 2017:37).

2.2. Implementation of Technology Change

Khumalo and Bimha (2018:1125) noted that, introducing new technology in Eswatini's cotton farming industry, in the form of genetically modified cotton, was seen as a viable option for

increasing productivity,but stakeholders persistently resisted the new technology. This study analysed the impact of production technology on human capital in the sugar cane farming industry in the same context (Eswatini).

Once an organisation has selected and approved new technology, it must introduce the technology to employees and involve them in the impleemnation of the technology. Organisations that fail to introduce their planned changes successfully can pay a high price that could lead to lost market position, credibility with stakeholders, decreased staff morale, and loss of key employees (Burnes, 1992; Lazenby, 2016). Successful implementation of new technology requires visionary leadership that has considered the benefits, consulted with influential leaders at all levels to identify unintended consequences, identified sources of resistance, and developed a detailed implementation plan over time (Lazenby, 2016). Spending time on the careful creation of a well thought out plan for implementation is the key to success.

The implementation of any new technology should be communicated to staff. Items such as status, benefits, training and expectations should be clearly provided(Burnes 1992; Brevis& Vrba,2014). Along with the "what" of the change, the "why" should be emphasized to provide staff with an understanding of the changes that are going to occur and what will be expected of them(Schraeder,2008; Brevis&Vrba,2014). Schraeder (2008) opines that, information about the change can be provided through email, newsletters, the company website, staff briefings or town hall meetings. Communication about the changes should also be tailored to the different levels and roles within an organisation, as each will react differently to the changes that are being made (Croft & Cochrane 2005).

Once the decision for change has been made and the change has been communicated to staff, the actual training on how to utilise the new technology must be conducted.According to Croft and Cochrane(2005),the design of the new technology training should take into account several considerations. These include: staff experience and skill set, complexity of the changes they are being asked to learn, time it will take to learn the changes, and the amount of time that will be provided for the learning to take place. With all of these items to consider, training designers must understand both the needs of the business and the needs of employees(Llorens, Salvano&Grau, 2003). Training should also consider how long it will take staff to master the new skills. In some cases, complex components should be given in multiple training sessions to spread out the learning process (Marler, 2006). Evaluations should be done to determine if training has been a success from an employee standpoint. The extent and quality of training can directly impact employees' intentions to use the technology, as well as their attitudes and beliefs about how useful the technology will be to them (Marler, 2006).

According to Gollapudi, Jangeti and Kotapati (2012),to help curtail conflict, new technology needs to satisfy the requirements of all departments within an organisation andsome of the attributes to be considered when implementing new technology include: usability, interoperability, common business views, agility, scalability, reliability, openness,

manageability, infrastructure and security. Any one of these attributes can cause conflict within an organisation due to negative employee responses upon implementing. Employees react differently to the introduction of new technology. To circumvent conflict, a variety of strategies should be applied by an organisation to mitigate the impact. Open communication should be utilized to reduce the possibility of misinterpretations.

At first, new technology may slow down production until employees become accustomed to using it (Feirer & Lindbeck,1986). When an employee becomes comfortable with the new tool and establishes a routine in using it, efficiency should increase. Therefore, it is easier to implement change that can be viewed positively by employees than that which is viewed negatively (Schraeder, Swamidass&Morrisson, 2006). In addition, choice of technology becomes more successful when departmental requirements are shared across an organisation, and business goals are aligned with its selection (Schraeder, Swamidass&Morrisson, 2006). Ideally, the technology selected should be easy to use at all levels of the organisation, and it must provide useful reports to assist in the decision making process of the organisation. The proposal for new technology should be accepted at all organisational levels and by all departments in order to increase the chances that it will be approved, accepted and implemented (Burnes,1992; Brevis & Vrba,2014).

2.3. Impact of technological change on human capital

A British study on the impact of technological change on human capital indicated that joblessness and unemployment were the main negative consequences (Titcomb, 2018). The United States(US) labour department reported that for the first time since records began, there were more job openings in the economy than there were workers. Titcomb (2018) argues that, more of these unfilled jobs are not in areas like medicine and information technology (IT); they are simply down to a lack of workers, which means there currently is need for unskilled labourers to perform routine jobs as they can easily be replaced by robots (Titcomb, 2018). Farmers were struggling to find enough employees to pick their crops, leaving produce rotting in fields. The US long-haul trucking industry was short of 51 000 drivers at the end of 2017. One manufacturing company in India was putting new job applicants who failed drug tests through rehabilitation because it urgently needed to recruit staff (Titcomb, 2018). There is considerable disagreement in the literature and amongst economists regarding the future of employment and the supposedly negative impact of technology or innovation (Mokyr, 2015).

Technological advancements and inventions change not only the work processes, but the everyday lives of workers as well (Kovachevska, 2018). Because of increased access to education and opportunities, developed countries are more likely to use modern technology because they can easily adjust the labour market and the whole economy to the changes. However, less developed countries find difficult to implement modern technology due to the labour market's poor adaptation to the technological changes, especially because they have high unemployment rates (Kovachevska,2018).Feldman(2013)argues that, a faster technological

change is likely to increase unemployment substantially. However, the adverse effect on unemployment appears to persist for three years and to disappear later on, so the effect is transitory, not permanent. Due to the skills gaps between labour supply and demand, labour supply cannot adjust to the technological change (Feldman,2013). Once the reallocation of labour is complete, unemployment levels may decline because the firms will be able to take full advantage of their improved international competitiveness(Feldmann, 2013).

Carr(2014) argued that, humans have been confronted with technological developments that seem to be threatening their livelihoods in the way they live and do their work. In the early 19thcentury, groups of self-named Luddites raged across the industrial counties of England, smashing the equipment of which they feared would take their jobs (Carr, 2014). Their success was short lived as mechanisation could not be stopped and it actually became so common that workers could only consent to their new robotic co-workers. The machines took over the physically demanding and repetitive tasks that were previously done by human workers (Brynjolfsson, 2014). Marx(1992) was pessimistic about the evolution of worker's living conditions and argued that, all methods for raising the social productivity of labour are put into effect at the cost of the individual worker. He believed that capitalism would inevitably lead to an ever great reduction in real wages and thus logically lead to the replacement of human labour by machines, which he portrayed as dead labour (Carr, 2014).

Merchant (2014) opined that markets were going to experience what he called technological unemployment. Technological unemployment is unemployment brought forward as a result of technological change and or development as a means of economizing labour (Marchant, 2014). It is argued that the impact of technological unemployment affect society greatly, and not just those unable to find sustainable unemployment. Technological unemployment destabilises economies since the unemployed cannot participate as consumers (Marchant, 2014). Despite this, long term technological unemployment remains a widely disputed concept asKeyns (1963) noted that, technological unemployment was only temporary and that what we now call automation would lead to a future of affluence and leisure for all. It seemed like (Keynes, 1963) had predicted the future when post–World War II economic expansion was huge and increases in real wages were high (Carr, 2014). However, Keynes' predictions were put in the dustbin when economic stagnation hit the world economy in the early and mid-1970s, while the 2009 economic crisis of some thirty years later continues to this day (Siu, 2015). Changes in technology are a key factor in understanding this decline (Karabarbounis, 2014).

METHODOLOGY

The quantitative research approach was used in the study. Quantitative research is generally associated with the positivist paradigm which involves collecting and converting data into numerical form so that statistical calculations can be made and conclusions drawn (Creswell, 2014). The quantitative research approach allows the researcher to discover complex causal relationships on the impactof technology on human capital. Quantitative research methods have

the potential to generate research data that can be analyzed using numerical or statistical techniques (Babbie, 2012).

Cross-sectional research design, often called survey design was applied to the study. Cross-sectional design entails the collection of data on more than one case and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables which are then examined to detect patterns of association (Creswell, 2014; Maree, 2016). The target population for this study were the 110 factory personnel based in the factories department of the RSSC's Simunye plant. They are all permanent employees, and since they work in the same plant/location and the size was found to be small, the researchers purposely targeted the whole group to participate in the study.

According to Babbie (2012), data collection is the collection of various kinds of empirical information or data. For instance, historical, statistical or documentary data.Data collection is carried out through a variety of techniques such as questionnaires, observation, document analysis and interviews, with the aim of producing reliable data (Mareee,2016). For this study, data was collected through the use of a structured questionnaire. A structured questionnaire was developed based on the four point Likert scale and the research objectives. Respondents were to indicate if they strongly agreed,agreed,disagreed or strongly disagreed with statements in the questionnaire. Objective or close ended questions were asked ; respondents were asked the same, simple, clear, concise and precise questions to ensure that the responses made to those questions were standard, making data analysis simple (Manion, 2012).

In order to make sure that the research questions were valid, the instrument was presented to a panel of experts, three of them were lecturers from the University of Eswatini and one was a an experienced manager from the farming enterprise. This was done so that research experts and employees familiar with the area of study could rate the instruments in terms of how effective they were in soliciting the information that was needed for the research. Validity refers to the congruence or goodness of fit between an operational definition and the concept it is purported to measure (McMillan & Schumacher, 2010). According to Neuman (2014), validity means truthfulness of findings and conclusions.

Additionally,instrument reliability was also ascertained. According to Leedy and Ormrod (2005), reliability refers to the consistency with which a measuring instrument yields certain results when the entity measured has not changed. Reliability is concerned with the extent to which any particular method of data collection is replicable. That is, if the research is to be conducted by someone else using the same method it will yield the same results. Instrument reliability for the whole questionnaire was tested by calculating a Cronbach's Coefficient Alpha,using the SPSS software.Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group(Pallant,2011; Bryman et al.,2014). Cronbach's Coefficient Alphawere calculated for questions about technology adopted between 2000 and 2018 to determine how workers were impacted. According to Bryman et al. (2014:38), while a result of 0.8 and above

implies an acceptable level of reliability, researchers accept an alpha score as low as 0.70. Introducing production technologies revealed 0.72 alpha score and how workers were impacted by the introduction of technology 0.78.Therefore the scales indicate acceptable reliability since they are between 0.70 and 0.80.

Ethical considerations are rules of right conduct and practices that guide research (Bryman et al., 2014; Creswell, 2014). For every study, informed consent has to be considered and participants must be provided with reasons why the research was being conducted,research purpose and procedures. Participants must be given the option to terminate their participation any time with no penalty and full disclosure of any risks associated with the study (McMillan &Schumacher, 2010). Permission to collect data from operations workers was granted by company management. Informed consent was solicited from individual participants who were asked to sign the cover letter as an indication of their volundaryparticipation in the study. The researchers further ensured that appropriate confidentiality procedures were implemented. For example, no names of participants were linked to any response and the analysis of results was aggregated.

RESULTS AND FINDINGS

The findings were presented in line with the objectives of the study.

4.1 Response Rate

As part of its corporate policy, the farming entity does not allow outsiders' direct access to the workers during working hours. Therefore, the researchers distributed the questionnaires through the human capital consultant and heads of departments and did not have direct contact with respondents. The indirect access procedure made it difficult for the researchers to get a higher response rate. As a resulta response rate of 61% of the 110 employees was achieved. However, the consensus for an acceptable response rate is that, a rate of 50% is adequate for analysis and reporting, a response rate of 60% is good, and a response rate of 70% is very good (Babbie & Mouton, 2001:261).

4.2 Demographic data of participants

The demographic data of the 67 participants who completed and returned the questionnaires was captured in Section C of the questionnaire. The researchers found it necessary to gather the participants' background information since demographic data act as a mirror relating to the participants' understanding of the impact of technology on human capital (Cline, 2014). Table 4.1 below presents the participants' gender, age, marital status, educational qualifications and years of service at the sugar company.

Table 4.1: *Participants* d*emographic data*

	Frequency	Percentage %
Gender		
Male	51	76
Female	16	24
Total	**67**	**100**
Age		
26-35 years	16	24
36-45 years	30	45
46-55 years	12	18
56-66 years	9	13
Total	**67**	**100**
Marital status		
Single	11	17
Married	47	70
Widowed	7	10
Divorced	2	3
Total	**67**	**100**
Qualifications		
Primary level	1	1
Post-primary level	3	4
O'level	44	66
Degree	16	24
Post-Graduate degree	3	5
Total	**67**	**100**
Years in service		
1-5 years	15	22
6-10 years	18	27
11-15 years	6	9
16-20 years	6	9
21 years & above	22	33
Total	**67**	**100**
Employment Position		
Manager	4	6
Supervisor	18	27
Foreman	10	15
Labourer	29	43
Artisans	6	9
Total	**67**	**100**

Source: Field data (2019)

The findings reveal that the work environment at the Simunye factory is male dominated 51 (76%), and thatmost participants were over the mature age of 35. It is also evident that a majority of the participants were married 47 (70%) and very few were either widowed or divorced.The data collected shows that most of the participants were Ordinary level (O'level) certificate holders 44 (66%) and a few had either attained degrees or post-primary school level. The years

in service also indicate that most of the participants have been with the company for a period of more than 6 years.

4.3 Production technologies introduced at Royal Swaziland Sugar Corporation in the years 2000 to 2018.

Table 4.2 shows the periods when the technology was introduced in the different departments at the factory. The results show that technology was acquired in a phased approach for the different departments and that all the departments have had new acquisitions between 2000 and 2018. However, most acquisitions were experienced after 2015, particularly in the central operations (the Raw House).

Table 4.2 *Introduction of production technologies from 2000 to 2018*

DEPARTMENT		2000 to 2005	2006 to 2010	2011 to 2015	2010 to below 2015	After 2015
Sugar Packing	F	-	6	7	-	1
	%	-	9	10	-	2
Raw House	F	2	-	-	2	10
	%	3	-	-	3	15
Laboratory	F	2	2	1	7	1
	%	3	3	2	10	2
Boilers	F	1	1	-	7	4
	%	2	2	-	10	6
Front End	F	-	1	7	1	2
	%	-	2	10	2	3
Distillery	F	7	-	1	2	1
	%	10	-	2	3	2

Source: Field data (2019)
Key: F=Frequency
Table 4.2 above shows the different machinery or technology introducedduring the period under review.

4.4 Machine or way of working that was replaced by the new technology at Royal Swaziland Sugar Corporation.

Table 4.3 *Old Machinery and New Technology*

Department	Old machinery	New technology
Sugar Packing	West weigh 50 kg packing scale	Auto-tech batch Scale
Raw House	Micro Exel Yokogawa system	Centum VP Yokogawa system
Laboratory	-Manual data capturing	Near Infrared Spectroscopy (NIRS)
Boilers	Micro Exel Yokogawa system	Centum VP Yokogawa system
Front End	Ganty cranes for offloading cane	Hilo crane cane offloading system
Distillery	Micro Exel Yokogawa system	Centum VP Yokogawa system

Source: Field data (2019)

Table 4.3 above shows the different machinery or ways of doing work before technology was introduced and also after the adaption of new technologies.

4.5 How the workers were impacted by the introduction of technology atRoyal Swaziland Sugar Corporation.

Table 4.4: How workers were impacted by the introduction of technology

Statements: Please indicate how you felt after the introduction of new technology in the company-		**SA**	**A**	**D**	**SD**	**Total**
Attitude towards work improved	F	5	48	8	6	67
	%	7	72	12	9	100
Motivation towards work improved	F	4	46	11	6	67
	%	6	69	16	9	100
The company recorded more absenteeisms	F	2	8	34	23	67
	%	3	12	51	34	100
Overall effect of the technology was positive	F	30	28	8	1	67
	%	45	42	12	1	100
The more the company introduces technological innovations, the higher the rate of job losses	F	24	14	27	2	67
	%	36	21	40	3	100
Cost effectiveness is an advantage of the automated system	F	44	18	3	2	67
	%	66	27	4	3	100
Efficiency is an advantage of the technological system	F	38	24	4	1	67
	%	57	36	6	1	100
Accuracy is an advantage of the technological system	F	41	18	7	1	67
	%	61	27	10	2	100
Increased production is an advantage of the technological system	F	37	18	8	4	67
	%	55	27	12	6	100
My job is safe in the company even with the introduction of technology	F	19	15	25	8	67
	%	29	22	37	12	100
Automation or technological advancement mostly brings more job opportunities	F	15	17	23	12	67
	%	23	25	34	18	100
Most people stand to lose their jobs	F	15	27	18	7	67
	%	22	40	27	11	100

Source: Field data (2019)

Key: SA= Strongly Agree A=AgreeD=Disagree SD=Strongly Disagree

F=Frequency

Generally, respondents felt that attitude towards work (79%), motivation (75%), efficiency (91%), accuracy (88%), productivity (82%) and job safety (51%) improved after the acquisition of new technology. Staff disagreed (85%) that there was more absenteeism after acquiring technology and they believed their jobs were safe under new technology (51%). Based on responses to Question 13, the overall effect of introducing the new technology is positive.However, there is evidence of the fear that as the company introduces more technology there will be less opportunities(52%(34+18) of the responses did not agree that technology created opportunities for staff; 49% (37+12) did not agree that their jobs were safe with the coming of new technology and 39%(27+11) believe people lost their jobs because of the introduction of technology.

4.6 Presentation of the relationship between changes that took place when technology was introduced and how workers were impacted.

The researchers assessed the relationship between changes that took place when technology was introduced and how workers were affected through the use of correlation analysis. Correlation is a statistical method used to assess a possible linear association between two continuous variables (Pallant, 2011). The Pearson correlation coefficient (r) was used to calculate the relationship based on correlation descriptors developed by (Hinkle, Wiersma&Jurs, 2003).

Table 4.5 ***Hindle, Wiersma and Jurs scale of descriptors***

Size of Correlation	Interpretation
.90 to 1.00 (-.90 to -1.00)	Very high positive (negative) correlation
.70 to .90 (-.70 to -.90)	High positive (negative) correlation
.50 to .70 (-50 to -.70)	Moderate positive (negative) correlation
.30 to .50 (-.30 to -.50)	Low positive (negative) correlation
.00 to .30 (.00 to -.30)	Little if any correlation

Source: Hinkle, Wiersma&Jurs (2003)

Pallant (2011) stated that a correlation coefficient shows the direction (either negative or positive and magnitude (-1 and +1) of the relationship between variables. The values indicate the strength of the relationship between variables. The findings in Table 4.6 show the correlation between changes that took place when technology was introduced and how workers were affected.

Table 4.6:*Correlation results between changes that took place when technology was introduced and how workers were affected*

		Adoption of technology	Affected workers
Adoption ofTechnology.	Pearson Correlation		0.391**
	Sig. (2-tailed)		.001
	n	67	67
Affected workers	Pearson Correlation	0.391**	1
	Sig. (2-tailed)	.001	
	n	67	67

**.Correlation is significant at the 0.01 level (2-tailed).

The results in Table 4.6 indicate that there was a low positive (r=.39) correlation observed between changes that took place when technology was introduced and how workers were affected. This means there is a relationship between the changes that took place when technology was introduced and how workers were affected.

4.7 Cross tabulation results on level of education and how workers were impacted by the introduction of technology at the sugar enterprise.

Cross tabulation is a method to quantitatively analyze the relationship between multiple variables. Also known as contingency tables or cross tabs, cross tabulation groups variables to understand the correlation between different variables (Pallant, 2011).Figure 4.2 below is a product of the cross tabulation of results on level of education and how workers were impacted by the introduction of technology at RSSC. The chart below shows the reaction of workers in their attitude towards the change in accordance to their level of education.

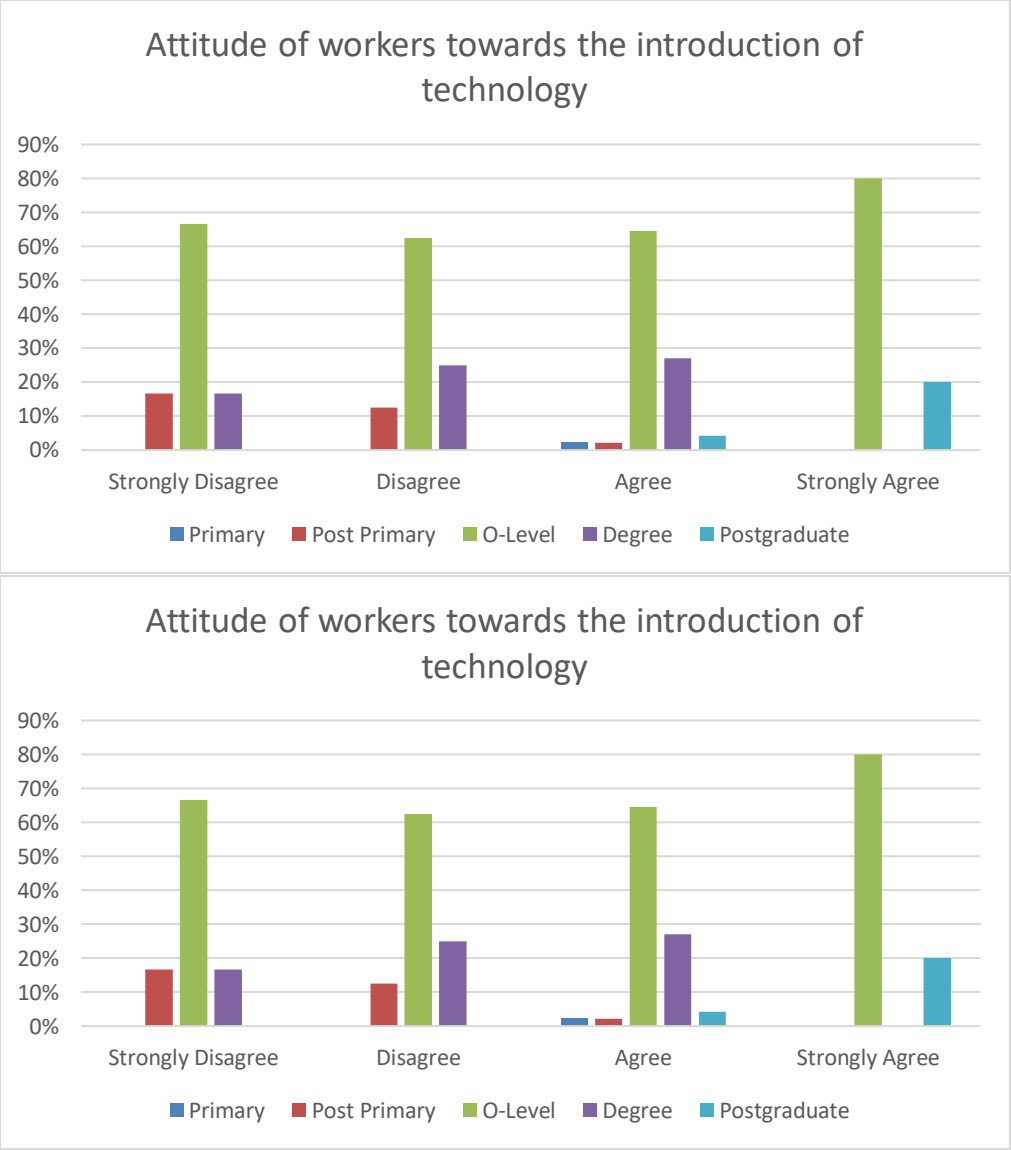

Figure 4.2:Workers' attitude towards work and level of education

The Figure shows that mostly workers with O'level certificates agreed that there was an improvement in attitude towards work after the introduction of technology,followed by the degree holders,post primary certificates,post graduates and finally primary education.

4.7 Motivation towards work improved because of the introduction of Technology

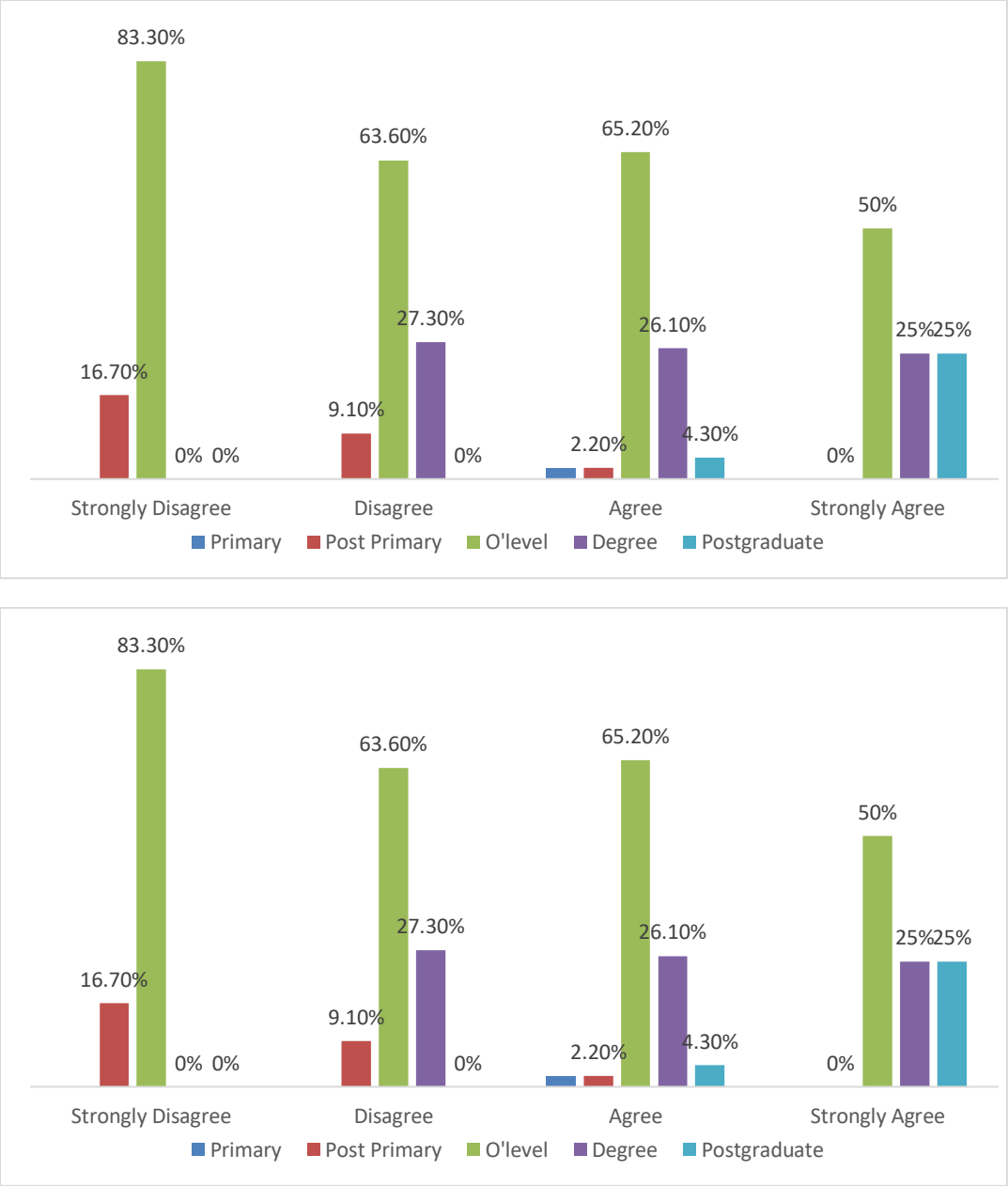

Figure 4.3: *Motivation towards work level of education*

Respondents with O'level strongly disagreed that technology motivates them followed by those with post primary education.O'level holders, degree holders and post primary certificate holders disagreed that technology motivated them.On disagreeing and strongly disagreeing O'level holders, degree and post graduates were followed by post primary holders

DISCUSSION OF FINDINGS

The findings cover a description of the demographic variables of the respondents: production technologies that were introduced at Royal Swaziland Sugar Corporation, from the old systems to the new ones, and the year in which the technologies were changed and how the workers were impacted by the introduction of the technology.

5.1 Description of the demographic variables

The findings on the profiles of respondents indicated that most participants were male 76%(51) of the respondents were males, and only 24% (16) were female. The views of both sexes were captured and there were no intentions to separate the views by gender. However, it is normal to have male dominated factory operations in the Kingdom of Eswatini, given that most of the factory jobs are physical. Most participants ; 76% (45%+18%+13%) were aged 36 and above. This shows that most of them were matured people, and from this it could be assumed that they are not so accustomed to technology, as technology is known to be of interest to the youthful employees

Most of the participants were holders of O'level qualifications, as represented by 44 (66%) of the participants. The fact that the workers have a high level of literacy but no further qualification beyond high school could be the drive behind their attitudes towards the new technology and the motivation towards work (Figures 4.2 and 4.3). O'level qualifications alone imply that these workers have no professional speciality and only possess the skills learned from training and experience gained on the farm. If these workers lose their jobs, they may not be able to find employment elsewhere, hence 49% fear of job losses reflected in the responses to Question 10.When computer technology replaces routine jobs, but complements higher skilled jobs, it means there is a rise in demand for college educated workers in non-routine occupations, and a declining demand for mainly low-skilled workers in routine occupations (Autor, 2015). This is likely to affect the employees at Royal Swaziland Sugar Corporation as they are just school leavers with no specific qualifications, yet the company is aggressively introducing new technologies and changing the way work is done thus implying more demand for college educated workers.

16 (24%) of the participants were degree holders, while just 3(5%) held post graduate degrees. This shows that the company has few skilled employees. Employees at the farming enterprise have mostly served the company for a period of more than 6 years as 78% (27%+9%+9%+33%). This shows that the company values its employees as they do not leave the firm; employee turn over is low. A higher number has served the company for more than 21 years (33%) of the participants. However,there is a possibility that these are aged employees and they may not easily adapt to technological changes, which may compel the company to either redeploy or retrench them. (Marchant, 2014) stated that the use of modern technologies may cause problems for the older employees, as they may not be able to adapt to the change, thereby forcing companies to retrench.

A majority (43%) of the participants are labourers. It is likely that these have been with the company for a considerably long time and are unskilled as per their employment positions. Labourers are normally school leavers who have no tertiary qualification, and they do unskilled manual work in the production department. They are called blue-collar workers as they work while dressed in overalls. Their jobs are normally physical, demanding and repetitive in nature, which causes them to be easily replaced by machinery (Brynjolfsson, 2014). This then would lead to technological unemployment (Marchant, 2014). The more RSSC introduces technological improvements to its processes, the higher the likelihood of these workers becoming redundant. Therefore, the company cannot avoid retrenchments whenever they acquire new technology, although at times people are moved to other departments. Workers who cannot be trained on new roles will feel technology does not bring them opportunities (49%) [Question 10] and have fear of losing their jobs (38%) [Question 12).The company then needs to come up with ways of assisting these employees to adjust in the advent of new technology.

5.2 Objective 1 – Identifying production technologies that were introduced at Royal Swaziland Sugar Corporation

This objective intended to identify the different technological innovations introduced at RSSC between 2000 and 2018. The are detailed below, as per department :

Sugar Packing – this is where the final product (sugar) is packed before it is sent to Swaziland Sugar Association (SSA) for sale. The sugar is weighed, packaged, bagged, palletised, wrapped and handled into full bags in this department. Technologies in this department were introduced between 2005 to 2010. Previously the company had been using the West Weigh 50 kg packing scale, which was a more manual weighing and bagging system, with a series of open-mouth bags. The West Weigh system produced 3 bags of sugar per minute, which was proving to be too slow for the company to meet the required targets. Royal Swaziland Sugar then introduced the Auto-tech batch system between 2005 and 2010. The auto-tech batch scale is a more automated system which requires less human intervention, and produces 10 bags of sugar per minute. The factory was therefore able to speed up operations and increase productivity.

With the automation of the Sugar Packing department comes increased productivity and efficiency, coupled with a saving on human capital. This means that, the manual procedures are now machine operated, and are performed even 70% (from 3 bags per minute to 10 bags per minute) faster than before. This is undoubtedly beneficial to the company because the company is able to meet targets on time, produce more bags of suagr, and even save. However, job creation and opportunities in this part of the process have become limited, owing to the introduction of new technology.

5.3 Objective 2 – How the workers were impacted by the introduction of technology at Royal Swaziland Sugar Corporation

This objective looked at how the workers (human capital) were impacted by the introduction of technology. A number of variables were taken into consideration, these included: attitude towards work, motivation, absenteeism, the overall effect, the fear of job losses, and the benefits of the technological change (including cost effectiveness, efficiency, accuracy and productivity).

Attitude towards work shows that 79 % (7% + 72%) of the participants indicated that their attitude towards work improved because of the introduction of technology. However, the remainder 21% (12% + 9%) disagreed that there was an improvement in the attitude towards work. Linked to the fact that most of the workers are high school graduates, the improvement in attitude towards work could be as a result of the graduates appreciating that the technology brings along opportunities for them to learn and acquire more skills. They view it as a way to make their job better and simpler. It is also a sign that the implementation of the new technology was well communicated, such that benefits and expectations were clearly provided. The 'what' of the change and the 'why' would have been emphasized in a way that provides the staff with an understanding of the changes (Ryan, 1992).

Motivation towards workaffects human behaviour and performance at work. It can be described as something that energises individuals to take action which is concerned with the choices the individual makes as part of his or her goal oriented behaviour (Robbins, 2009). From the study 75% (6% + 69%) indicated that motivation improved when technology was introduced at RSSC, yet 25 % (16% + 9%) did not see any improvement in motivation levels. Motivation is a person's intensity, direction and persistence of efforts to attain a specific objective(Fuller,Valcichi& George,2008; Saraswathi,2011). It is therefore not alarming that some employees were highly motivated and some were not after the introduction of technology. Motivation levels can be dependent on a number of factors, such as, how the implementation process went, to how the transition from the old system to the new system was handled.Lahoud (2006) discovered that motivation factors are correlated positively with a person's education and life experience.

The overall impact of the technological change was mostly positive, as evidenced by 87% (45% + 42%) of the participants that agree with notion. The remaining minority of 13% (12% + 1%) do not agree. The positive response could mean that the company implemented the change in the right manner, given that there was involvement of the employees, and they could see the benefit of implementation. It also means that the employees started seeing the benefits of implementing the technological change. In general, technological change can bring increased efficiency, improved quality, assist in bringing products to the market quicker, expand the skill set of employees, improve communication, reduce costs and help foster new innovations (Schraeder, 2008).

Cost effectiveness, efficiency, accuracy and high productivity are some of the advantages of an automated system (Spector,2013). Most of the participants noticed great improvements in the 4 variables after the introduction of technology, which has benefits such as: improved

communication, reduced costs and help foster new innovations (Schraeder, 2008). Technology in the workplace has helped workers become more efficient than ever before. What used to take hours can now be done in minutes due to technological advancement which also has effects such as: increased efficiency, improved quality, assisting in bringing products to the market quicker and expanding the skill set of employees, improving communication, reducing costs and helping to foster new innovations (Schraeder, 2008).

5.4 The relationship between changes that took place when technology was introduced and how workers were impacted

The results indicated that there was a low positive (r=.39) correlation observed between changes that took place when technology was introduced and how workers were affected. This means that there is a relationship between the changes that took place when technology was introduced and how workers were impacted. Fewer employees were negatively affected by the change.

5.5 Level of education and how workers were impacted by the introduction of technology at RSSC.

It was mostly workers with O'level certificates that agreed that there was an improvement in attitude towards work after the introduction of technology, followed by degree holders, then post graduate certificate holders. Few primary school certificate holders and post primary school certificate holders noticed changes in attitude after technology was introduced.

Educated employees have a higher appreciation of new technology because they have greater capacity, competences and drive to learn the use of new technology and apply learned skills. They are also easier to redeploy based on their versatile skills sets which makes it easier for attitude adjustment compared to those with lower levels of education. Employees with lower levels of education were affected significantly perhaps due to repercussions such as: redeployment, retrenchment or even more training and development to as they did not adapt easily to the technological developments replacing the manual business processes. Skills-biased technological change, where computer technology replaces routine jobs but complements higher skilled jobs (Autor, 2015) is the reason why the highly educated staff members showed more positive attitudes towards work after technology was introduced.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The study examined how the introduction of production technology impacted on human capital. The research revealed that, RSSC has over time, steadily introduced new technologies such as the Auto-Tech batch scale, the Centum VP Yokogawa, SAP HANA, and the Hilo crane cane offloading system. It can be safely concluded that RSSC introduced several technologies in its different production operations between 2000 and 2018 in a phased approach and that the technological investments were equitably distributed among the different departments.

Increased productivity favours the company more than it does the employees, as it often reduces the manpower required for carrying out the work. The study findings confirmed Taylor's philosophy that, introducing scientific methods such as mechanisation, caused productivity at companies to rise drastically thus most companies embarked on technological changes as a way of increasing productivity (Lazenby, 2016).

When new technology is introduced in the organisation, different stakeholders in the organisation will have different expectations. After the introduction of technology it therefore becomes necessary to track the changes in light of the expectations of the different stakeholders. From the study, it can be concluded that the implementation of new production technology at Royal Swaziland Sugar Corporation (RSSC) brought about many changes which evoked mixed feelings among the workers. Some changes were positive while some were negative. For example, on one hand, staff got an opportunity to be trained and gain skills, workers attitudes towards work improved, there were productivity gains to benefit both employer and workers; workers were informed about the new technology and the change process was well implemented. On the other hand, workers were not so happy because they were not part of the decision making processes relating to the introduction of new technology. In addition, implications such as staff redeployment, retrenchment and lack of promotions do not sound nice, never mind their levels and magnitude, hence morale levels were low among workers.

The researchers concluded that, when a change programme such as introducing new technology is well managed, it has higher chances of success than failure. This technology implementation project at the RSSC was successful. However, in every successful project, people have lessons to learn. Some of the lessons from the study include: the importance of effective communication to workers, the existence of the unavoidable conflict between the goals of the capitalists and labour, yet the two have to core-exist. Furthermore, it is a fact that, in any work set up, change is endemic and people have to appreciate it. It is also worth noting that, while many employees may lose jobs because of automation related to new technology, there are job opportunities where human labour is needed to operate the new technology though the required personnel may be fewer in numbers.

Recommendations

From the employer's point of view, investing in new production technology is a positive development, not only for the company's growth and survival but also for the national economy's overall growth domestic product. Growth and expansion have potential to create employment in the future even for some of the employees that get retrenched now. Investment initiatives by the company, without seeking subvention from the government, gives the government an opportunity to direct the resources it has to other areas of need. It is recommended that the company maintains its investment in new technology and that where possible, the company gets support from government.

Unemployment which results from implementing new technology is mostly temporary and unavoidable. However, it is a reality that the company cannot maintain high staff levels it as it did before the techno-era. The company is encouraged to provide entrepreneurial skills and other survival skills to the retrenched staff before letting them go. For example, those encouraged to start businesses can be given preferential treatment in the award of services and supply contracts. The company can also prioritise re-hiring retrenchees if it opens up employment opportunities in the future.

Another crucial recommendation is the importance of participatory consultative processes of employees who have a crucial role to play in the successful implementation of new technology approaches. For any change to be a success there must be a sound change implementation strategy that responds to the needs of employees. Thus, workers must be incorporated in the company's technology implementation projects in future.
Government policies should encourage capital investments by companies so as to create employment in the future or to earn more foreign currency for the country. In that regard, tax holidays and other incentives are recommended for those companies that invest in industrial and production technology.

In order to encourage transparency and accountability on sensitive labour issues such as job losses through retrenchments, the government must put in place an independent retrenchment board that regulates and oversees retrenchment cases and advises government on appropriate legislation for same. This board can work closely with representatives of labour, employers and academic institutions.

The study gathered the views of production employees alone and findings were restricted to Royal Swaziland Sugar Corporation case alone. As a result, the findings can only be a good starting point for exploring the impact on human capital of introducing production technology. Further studies at industry and national levels could yield more informative results.

The study was a basic quantitative study that did not permit the collection of detailed and different opinions on the issues studied. The use of other techniques which have potential to investigate issues widely and in-depth such as applying a mixed methods approach, is recommended. This can yield more detailed information and quality for decision makers in industry, policy makers in government and for scholars.

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