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INCREASING OPERATIONAL MANAGEMENT EFFICIENCY IN TEXTILE ENTERPRISES: BASED ON THE INTEGRATION OF LEAN MANUFACTURING AND INDUSTRY 4.0 TECHNOLOGIES

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Abstract. This in the article textile in enterprises operational management efficiency increase theoretical and practical aspects research World in the economy of competition increase , work release expenses increase and consumers requirements change under the circumstances of enterprises operational efficiency increase current to the point The research focuses on the concept of Lean Manufacturing , Industry 4.0 technologies and digital transformation of tools textile in the industry application analysis Research methodology as systematic approach , comparative analysis , scientific abstraction , synthesis and generalization from the methods used . Results According to , Lean Manufacturing tools (5S, Kaizen, TPM, VSM, JIT) and Industry 4.0 technologies integration working release efficiency noticeable at the level increase , product cost reduce , work release cycle reduction and from resources use efficiency improve opportunity Research in the end textile in enterprises operational management efficiency increase according to practical recommendations working released .

Key words: operational management , textile industry , Lean Manufacturing, Industry 4.0, digital transformation , production release efficiency , TPM, Kaizen, 5S.

1. Introduction

World economy globalization under the circumstances textile industry the most competitive from networks one is considered . The last in years working release expenses increase , energy resources prices increase , ecological of requirements increase and consumers to quality was requirements increase enterprises in front of new tasks is putting . Such under the circumstances operational management efficiency increase of enterprises far term competitiveness provider main from factors one is considered .

Operation management of the enterprise working release resources effective management , production release processes optimization and value create chain to improve aimed at management activity as Heizer, Render , and Munson (2020) argue that modern operational management main purpose expenses minimize with one at the time product quality and customers satisfaction from increasing consists of .

Last ten The concept of Lean Manufacturing in the years working release efficiency increase the most effective from the means one as was formed by Womack and Jones (2003) working issued this concept working in the output losses reduce , value uncreated operations eliminate to grow and continuous improvement principles is based on .

From this In addition , Industry 4.0 technologies development working release systems digitization and automation opportunities expanding . Smart sensors , artificial intelligence , IoT,

Big Data and digital twin technologies working release processes in real time monitoring in mode and management opportunity Research on the integration of Lean and Industry 4.0 of enterprises operational efficiency noticeable at the level increase showing .

This of the article purpose textile in enterprises operational management efficiency increase modern mechanisms research to grow and Lean Manufacturing and Industry 4.0 technologies integrated model working from the exit consists of .

2. Research Methodology

In the study scientific of knowing general and special from the methods used . Including : systematic analysis;comparative analysis ; synthesis and induction ; scientific abstraction; content analysis ; bibliometrics analysis .

The research information database in Scopus, Web of Science and Google Scholar databases indexed scientific articles organization In particular , in the areas of Lean Manufacturing, Digital Lean, Industry 4.0 and Textile Manufacturing modern research studied .

Operation efficiency in evaluation following from indicators used :

1. OEE (Overall Equipment Effectiveness);
2. working release cyclical duration ;
3. working release cost ;
4. defective products share ;
5. labor fertility ;
6. working release from the power use level .

Also , Lean Manufacturing tools The effectiveness was also evaluated :

- 5S;
- Kaizen;
- TPM;
- SMED;
- Value Stream Mapping;
- Just in Time.

Analyses this shows that textiles in the industry especially 5S and Value Stream Mapping tools operational efficiency in increasing important importance profession will reach

3. Research and results

Analysing showed that textiles in enterprises operational management efficiency to increase obstacle doing one row systematic and organizational problems there is are , they are of enterprises working release results , financial indicators and in the market competitiveness negative impact In particular , in enterprises of equipment void to stand , to work release from the power complete unused , materials of the flow disproportionate organization excess , excess reserves formation , production in the output of losses high level , energy from resources ineffective use and working release processes enough at the level non-digitization main problems as was determined . This problems as a result working release expenses increasing goes , product price tag rises , works release cyclical extends and of enterprises internal and external in the markets competition advantages decreases . Especially in modern textile in the industry of orders short in terms of time execution and product to the quality being put of requirements increasing progress under the circumstances this problems enterprises of activity efficiency noticeable at the level limiting is putting .

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Analyses Lean Manufacturing concept throughout textile in enterprises operational efficiency in progress The importance of the study was also studied . results this concept working release in the processes losses minimize through of enterprises general efficiency increase opportunity to give Lean Manufacturing system excess working release , wait times , additional transportation costs , additional again work operations , plus reserves , surplus actions and defective products such as seven main to disappear to reduce aimed at is , this of losses eliminate to be working release processes to optimize service Research to the result according to the 5S system current to grow work their places effective organization work , labor discipline reinforcement , workers movements optimization and working release from the fields use efficiency increase opportunity gives . With this together with the Value Stream Mapping (VSM) tool use working release currents in detail mapping and value uncreated operations determination opportunity giving , in enterprises working release cycle duration to reduce service does .

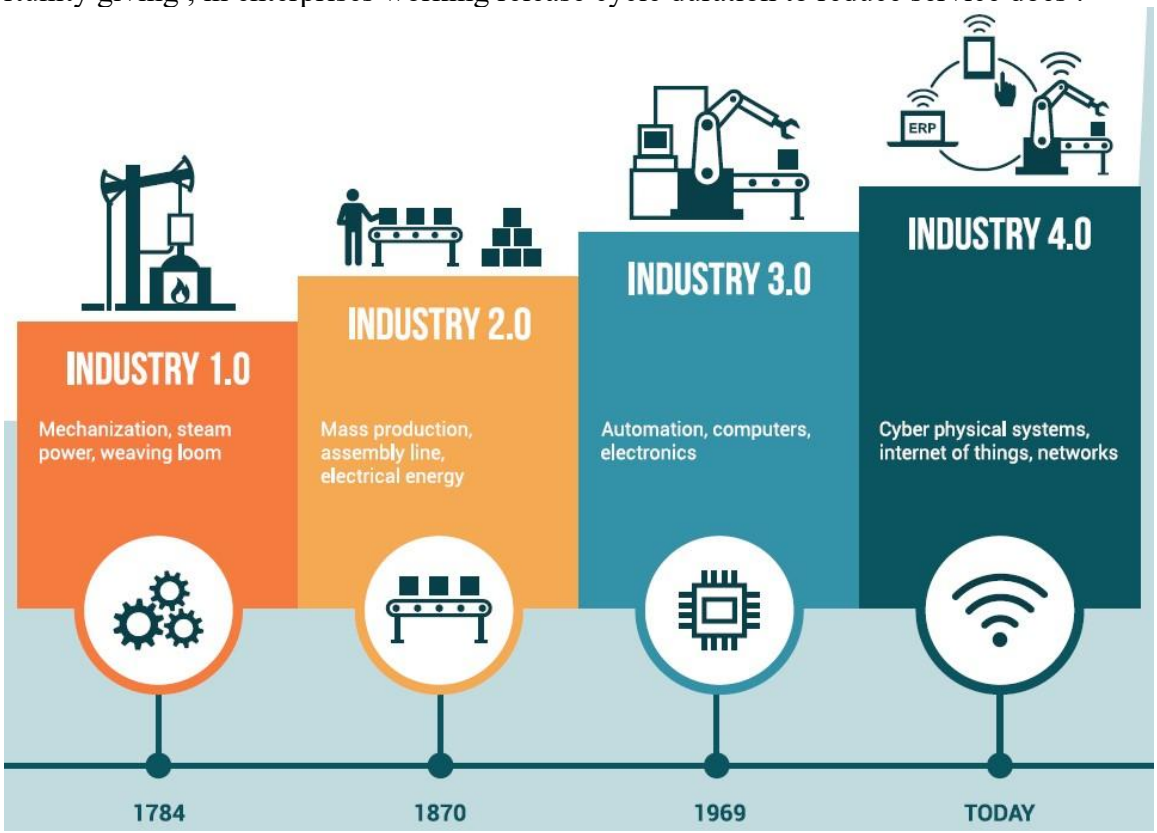


Fig.1. The industrial revolution and the subsequent steps [16]

Analyses this showed that the TPM (Total Productive Maintenance) system current to be equipment malfunctions and emergency stops number reduces , resulting in working of release continuity provided and OEE (Overall Equipment Effectiveness) indicators will improve . From now on In addition , the SMED (Single Minute Exchange of Die) method application equipment again adjustment time to reduce service to do , to work release flexibility increases and small at parties product working to release economic in terms of effective organization to grow opportunity Kaizen principles create current to be and employees continuous improvement to the processes attraction to grow through in enterprises innovative of culture to the formation and operational of processes regular accordingly getting better to go service does .

Research Industry 4.0 technologies during textile in enterprises operational management to the effectiveness Analysis of the impact Results this showed that IoT sensors , artificial intelligence , Big Data analytics , cloud calculation technologies and digital twins such as modern technologies working release systems efficiency noticeable at the level In particular , real time monitoring in mode opportunity equipment status permanent control to do , technological processes optimization and working in the output malfunctions in advance determination opportunity Predictive technician service show systems equipment from work from the exit before probable malfunctions define , technical service to show planning opportunity creates . This is repair expenses reduce and working of release continuity to provide service does . Automated quality control systems product quality over control reinforced , defective products share reduces energy monitoring systems and energy spending optimization through of enterprises expenses reduction opportunity gives .

Research results based on textile enterprises Lean Manufacturing and Industry 4.0 technologies for integration based operational management improvement model working This model is diagnostic , Lean transformation , digitalization and smart working release stages own inside Diagnostics in the phase working release processes are audited , OEE indicators is evaluated and value currents will be mapped . Next Lean tools such as 5S, Kaizen, TPM, SMED and JIT in the phase current Digitization IoT sensors , ERP systems , MES platforms in the development phase and Big Data analytics working release to systems integration will be done . Final in stages and artificial intelligence , digital twins and automated decision acceptance to do systems based on smart working release environment formation in mind is held . This model to practice implementation to be operational expenses reduce , work release efficiency increase , resources use level improve and of enterprises international in the markets competitiveness reinforcement opportunity gives .

Received results international scientific research with harmony part , Lean Manufacturing tools and Industry 4.0 technologies integrated without application separately to be used relatively to be more effective confirms . With this together , this transformation success human capital quality directly with related that was determined . Employees digital competencies develop them modern technologies with to work preparation and continuous education system on the road Putting Industry 4.0 technologies effective current in the process of important factor is considered . So weaving in enterprises operational management efficiency Improving Lean Manufacturing principles and digital technologies integration based complex requires an approach and this approach of enterprises far term stable development for important strategic factor as manifestation will be

4.Conclusion s

Research results following conclusions formation opportunity gave :

1. Operation management efficiency textile of enterprises competitiveness determinant main from factors is one .
2. Lean Manufacturing tools working in the output losses reduce and from resources use efficiency increase opportunity gives .
3. Industry 4.0 technologies working release processes in real time in mode management opportunities expands .
4. Lean Manufacturing and Industry 4.0 Integration separately to be used relatively higher the results provides .
5. Digital Lean concept textile of enterprises operational efficiency increase promising direction is considered .

6. Monitoring OEE indicators in enterprises system current to grow to the goal according to .
7. TPM and predictive technician service systems equipment efficiency increases .
8. IoT and Big Data technologies use working release expenses reduces .
9. Employees digital competencies develop necessary .
10. Offer done integrated model enterprises stable development and international in the markets competitiveness to increase service does .

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