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THE IMPACT OF INNOVATION ON THE MANAGEMENT OF MISAPPLICATION OF CHANGE IN THE PRODUCTION SYSTEM IN THE AUTOMOTIVE INDUSTRY

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Review Article

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ABSTRACT

Changes in the production system are always good information, because when there are changes, then there are production and processes. Errors or incorrect implementation of the change may occur with the implementation of these changes. Eliminating errors is one of the top priorities of any company that wants to achieve its quality goals.
This paper describes the process by which a change request was implemented incorrectly and its consequences. the aim is to avoid the incorrect implementation of changes. The paper also presents how to suppress the implementation process and the steps followed to discover errors. Researching the methodology shows that there are frequent errors in the process of implementing changes to easily products or services, but there are also many ways to solve them. Advanced technology helps to discover them and remove them in the best possible way.
In conclusion, the paper, decided that it is important that the changes brought in the process are carefully monitored and that there is a traceability of the information that is related to the change.

Keywords: *Production system, Internal Coordination, Local Coordination, regularly meetings, Human Errors, Change description, Engineering Change Request.*

1. INTRODUCTION

The automotive industry is transforming as innovative technology, shifting business models and changing driver behaviors impact the way cars are designed and built. Innovative technology is increasing the complexity of car designs, while rising adoption of ride sharing services are pushing the limits on product reliability and "zero failure" safety and security, as cars must withstand multiple drivers and longer driving times (Thompson, 2020).
The presented paper described the process of Engineering Change Request and the flow from creation till implementation. This analysis was made in a company with activity domain in Automotive industry and which make production series for car parts.
Because not always the process is correct then can appear errors. These errors can cause problems and problems like these can affect the customer. From this reason was started this analysis and this topic is still open in company.
A core principle in company is the removal of problems within an operation. And in any business, one of the heaviest drains on profitability is waste. The problems can come in the form of time, material, and labor. But it may also be related to the utilization of skill sets as well as poor planning (Gay, 2016).

In today's manufacturing environment, different parts manufactured in-house and bought from suppliers are often assembled into a finished product. Competition has made it very important for companies to deliver a customized product on a promised date (Asamoah-Barnieh, Smedberg, 2009).

As stated by Mannan and Ferdousi (2007) "the key to competing in the international marketplace is to simultaneously improve both quality and productivity on continual basis." In today's competitive and changing business world, lean production philosophy has brought changes in management practices to improve customer satisfaction as well as organizational effectiveness and efficiency (Karim, Kazi, 2013; Ferdousi and Ahmed, 2009). Customers are now demanding a wide variety of products at a lower cost but with fast delivery (Ferdousi and Ahmed, 2009). They also expect more innovative products at competitive price as customers have more opportunities to choose from a variety of products.

The aim of this work paper is to describe and relate a case when an Engineering Change Request was wrong implemented in production system. Also, the work paper presents the best way for avoid these cases.

For presented work paper I was involved in implementation process, and I met cases when an Engineering Change Request was wrong implemented. Because I am part of Product Data Management department, I am involved in this process and always the attention is very important. The data accuracy must be a priority in implementation process of Engineering Change in production system.

1. METHODS

Organizational change happens every day as a matter of course. The challenge lies in instituting and managing manufactured change in a deliberate and focused direction, and within a specified timeframe (Dickson, 2020).

A change initiative can be any attempt to initiate organizational change - from new products on the market to changes in workflows. Change initiatives require management - however, not all change management initiatives are successful. Most probably you have had the chance to see some of these initiatives fail firsthand (Nini, 2020).

The change process is started when appear a new idea for optimization any products or processes. This idea will explain in an Engineering Change Request. The process for Engineering Change Request is standard for each type of change, the difference is only the type of flow. This can be correction, when the change will change something in text documents or a minor change which does not affect fit, form or function of the product. In this type of flow will be involved only the initiator and the manager of initiator. Another type of flow can be engineering change. In this flow, regularly, is involved also the customer. In this type of flow will be involved also all responsible persons from affected department. This means that the new change will affect one product or one process. This is the longest type of flow. And the last type of flow is simplified flow. This flow looks like correction flow but can be involved also responsible persons from affected departments (Pop, 2021b).

With an Engineering Change Request, the change is described and approved by all involved persons and departments. The Engineering Change Request will go through from different steps and in the end will be implemented in production system. This step is proceeded by Product Data Management Department. They are specialized in implementation of the changes in production system.

For a correct implementation, in production system, the Product Data Management Department need a correct and detailed change description.

The change description is one of the most important field from Engineering Change Request. For this reason, is very important that this will be correctly completed. The change description also

presents a standard structure which must be followed. The first step will be to select if the change is minor change or if the change will affect some special characteristics, or if is necessary that to be added additional approvers. Further will be mentioned a short description for change. It is something like a brief description and will be used when the Engineering Change Request will be implemented in production system. With this brief description will be easier to know what is changed by the Engineering Change Request.

The next step will mention if exist another Engineering Change Request which can affect the actual change. Normally this point is marked with no but exist some cases when exist another change who depend on the actual change.

Further will be described the detailed change. For example, what will be change from who in what, if is necessary create something new in production system, if something will be deleted.

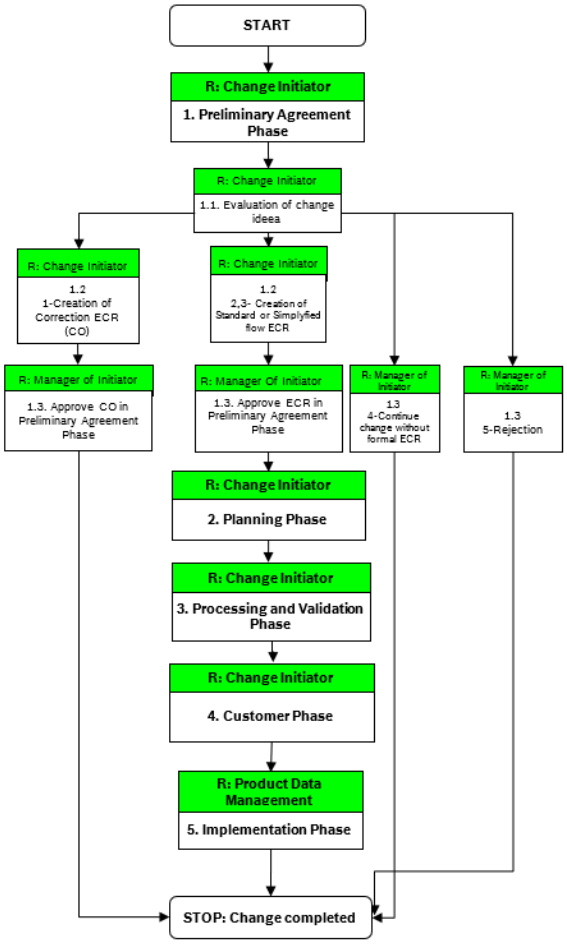
The next step will mention the affected parts, products, sensors or documents. Further will be mentioned also the reason of this change. This is important because is possible that some involved persons do not understand exactly the change.

The last step is risk estimation. All Engineering Change Request must to present a risk evaluation. This procedure will assure that if something issues wrong the risk is known and all involved persons know what must to do.

The present work paper will present a study case when the change description was wrong described, and the Product Data Management department implemented incorrectly the change in production system (Pop, 2022).

For a better understanding for the process, follow below figure:

Figure 1. Engineering Change Request flow.



Source: Internal, from analyzed company.

When you dig deep enough, you will find a wide range of root causes that are unique to the specific change initiative that failed. Once you collect information about all those root causes, you should cluster them into categories with similar themes you will get valuable insights into why change initiatives fail in general. While this work paper won't tell you in detail how to prevent a change initiative from failing, it will at least provide you with some guidance on what to consider keeping it on track next time (Nini, 2020).

3. RESULTS

Change management is a systematic approach to dealing with the transition or transformation of an organization's goals, processes or technologies. The purpose of change management is to implement strategies for effecting change, controlling change and helping people to adapt to change. Such strategies include having a structured procedure for requesting a change, as well as mechanisms for responding to requests and following them up.

To be effective, the change management process must take into consideration how an adjustment or replacement will impact processes, systems, and employees within the organization. There must be a process for planning and testing change, a process for communicating change, a process for scheduling and implementing change, a process for documenting change and a process for evaluating its effects. Documentation is a critical component of change management, not only to maintain an audit trail should a rollback become necessary but also to ensure compliance with internal and external controls, including regulatory compliance (Prat, 2022).

In the industrial business process, one of the efforts to increase productivity and quality is to Prevent Error and Detect Error. Productivity is a mental attitude that always holds the view that today's quality of life must be better than yesterday, and today is done for the good of tomorrow. To achieve an optimal level of productivity, it is necessary to make a multidisciplinary approach that involves all efforts, skills, expertise, capital, technology, management, information, and other resources in an integrated manner to make improvements to improve the quality of human life (Prabowo, Siti, 2020).

This case study was realized in a company from Romania. The company has the main plant in Germany. The internal production has the application domain in automotive and the main activities are making car sensors.

The process, for implementation the changes in production system, is started when the Engineering Change Request is already approved by all involved persons from affected departments, is checked and approved by a specialized team, which is called Review Team and is also approved by customer, when is necessary.

In cases when the customer approval is necessary, exist also samples with the new change, already created and analyzed (Pop, 2021a).

All documents which show that the new change is valid are attached in Engineering Change Request and can be viewed by anybody.

When the Engineering Change Request arrive at Product Data Management Department, they will check all fields, will check what about will be changed in production system and will check how much plants are affected. The change must be implemented for all affected plants and in distribution list, where are all persons who approved the change must to be also persons from all affected plants. The Product Data Management Department from Lead Plant will be responsible to implement the change for all affected plants.

If all right, the implementation phase can start. Below we can see change description for a change who was wrong described and caused errors in production system:

0: Process relevant information:

- Change Requester: Name on Engineering Change Initiator

- minor change?

-> NO [point can be deleted]

-> YES: Comment all footnote issues out of following Links.

- management release?

-> NO [point can be deleted]

-> YES: see chapter 5 for more information

1: Change description: Correction of drawing for customer product on the component

1.1 Short overall change description:

[clear description (Project name, Headline ...)]

Correction of drawing for customer XXX product number 1234567891 on the component, only in drawing. No physical change.

Wrong marking: XXXX.XXX.XXX

Correct marking: XXXX.XXX.XXX

Customer affected: XXX

PN affected: 1234567891

Plant affected: Romania

DEX not needed / No components changed

1.2 Additional Engineering Change Request requirement, information or customer request:

[If necessary/available]: Not available

2: Detailed change description:

[What will be changed: e.g. part list ...]

- from: ... ?

- to: ... ?

Only Last Process Change will appear in bill of materials with the number of this Engineering Change Request

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Create new ... Not affected

Delete … Not affected

3: Information of affected products:

- affected product: Original sensor for speed

- affected parts: Original sensor 1234567891

- affected sensor: One Product Number

- affected documents: Tests and capabilities attached in Engineering Change Request

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4: Reason of change:

[Describe clearly and understandable! Why do we need this change?]

The customer requests a new type of component in drawing of sensor.

5: Further concerns / hints / remarks

- Special characteristics (SC) affected

-> NO

-> YES:

- additional approvers:

-> NO

-> YES:

- Are heat and surface treatment operations affected?

-> NO [heat and surface treatment information can be deleted]

-> YES:

- Should ECR be implemented with management release?

-> NO [Point can be deleted]

-> YES: Reason

6: Risk estimation (!! required for each Engineering Change Request !!)

Is Risk estimation necessary (change in fit, form, function or process)?

-> NO ->Risk estimation not necessary because

product variant with fit, form, function and process already in serial production.

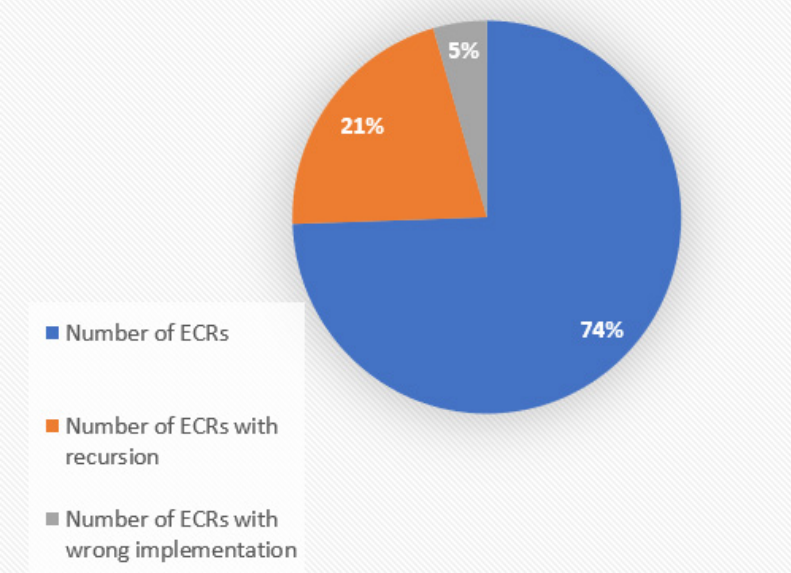
-> YES -> please attach risk estimation

So, if we go through above change description created for an Engineering Change Request , all appear all right and the change in production system is only in the last line from bill of materials.
All that is with bold is completed in template by initiator of Engineering Change Request.
The change will appear, in production system, like this:

Line xxx.x Last Process Change YYYYY Date: 30.03.2022 By: YYYYYYYYY

This line means that a new Engineering Change Request changed something which not affect the fit, form or function and will appear in bill of materials only for traceability.
This line will appear in all affected plants.
In bill of material, each line has assigned a number, in our example, the line is noted with xxx.x and each change are realized with an Engineering Change Request number which in our example is noted with YYYYYYYYY.
In the moment when the Product Data Management will release the change in production system the bill of materials will be changed for all affected plants and the production process will function with the new change.
In our case in production process is not exist any change, so, the process will remain same, but the really change which was to exist is a change in drawing, requested by customer.
Because the initiator of Engineering Change Request completed wrong the change description, the implementation is not ok, and this problem can lead to complains from customer. This problem is very seriously for company and a point like that is bad.
Coming back at our case, after release from Product Data Management Department, the production process remained the same and all worked good till in the moment when somebody from production saw that the change from customer is not in production system.
Usually, every production department has a responsible person which check all Engineering Change Request after implementation in production system. In this case was checked later and in this moment the responsible has announced the Product Data Management and the manager about this error.
If the decisions are based on strong feelings, when emotions are not controlled in a constructive way, can be wrong decisions. From these reasons is important that the chosen way must be the correct one and the right one. (Dâmbean; Gabor; 2021).
In general, in these cases is applied part of Lean Manufacturing process. With Root Cause Analysis can be find the reason of this error and can be defined the next step to avoid this situation.
For starting the Root Cause Analysis process the Engineering Change Request will be checked again by Product Data Management Department together with Local Change Coordinator for affected product and the initiator of Engineering Change Request.
All fields are completed clearly, and all seems like good, until at change description. When Product Data Management department understood exactly what Engineering Change Request will change in production system then they understood where the problem is. Is clearly that the problem was caused by a wrong change description and even if, the Product Data Management Department can fix this problem, the production system will maintain the history of changes. So, the problem was solved in time and the customer do not was affected, but this error caused scrap products. Scrap products means additional costs for company, and this will cause discussions in high management level.
For an overview about how many cases can appear in one year with wrong implementation I create a statistical chart. For this analysis I used a base of dates with all Engineering Change Request which was created and implemented last year (Pop, 2021c).
Below we can see the dates from analysis. Even if it is small, there is a rate of 5% with wrong implementation the Engineering Change Requests in production system.

Figure 2. Status of wrong implementation of Engineering Change Request in production system.



Number of ECRs	Number of ECRs with recursion	Number of ECRs with wrong implementation
67	19	4

Source: Internal, from analyzed company.

This result can cause problems in connection with customer, but if the coordination process unfolds well, in time, this problem can be solved easily.

4. DISCUSSION

The three characteristics of collective term are team organization, cross training and employee involvement. Team organization means that the workforce is organized in small teams, who are most of the time heterogeneous in expertise and are responsible for a part of the production process. This team can be responsible for a certain product or 'product family'. Because the team members have different expertise and backgrounds they can approach the waste from different angles. The element of cross training means that employees are trained to do a variety of tasks. Task can include handling different machinery, doing quality checks, or minor machine repairs (Deflorin and Scherrer-Rathje, 2012). This way, personnel can more easily replace people that are absent or help where extra capacity is needed so waiting time is minimized.
Defects control, standardization and bundled techniques all prevent mistakes, variability and inefficiency. To make defects control work effectively the culture has to change, and the workers have to be trained. To be able to prevent mistakes, you first need to find and locate them (Cornelissen, 2013).

5. CONCLUSION

Improvement strategies consists of improvement circles, continuous improvement, and root cause analysis. Continuous improvement can be traced back to the plan-do-check-act methodology.
Being part of Product Data Management department, I am involved in implementation process I am always informed about all changes with affect the company processes or products. The company has a good strategy and it use the Lean manufacturing processes for resolve the deviations. For this reason, exist a good traceability in internal communication and all information are know by all involved responsible persons.
Internal, in company are clearly defined the strategy and the steps for way to work. All processes are clearly defined and describes and are accessible for responsible persons from involved departments.
In the way of this work paper was some steps when the information was not available or some parts was of process was blocked in involved departments, but always, in the end there was a solution to find the root cause and solve the deviation.
At the end of this work paper, we can conclude that it is important to implement tools and techniques in a holistic way. While in the implementation process, it pays to carefully consider which steps to take, to prevent sub optimal results or even failure. Constantly keeping in mind not to exaggerate and overdo the initiative will increase the chances of a successful implementation.
When people know what to expect, are not blamed for mistakes or defects, and are shown how they are going to personally benefit, the employee resistance will be minimized.
Technological advancement has contributed to fundamental changes in the tourism industry and helped people to make a travel decision. Once this decision more ways are opened to news and learn about another technical instruments which can make the production system better then never (Varga; Gabor; 2021).
Is very important to always have a good traceability of changes and more points of view, because in some cases the mistake can be found in this way.

REFERENCES

Asamoah-Barnieh R., Smedberg K. (2009). The Problem of Missing Items at the Time of Production: A Case Study at Fläkt Woods in Jönköping. Thesis Work, Lap Lambert Academic Publishing, ISBN-10 : 9783838388656. https://www.amazon.com/Problem-Missing-Items-Time-Production/dp/3838388658.

Cornelissen R. (2013). What are the main challenges when implementing lean and how do industry and company characteristics influence these challenges? Bachelor thesis, Wageningen University. https://edepot.wur.nl/286448.

Dâmbean C. A., Gabor M. R. (2021). Implications of Emotional Intelligence in Human Resource Management. *ECONOMICS*, 9 (2), 73-90. https://doi.org/10.2478/eoik-2021-0016

Das S., Patnaik A. (2015). Production planning in the apparel industry; Chapter 4.7 Manufacturing performance improvement through lean production. *Garment Manufacturing Technology*, Corpus ID: 167084922, 81-108. https://doi.org/10.1016/B978-1-78242-232-7.00004-7.

Deflorin, P. and Scherrer-Rathje, M. (2012). Challenges in the transformation to lean production from different manufacturing-process choices: a path-dependent perspective. *International Journal of Production Research*, 50(14), 3956-3973. https://doi.org/10.1080/00207543.2011.613862.

Dickson G. (2020). 10 Reasons the Change Management Process Fails (and How You Can Succeed, https://www.workzone.com/blog/10-reasons-the-change-management-process-fails-and-how-you-can-succeed/.

Ferdousi F., Ahmed A. (2009). An Investigation of Manufacturing Performance Improvement through Lean Production: A Study on Bangladeshi Garment Firms. *International Journal of Business and Management*, 4(9), 106-116. 10.5539/ijbm.v4n9p106.

Gay C. (2016). 8 Wastes of Lean Manufacturing. Machine Metrics https://www.machinemetrics.com/blog/8-wastes-of-lean-manufacturing.

Karim A., Kazi A.(2013). A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Business Process Management Journal*, 19(1),169-196. https://doi.org/10.1108/14637151311294912.

Mannan S. R., Ferdousi S. (2007). Relationship of Forced Vital Capacity. *Journal of Bangladesh Society of Physiologist,* 2, 7-12. https://doi.org/10.3329/jbsp.v2i0.976.

Nini M. (2020). 12 reasons why change management initiatives fail and how to fix them. Online blog, posted in Change Management. https://www.ckju.net/en/blog/12-reasons-why-change-management-initiatives-fail-and-how-fix-them/99013.

Prabowo R. F., Siti A. (2020). Poka-Yoke Method Implementation in Industries: A Systematic Literature Review. *IJIEM (Indonesian Journal of Industrial Engineering & Management*), 1 (1), 12-24. https://publikasi.mercubuana.ac.id/index.php/ijiem/index.

Pratt M. K. (2022). Change management. https://www.techtarget.com/searchcio/definition/change-management.

Pop O. B. (2022). Impact of Engineering Change Request in Production System in the Pandemic Period. International Conference on Business Excellence, Vol. 16. https://bizexcellence.ro/icbe-conference/.

Pop O. B. (2021a). Theoretical Review of Engineering Change in Automotive. International Conference of Doctoral Students Andyoung Researchers. https://phd.umfst.ro/.

Pop O. B. (2021b). Analysis of Key Performance Indicators Impact of Change Requests in Order to Optimize the Manufacturing Process. *ACTA MARISIENSIS, SERIA OECONOMICA*, 15 (2), 1 – 10. https://doi.org/10.2478/amso-2021-0006.

Pop O. B. (2021c). Dynamic Analysis over the Changes Impact in Production Process in Automotive Industry. *Acta Marisiensis. Seria Technologica*, 18(2), 7-12. https://doi.org/10.2478/amset-2021-0011.

Thompson A. (2020). Error-proofing production for automotive manufacturing https://www.quality.org/knowledge/error-proofing-production-automotive-manufacturing.

Varga I. E., Gabor M. R. (2021). The Influence of Social Networks in Travel Decisions. *ECONOMICS*, 9 (2), 35-48. https://doi.org/10.2478/eoik-2021-0015.