A Work Project, presented as part of the requirements for the Award of a Master Degree in Management from the NOVA – School of Business and Economics.

Developing a Strategy for Business Unit of Tool & Die in Volkswagen Autoeuropa

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A Project carried out on the Master in Management Program, under the supervision of:

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Lisbon, January 3, 2018

Acknowledgments

I would like to thank to my advisor, Professor Manuel Baganha, for the support during my work, motivation and knowledge. His assistance helped me to perform my work and writing this thesis. I would like to thank my advisor in Volkswagen Autoeuropa Joana Domingues for her guidance, full-time availability, assistance, knowledge and motivation. She helped me understand the company's strategy and provided me with all the contacts and access to various areas of the company

Thank you to Anderson Capuzzo for his guidance, knowledge and for gave me access to the Tool&Die Unit and facilities at Volkswagen Autoeuropa.

Thank you to Margarida Pereira for giving me the opportunity develop this work and supporting me during my internship in Volkswagen Autoeuropa.

I would like to thank all of the IELM and Stamping members for their help and support in during my internship.

I also would like to thank for Volkswagen Autoeuropa giving me the opportunity to development my work.

Abstract

The main purpose of this thesis is the develop a strategy for the Tool&Die unit in Volkswagen Autoeuropa, to contribute for competitiveness of the factory. During my work I develop a group of KPI´s to evaluate the performance and follow the implementation of the strategy, the majority of them were implement. The KPI´s are: Absenteeism, Hours of specific training, Hours by project, project stage and overtime, Machine and Press uptime, Milestone achievement, €/project, Operative results, Index of work accidents, and medical restrictions, Costs of non-quality, NC´s per stage, AK and BK per stage, Superficial report and Additional work.

Volkswagen Autoeuropa, Tool&Die, Strategy, Productivity

Contents

Introduction

The automobile manufacturing is still the world´s largest manufacturing activity, with nearly 50 million new vehicles produced each year. However, this industry is constantly changing for example, after World War I, Henry Ford and General Motors´s Alfred Sloan moved the world manufacture from centuries of craft production into the age of mass production, allowing a more flexibility and consistent interchangeability of parts and the simplicity of attaching them to each other what can be done by semiskilled or unskilled workers. An additional fact that has impact on the automobile industry was the introduction of automation, that contributes to gradually reduce the need for assemblers and the introduction of the indirect roles that helps to design tasks, parts and tools that could be handled by unskilled workers (Womack, James; Ross, Daniel; Jones 1993). After World War II, Eiji Toyoda and Taiichi Ohno at the Toyota Motor Company in Japan pioneered the concept of lean production that changed the industry as well, by using less of human effort in the factory, manufacturing space, the investment in tools, engineering hours in developing a new product and time. The main goal pursuing the perfection and continuous improvement is based on building with quality, standardized work and follow work instructions (Womack, James; Ross, Daniel; Jones 1993).

One of the most notable Group in Automotive Industry is Volkswagen Group, and one of the factories of the group is Volkswagen Autoeuropa in Portugal, where my thesis was developed. I decide to focus on Tool&Die Unit since this unit is at a moment a point of differentiation comparing with other plants of the Volkswagen Group what, is an opportunity to develop this analysis. The fact of developing this thesis in the company allowed access to data and information's making this work solid proposal that suits the objectives and will add value for the

company. It should also be referred that the access to the key decisions makers was faster and more direct, contributing to a quick exchange of perspectives about the approach when necessary and a quicker implementation of the work when it finished (Eisenhardt and Graebner 2007). Developing the thesis in Volkswagen allowed me to observe the daily operations of the company, interact with corporate actors, participate in brainstorm sessions and learn about the different business areas of the company. In the next pages will be present how the Tool & Die Unit could become more competitive and the process create to measure the strategy in a long run. Moreover, it was present a proposal of how could the Tool & Die Unit become more productivity in the daily operations. The final goal is to contribute to an increase in the competitiveness of the unit by presenting a proposal of how the unit could become more productive.

Tool and Die Manufacturing in Automotive Industry

Global Scenario and Main Trends in the Tool Shoop

Automotive stamping dies and press lines are high cost and longtime time investments, for being competitive in this industry the main manufactures need to combine strengths of their engineering and manufacturing teams. The main goal of a Tool&Die unit is to produce tools that allow build stamped parts with right dimension that fit in the type of press that the tool will work and fulfill the requests of meccanization and robotization (Siemens 2015). The

Figure 1 shows an example of a Tool produce, in this case, in Volkswagen Autoeuropa.

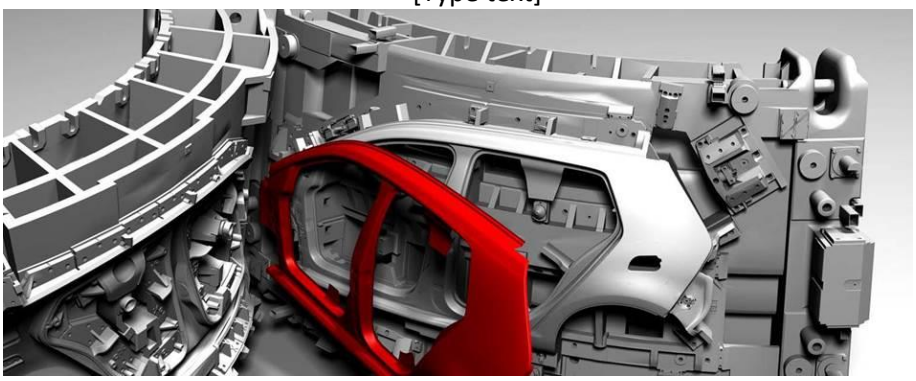

Figure 1: Example of a Tool (Source: Volkswagen Autoeuropa)

The most important particularly in this job is the high amount of training needed to become a fully trained tool and die maker, usually is necessary four or five years of part time classroom work in a technical college, while working full time and on the job training. Nowadays this industry is facing a looming skills shortage, for example some often do not have the skills needed in a highly computerized environment which could compromise the level of production, the quality and productivity. However, the major limiting factor is reduced number of people entering in this occupation, most of young people who have the educational and personal qualifications necessary to learn tool and die making usually prefer to attend college or do not wish to enter production occupations (Siemens 2015). To overcome countries like China, Portugal and the remaining European countries need to bet in manufacture intelligently and rationally to compete with low wage countries (Acworth et al. 2007). The Future of toolmaking is on the adoption of new technologies such as 3D printing, investing in automation of some stages of the project, workforce development, high end equipment, as well as shifting operations towards industrialization and toolmaking 4.0. Is important investing in new concepts in tool making that can further increase quality as well as productivity, flexibility, efficiency and shorting lead times. In this sector the global trends are: Increase the stroke rate by 10%, reduce try out time by 70%, reduce die design errors by 90% and finally reduce tooling design cost by 50% (Siemens 2015).

Volkswagen Group : Strategy 2025

The Volkswagen Group is a German Group with its headquarters in Wolfsburg, the brand is one of the world's leading manufacturers of automobiles and commercial vehicles in Europe. The group has 120 operations plants in Europe, Asia, Africa and Americas, and comprises twelve brands: Volkswagen Passenger Cars, Audi, SEAT, ŠKODA, Bentley, Bugatti, Lamborghini, Porsche, Ducati, Volkswagen Commercial Vehicles, Scania and MAN. In addition, the Volkswagen Group offers a wide range of financial services, including dealer and customer financing, leasing, banking and insurance activities, and fleet management. The **Vision** embodied in the group is Volkswagen Group becoming a leading provider of sustainable mobility, in order to achieve this the **Mission** of the group is based in four premises: develop tailor made mobility solutions to the customers, serve diverse needs with a portfolio of strong brands, assume responsibility regarding the environment safety and social issues and act integrity and build on reliability, quality and passion. The brand is perceived as symbol of character and reliability, and has a huge focus on quality but at the same time offers an affordable price to the customers (Volkswagen 2017).

The automotive industry is going through a period of change due to external factors mainly linked with digital transformation where will be implement self-driving systems, e- mobility and connected vehicles concepts which will contribute to evolutionary changes that force the Volkswagen group to reposition the brand for the future(Mohr, D; Muller, N; Krieg, A; Gao, P; Kaas, H W; Krieger, A; Hensley 2013). The strategy 2025 aims to positioning Volkswagen as a driving force behind expansion of electro mobility and by 2025 more than 30 models will be electric. The main targets that the group wants to achieve are a margin of 8% and annual unit sales of 2 to 3 million e-cars by 2025 (Volkswagen AG Wolfsburg 2017).

Volkswagen Brand: Transform 2025+

The Volkswagen Brand stands for innovative, high-quality and reliable cars. Volkswagen is represented in all key market segments with more than 70 different models. It supplies most of its cars to customers in China and Germany. In 2016 the Volkswagen brand had a revenue of 105.651 (€ million) and the deliveries by market are Europa/Other Markets (31.6%), North America (9.7%) , South America (5.6%) and Asia-Pacific (53.0%) (Report 2016). Until 2030 the brand wants to be able to offer mobility solutions, worldwide, and a digitally linked production, for achieving this purpose, until 2025 Volkswagen wants to be a reference in E-mobility and until 2020 focus on the restructuring and financial turnaround (Volkswagen 2017).

The strategy transform 2025+ is specific to Volkswagen brand and integrity and sustainability were defined as key elements of the strategy in order to reinforce trust in the Brand. The Brand wants develop new products based on MEB (Modular Electric Toolkit) and produce 1 million electric cars per year, to do so is necessary 35% fewer hours of labor per vehicle during the production process and having implemented lean and digital processes. The Volkswagen brand wants to achieve a position as “Top of Volume”, meaning intend to become the leading high-volume manufacturer in the most important international markets. It is expect by 2025 to have a profit margin of 6% what will be accomplished by betting in electric vehicles in a way that motivates customers to switch from conventional vehicle technologies. In order to be successful in accomplished the goals proposed is important establish important partnerships both between brands of the group or external companies where the services could complement the Volkswagen products (Volkswagen AG Wolfsburg 2017).

Transform Factory +

In order to become globally competitive in volume segment and become the world leader in e-mobility the most important area in the brand is Production and Logistics and must be adapt to this changing market environment in order to be successful in the future and to operate the best factories worldwide for e-mobility by 2025. The strategy established by the Volkswagen group allow that each factory and division implement their own plans for change and contribute to the success of the brand. Through the structure and the contents of the Transform Factory + is ensured a continuous process worldwide with which every manager of the Production & Logistics team is able to position himself with his team and contributing to the brand strategy Transform 2025 + and for Group Strategy (Volkswagen AG Wolfsburg 2017).

The transform factory has twelve different key actions areas, **Factories of the future**: -50% factory cost per vehicle (This action area is focus on digitalization, automation and innovation in production areas), **Optimal Investment**: Achieve an investment ratio for vehicle construction of less than 2.5% of the Volkswagen brand´s sales. **Logistics:** Reduce logistics costs per vehicle by 30%, **Productivity**: The aim is to reduce hours per unit by 35%, **Ramp Up Excellence**: The goal is 95% ramp up efficiency, **Think Blue Factory**: Sustainable production processes in resource optimized factories, thus helping to relieve strain on the environment caused by production by 45%, **Sustainable structures**: The goal is achieved a flexibility gradient of > 1. Meaning that fixed costs will fall more than variable costs, helping to increase flexibility, **Demographics & Ergonomics**: The goal is to reach a utilization rate of 100%, **Team of the future** : Reaching 81 points in team index, **Quality**: Achieving a quality index of 100% and **Designed for Manufacturing**: Gutanteil of 100%. Each action area is made up of a strategic goal, a KPI with a target for 2025 and a detail work package, which is broken down in initiatives, which contribute

to the brand targets (Volkswagen AG Wolfsburg 2017). One of the most important points in the strategy is exchange of measures across all factories of the brand. The measures can be from Volkswagen brand plants, measures from visits to competitors or group Top measures. Each area in a given factory will have their own strategy and adapt the orientations given by the central given their own input, the performance indicators are top-down deployed, ensuring the definition of targets from the production area level to the shop floor staff level. Every worker need to know what is the strategy and how they can contribute to achieve this goal

Volkswagen AutoEuropa

The AutoEuropa is one of the factories belong to the Volkswagen Group, located in the industrial park in Palmela, Portugal. Now is producing 4 different models: Sharan, Scirocco, SEAT Alhambra and T-ROC (Start being produce in August 2017) (Volkswagen AE 2017). Autoeuropa regarding the strategy proposed by Volkswagen, has his own strategy that until 2030 is expected to be an add value plant for Volkswagen Brand, for this is expected that until 2025 the brand is to be sustainable in core processes of the business. In short term, until 2020 Autoeuropa intends to become competitive in terms of cost, by reducing -1000€/car this goal is align with the Volkswagen strategy of restructuring and financial turnaround.

Business Unit Tool and Dies Evolution

During my internship I have the opportunity to understand how it works the tool shop of Volkswagen Autoeuropa and in the following paragraphs I will explain what I learn, in order to understand the work later developed. This Business Unit (henceforth called BU) is responsible for the manufacturing of Tools and Die for the parts production. This Unit has a great strategic impact in Autoeuropa because is a unit that doesn´t have a direct impact in core production and besides that there only 5 Volkswagen plants that are able to produce Tools and Dies, which show that the

remaining plants in Volkswagen Brand doesn´t have this type of unit. In Autoeuropa are produced tools for the production of fenders, bonnets and the roof of Volkswagen Vehicles; however the expertise is in the production of fenders and bonnets. The main client of the Business Unit is Volkswagen Brand and the priority is producing tools for Volkswagen vehicles, however in case of having capability is possible the production for other brands of Volkswagen Group and besides the production of tools this unit performs maintenance work in Autoeuropa.

There are 4 stages during the project: Engineering (Design and structure of the tool) Machining (Die manufacturing), Assembly (Assembly of Components) and Try Out (Adjustments and optimization to assure the production of the part without any irregularly). In the Engineering stage, a viability study to build the tool using CAM (Compute Aided Manufacturing)/CAE (Compute Aided Engineering) software is made and several simulations are performed until the desire outcome is achieved. The following stage is Machining, where are used the CNC (Computer numerical control) data to develop the machining program. Some of the components after machining need to be assembly and some adjustments need to be made to ensure the right performance of the tool, and this work is done manually by tool makers. The last stage of the process is the try-out, where is assure that the parts obtain by the tool has the right dimension and with required quality, adjustments are made until the part has the right dimensions

In tool production there are taking in account three important factors the quality, stability (evaluated in terms of superficial audit, dimensional report and function verification) and productivity (evaluated in terms of strokes/min), to assure that the tools is producing the parts with right dimensions, parameters and quality [12].There is three important stages that can be overdue, that are VFF (the parts are not yet with the right dimensions and superficial requirements) PVS

(Parts with regular surface and with right dimensions) and SO (Parts with exact dimensions and surface).

This unit resort to external companies to perform some of the work, however there is a distinction between what is Class 1 or Class 2 Part, when is a Class 1 part all of the work is perform in the BU, on the other hand in Class 2 part everything that exceed the capacity (Annex I) is perform be an external company. Usually, in engineering stage 70% is made by an external company and 30% is made in BU, in Machining 60% external and 30% internal, in Assembly the percentage is 50% both internal and external and finally in the try-out everything is done by Autoeuropa BU, once that as more impact on quality.

In terms of Business Volume evolution is expect an increase of tools produce until 2021 because of the new launches project for Volkswagen Group which lead to a greater necessity of producing new tools. The growth until 2021 (Annex II) is expected to be 25%, part due to an investment to Tool shop extension to follow the strategic decision for incorporate core external stamped parts in their business, this extension will have positive impacts in the business (Tool&Die 2017).

Competitive scenario in Europe Tool shop

The main competitors of this Business Unit are the other BU´s in Volkswagen Brand, Wolfsburg, Osnabruck, Mexico and Brazil. However outside of Volkswagen there are External suppliers able to produce tools and can be seen as a strong competitor. In the following charts is presenting the comparison between the main competitors, in five parameters. The parameters are Labor Cost that was evaluated based on Labor Cost Index, in Germany the index is 111.97, in Brazil is 140.43, on the other hand in Portugal is 110.10, which can corroborate the fact of producing in Portugal is cheaper comparing with Germany. In Mexico the index is lower comparing with other countries, 81.30 however the logistic cost of shipping a tool is much higher comparing with European units

like Portugal and Germany ("Trading Economy" 2017). The recognition and expertise are related with the capability and skills needed for production and development of the tools, each plant has expertise in different types of parts or for example the plant in Wolfsburg had the expertise in producing doors and side panels. In terms of capacity was evaluated the capability of receiving more tools and do more projects, currently with increase of the demanding some plants aren't able to receive more projects which opens the opportunity to other plants gain a new position. In terms of the location this comparison was made assuming that Autoeuropa is positioned to be competitive and offer solution for European Market. And finally, the last parameter shows if the tools are produce in Volkswagen Group, which allows a greater flexibility and not relaying on external suppliers for produce tools and die. The competitive scenario was analyzed, and the outcome is present in the Annex III, this analyze was performed during my internship, using all the knowledge gain about this unit.

Regarding the capacity of Autoeuropa, currently the present status in terms of manpower and facilities needs to be adapted to be able to address the current market needs and changes in terms of volume to be produced. Until 2020, an extension will occur which allow an increase in terms of facilities and employees which will contribute to the growth of this unit and consequent growth of Autoeuropa plant. This invest will contribute to the increase of capacity of Autoeuropa Business Unit. The most well positioned Business Unit is Volkswagen Wolfsburg, so in order to improve the productivity is important analyze the productivity comparing with Wolfsburg. The main criteria for comparison were the labor cost, the quantity of NC´s and the time spending by each team. In Autoeuropa there is more 70% of NC´s comparing with Wolfsburg, however this trend during 2017 is starting to exchange and by the end of 2017 the percentage should be around 20%. The time spending by each team is different between two units, in Autoeuropa the unit spends

more 50% of time in machining, more 30% of time in try-out and less 40% of time in Engineering, and this has impact in the productivity and in the quality of the product. The fact of Wolfsburg spending more time in the early stage of the developing of the product allows avoiding future errors in the construction of the product and possible NC´s. The time investing in Engineering contributes save time in the future stages (Machining, Assembly and Try-out). I develop a SWOT (Annex IV) analysis to this unit that summarizes all the aspects learn during my internship.

BU Strategy: Targets and Goals

In terms of strategy is important to evaluate the impact of the business unit strategy in Autoeuropa. Currently the competitive advantage of this unit is based mainly due to the cost and location, because the cost of producing is lower comparing with competition and the location is privileged considering the Western, Central and Eastern Europa. Besides this Autoeuropa has a known expertise in the production of fenders and hoods, which make that all the tools of this category are attributed to Autoeuropa. The combination of these three factors makes this unit attractive for investment and profitable for Volkswagen. However since the current environment is changing, due to the higher demand of tools and the expected growth of launches it is important to assure the ability of producing new tools using economies of scale and retaining the know-how.

According information collect during my internship, in my opinion, BU can become competitive by: investing in producing tools to make doors and side panels for Volkswagen Brand, currently the production of these tools is mostly performed in Wolfsburg however the increasing in number of launches will lead lack of capacity in Wolfsburg. This opportunity allows that some of these tools could be develop in others BU, in this scenario Autoeuropa should take the opportunity to develop skills and expertise in doors and laterals.

In order to increase productivity Autoeuropa BU should combine the lower cost of labor with spending less time in the different stages of the process, for example in Machining and Try Out. On the other hand to sustain the advantage in a long term is important to create strategies for talent development and retention, this will assure that in the future the unit will have a high skilled and trained workforce strengthen the ability of the workers. Also having more qualified workers contribute to a quick adaption to changing market demands and benefit from innovation and investments. The training and talent development allow anticipating and building competencies for future needs and in BU is particularly important the training and retention of know how because it is a highly technical work, which takes long time to learn, making the replacement of a worker hard. Another important goal is the Autoeuropa BU is able to influence positively the Volkswagen Mix, meaning to have a financial positive contribution when comparing with the other BU in the group. And finally affected by external exchanges in all automotive industry, is important implementing innovative processes, specially automated and digital processes that would benefit the process and contribute to build the tool making of the future. All these strategic goals will influence the costs, flexibility, skill level needed and productivity of the Volkswagen Autoeuropa and will allow that Autoeuropa become the major BU supporting Volkswagen Wolfsburg.

This strategy in BU cannot be seen as isolated actions that only contribute for this unit, this will have impact in the strategy of Autoeuropa. Taking in consideration the strategic goals mentioned above during my internship I define a strategy for BU until 2025. The first stage between 2015 and 2020 is decreasing by 30% hours spending in the machining and try out. These two stages of the process are important because comparing with other BU these stages is taking more time that should. Between 2020 and 2025 the main goal is improving and implementing innovative

processes which should represent an increasing in 40% of new projects received. By 2030 is expected that BU becomes one of the major suppliers of Tools at Volkswagen Group.

Measure and Follow up the strategy in BU

Productivity

Besides having a strategy is important the definition of its measurement in a long run, and follow up the strategy. The KPI (Key Performance Indicators) system embodies a strategic objective and measures performance against a goal (Eckerson 2009). The measure of the performance must be aligning with business strategy. For each action area during my internship I develop a group of KPI´s that will allow to ensure that the unit is in the right path to reach the proposed goals, in terms of productivity there several KPI´s that could be follow and contribute to reduce the hours spending in a project by -38%, for example **Hours per Project** gives information regarding the number of hours spending in a project, taking in consideration that the goal is reducing the overall number of hours per year. **Hours per project stage** will indicate if the unit is able to increase the productivity by decreasing the number of hours spending in Machining and Try-out. In this business unit is important follow up the number of hours spending in different stages, CAD, Project, Machining, Assembly and Try out.

Other possible KPI´s, in the productivity filed are: **Strokes/ min** (related with the tool function), what contributes for the evaluation of number of parts produce per hour, that is one of the main measures of productivity. The tool needs to be able of producing parts and reach the number of strokes predicted; if the tool doesn´t reach the stroke predict then is necessary spending more hours in the process. The SFM audit and **5S & TPM score** are KPI´s related with implementation of Lean tools in the daily operations. The implementation of lean tools allows an increasing in productivity, by decreasing the time, human effort and engineering hours. In Volkswagen Plant is

already implement in the productions areas, a Shop Floor Audit however is needed it to be adapt to fit in Tool & Dies daily operations. Another important KPI in the productivity field is **Hours of overtime**, because the overtime represents higher costs for the unit and consequent for the company. The overtime is needed in this unit, mainly in the home line try out, and it is planned in the beginning of the year and is important to assure that isn´t done more overtime than what is planned. If the unit could accomplish the hours planned for overtime, will be more productive, the reduction of hours need to the takes in account the overtime. The KPI´s of **Uptime**, in this case the **Machine and Press**, will provide the information of the about the percentage of time the machines and Press are operational, taking in consideration all the available time. The **Milestones Achievement** in the project need to be accomplish, because the deadlines need to be respect, the Road Map of the project show the timing for each of the stages of the project and in order to decrease the overall time of the project is necessary to assure that in each of these stages the operations are perform in the establish deadline to not comprise the final delivery data. The Milestones of the project are MDV (Die Design for Model Release), GG and GS (Foundry/Steel arrival), O (3D Final), E8 (Protocol Acceptance in Assembly) and WT (Copy completed at 80%).

Think Blue Factory

Considering the environmental metrics is expected that all the areas contribute for environmental sustainability of the plant. A global KPI used in the plant is UEP that takes in consideration the following parameters: energy consumptions, CO_2 emissions, VOC´s emissions, waste for disposal and water consumption. In BU should be measure CO_2 emissions, Natural Gas Consumption and Electricity Consumption these KPI´s are the ones that are directly related with BU. The measuring of energy, VOC and water is made centrally throughout all the plant and is not dividing by area.

Sustainable Structures

In this action area the main goal of this area is assuring that the reduction in fixed costs is greater that the reduction on variable costs. In terms of sustainability the firm will benefit if the weight of variable costs is greater than fixed costs, which become the firm more flexible.

The KPI´s suggest are **€/project** is a metric that allows the follow up of how much money is spending overall on the project, this measure allows ensuring that each stage of the project accomplish the predict budget. The overall money spending in a project is a sum of fixed and variable costs, which are important considerer to ensure that the fixed cost doesn´t, exceed the variable costs. Regarding costs in the BU there is an important portion taking in consideration, the **Outsourcing costs**. In Tools and Die isn´t possible to perform all the operations "in house" the unit decides transferring portions of work to outside suppliers rather than completing it internally, however this process represent costs for the unit that represent a significant percentage in the variable costs. The other financial indicator is **Operative results** that provide information about the percentage of total sales revenue that the unit retains after incurring the direct costs associated with producing tools. This metric is split by different stages. Another KPI that is important being following to ensure effective governance is **Systematic target down to specialist level** by area, which contributes for an effective governance of this unit. Setting targets is essential for achieving the purposed goals; however, the targets set will have impact in all of the structure, for example the targets established for the team has impact in the manager. The evaluation of teams and specialists is made based on KPI´s that were defined as priority.

Demographic and Ergonomics

In Demographic and Ergonomics action area the goal is to ensure that all direct processes in the plant are designed for lifetime work, for that the following KPI´s should be implement,

Absenteeism will measure the attendance of the employees in their workplace, which has a strong impact on organization's productivity, revenue, and costs. The **work accidents** will have effect not only the health of the workers, their motivation and the productivity. The **severity of the accidents** in the unit need to be evaluate as well because the number of accidents won´t give the information if the accidents has a great impact in the days that a worker is missing to the work. Finally, the **medical restrictions** are related with the number of workers that were forced to adapt the functions due to a medical restriction.

Logistics

In Logistics action area the goal for the Business Unit is optimize the **Costs of transportation** and **Raw material**, because these costs are the most predominant. Regarding these costs, the way of optimize the cost of services and transport is by anticipate the needs in order to be possible a better price negotiation

Quality

In the production of tools the quality is one of the most critical aspects because the parts made by the business unit has a great impact in the vehicle, taking this in consideration the parts produce in this unit need to have the highest quality possible. The **AK and BK** nomenclature is related with dimensional evaluation of a part produce, in this evaluation if a part produce has an AK fault the part cannot integrate the vehicle structure because will compromise the structure and safety of the vehicle. The BK faults are the ones that doesn´t compromise the structure of the vehicle but will influence the note attribute in the dimensional report. This needed to be measure in each of the important stages of the project, PVS, O and SOP. The other quality parameter is the **Superficial report** that evaluates the superficial part of the part produce by the tool, in this analysis are evaluate possible deformation, wrinkles or jags. The plant needs to ensure that all the requirements in terms

of quality management systems are fulfilled; in the BU there is a specific guideline that is **VDA 6.7** that is especially adapted to the particularities of the unit production and job shop production during the production equipment manufacturing. These guidelines need to be follow to ensure that the business keeps running. The KPI regarding **Costs of non-quality** is important to follow because if something in the process or in the product isn't right and needs to be adapt or change will represent an increase of costs and needs to be control it. The **Customer satisfaction** is other important KPI that should take in consideration to track the overall satisfaction of the clients Finally, **NC´s** is a criteria related with non-conformities that during the production of tools could be attribute to different stages that have impact in the quality of the product so need to be control it and follow up.

Optimal Investment

The optimal investment intends to ensure that all the investments made in the production of tools will has an positive impact and will generate a return for the unit. In order to ensure that the BU is able to have until 2025 more 40% of new projects is important follow one KPI, **Additional Work** how much time each team is able to dedicate to new projects and collect revenue with it.

Factories of the future

The factories of the future are related with the brand goal of developing a plant that's becoming a Tool making of the future. In order to achieve this is possible implement some activities related with the automation and digitalization of the process and the following KPI´s that could be follow **Countinous Improvement** and **Nº of innovative projects implement** .

Team of the future

In this action field the main goal is having a global team focused on the competences for the work environment of the future. The main goal until 2025 is 81 points in team of the future index, these is related with Stimmungsbarometer, that is the tool used in Volkswagen to evaluate the global satisfaction of the workforce. In terms of KPI´s can be used **Stimmungsbarometer ,** because is a tool used to asset the overall satisfaction of employees and the results should be follow up to asset the motivations and commitment of the workforce. The KPI could be divided in **index** is a way of perceive what could be improve and which actions is important implement in order to reach the purpose of the company regarding their workers. The **participation rate** reflects the adherence of the workforce to this survey. The **team index** is group of questions that are taken from the Stimmungsbarometer and will direct link with the calculation of the team of the future index. The **Hours of specific training** are related with hours spending in specific skills that contributes to obtain a higher qualification in specific skills,

How to increase productivity in BU

Taking in consideration that the main goal of the unit is increase the productivity is important having a well-defined plan of strategic and operations, during my internship, I develop a group of recommendations regarding three main areas.

Process

In order to have a more productive process one of the most important aspects in reducing the errors during the Engineering, there is two actions that can be perform to achieve the goal. One of them is implementing checklist, this is a list of tasks that needed to be done before the process of Engineering is finished, this will contribute to decrease the number of errors once is a requirement check all the points before release the product. On the other hand by using the software Ms-Bohre

is possible performing the operation in only one step, like show on Annex V, the represent a saving of time and errors in the design of the Tool.

The Theoretical Analysis Annex VI represents the maximum quality that the part produce by the tool can achieve, by comparing the part after Try-Out. This comparison helps to understand if some aspects in the Engineering could be improved that will contribute to a higher quality part in the end of the process. Another process that contributes to an increase of productivity is using Springback Analysis Annex VII that evaluates the possible deformations in the material after the part been withdrawn from the tool. If the analysis is performed operation by operation is possible define a strategy to compensate the deviations in the different stages of the process. This contributes to decrease the amount of time spending in corrections because the deviations could be anticipated. Moreover, is important having a mechanism to control the quality of the work when moves from one team to another. For that reason is being implement the checklists that helps to ensure that some errors and deviations are check before passing the work to another team. This need to be performed by all teams should be a regular and common practice. The Tool&Die Volkswagen Autoeuropa is part of a group of other tool shops, and this could be used to acquire knowledge and use the benchmarking from Group Best Practices, some tool shops of the group has implemented more productive and efficient practices that could be implementing by Tool&Die Unit in Autoeuropa.

Finally this unit could perform the Prototype and Experimental Dies Annex IX, these are the early stages of the development of a tool and usually are perform by an external companies, which represent less control in the initial stage of the process. If the unit starts to perform the project since this stage is possible earn hours in the next stages of the product development, on the other hand contributes to have flexibility in the deadlines during the project. The main contributions for the

improvement of the productivity are having access to some data (Ex. List of suppliers of material), decreasing the time in future stages of the process, flexibility in the deadlines and have the opportunity since the beginning contributes to an improvement in performance and quality.

Ergonomic

In terms of ergonomic after a careful evaluation it was showed that some positions mainly associated to Try Out stage, present risk for the workforce. The workforce in Tool&Die unit is one of the most aged populations in the plant and besides that the work performed in this unit it´s mainly manual which increase the risk of the workers' health. The main risks identified in this unit were the spine flexions, working in confined spaces, high demands on concentration, working squatting or kneeling on uneven floor, working standing up and arms bending in 90º (Ergonomic Team 2016). All of these factors could contribute to a decrease of the productivity, which could compromise the goal of the unit in decreasing the number of hours spending in a given project. In order to improve the health and welfare of the workers and increase productivity could be implement programs like physiotherapy programs, rotation programs and implement a period of warming before starting some work positions.

Management people

In order to achieve the strategic goals, a better performance and a competitive advantage for the unit, the management team needs to be able to make best possible utilization their resources, and one of the main strengths of this unit is the human resources. The people in this unit perform a specific type of work and have technical skills hard to replace. The satisfaction of the employees has impact on productivity, one of the reasons for that is the turn over costs associated with recruiting and training will lowered the productivity and loss of expertise. Taking this is considerations are important to have strategies that allow capturing and retaining talent, and keep

the current employees satisfied. In Tool&Die unit the index of satisfaction is more or less 10% lower comparing with Autoeuropa and 20% lower comparing with the corporative target establish by Volkswagen AG. Mostly of the employees feel dissatisfied regarding, theirs teams, collaboration and work. To improve the global satisfaction off employees is important implementing some actions at global level that will promote a higher satisfaction in the work force and contribute to achieve a higher productivity at work.

In order to the workforce have a clear image of what is the unit strategy and what are the future goals of the unit is important having management and coordination involvement by communicating the strategy to the employees to promote the involvement and contribution of all the employees. Is important sharing main deadlines, strategic targets and possible errors or faults associated to each stage of the project. Nowadays, some teams in the plant already have this routine; however is not common practice across the unit and should be.

In order to be able of retaining and developing talent in the unit, is important to promote training focus on the job training that will have an impact on productivity, mainly on quality and quantity of the work. On way of achieving the goal is by making partnerships with ATEC an academy that provides specific training in the industry, in this case is able to offer specific technical courses, for example, Machining Technician and Programming(“ATEC” n.d.) that is one of the core competences to work in a tool shop. Besides ATEC, FANUC is an academy that offers a wide range of courses in machining and robotization which could be a good partner to provide training and specific skills to the workers of a tool shop(“FANUC” 2017). However some skills aren’t possible to learn unless training and learning on the job, for example the assembly of some components, the tool clamping and fountain adjustment. To assure that these late skills be implement is promoting cross training (Reh 2017) which allows more flexibility in managing the

workforce and helps the employees learning new skills, increase their value to the unit and combat position fatigue. In Tool&Die this could be implementing mainly in CAD (between different teams Die Design, Method and Reference Data) and between Assembly and Try out.

Another way of giving a proper training and skills to the workforce is by implementing "Mentorship Program", allowing that the expertise and experience would be transfer for younger generations to assure a smooth transfer of knowhow. In this program when new workers were hired they should must be accompanied by someone with experience and in the end of the career, the goal isn't only learn to perform the job function but as well learning with experience and acquire specific knowledge that is only possible to achieve on the job training.

Finally other way of assuring that the knowledge is not lost is by having a routine of lessons learn at the end of the project, a meeting that involve all of department in order to understand what goes wrong or should be improve during the different stages of the project, and in order to maintain a good environment in work is important to foster social connections among the workforce, (Ex. creating sport teams, events or activities) to join employees outside of work context.

Final Conclusions and Recommendations

The Volkswagen brand has as main goal become a Top of volume brand and all the units need to create strategies and operations that contribute for the brand goal. In Autoeuropa the main goals of the plant is being able of add value and being a sustainable plant, and in short term Autoeuropa aims to decreasing 1000€ per car. During my internship I develop a strategy, of how The Tool&Die Unit could contributing for the strategy of the plant as well for the Group strategy, and the conclusion is by focus on improving quality, increasing productivity, developing new competences, adopt innovative processes and creating a strategy to retain and develop specific

talent. However to evaluate if the business unit is in the right path is developing KPI´s that have impact on the business and follow up of the strategy aligning with goals of the business unit. The KPI´s are defined based on the brand key action, which contributes to integrate the business unit in the brand strategy. The KPI´s developed during my internship are mainly focus on Quality, Cost, Productivity and People and were present to the top management of the Area, and most of them are already implement in Tool&Die Unit. Another aspect developing during my thesis was trying to improve the productivity, in terms of process, ergonomics and management of the people. In terms of process is important my suggestion is that the unit should focus on reducing the errors associated in engineering stage, which will contribute to decreasing the time spending in correction errors in the further stages of the project, this will contribute for improving productivity of the Tool Shop. In terms of Ergonimcs is important implement programs to improve the health of the workers and finally regarding the people my suggestion is attracting talent by establish partnerships with Academies (Ex. ATEC and FANUC) that provides specific training. On the other hand, the on the job training need to be well design to assure that the knowledge and the experience are pass for the younger generations and could be complemented by a Mentoring Program, where the most experienced workers before retired shared the knowledge to younger generations. And finally promoting cross training between different areas and having a well define plan of communication of the strategy, because if the workers feel that they could influence the outcome and contribute to the goals of the unit, they will put more efforts in their daily work. The communication needs to regular and involve all the levels of management as well establish a team that could spread the message among their peers. Overall all the work and recommendations present in this thesis could contribute to positioned Volkswagen Autoeuropa as a competitive factory and contributing for Volkswagen Brand Goals.

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