Developing Innovative and Attractive CVET programmes in industrial shoe production

Train-the-Trainer Manual

Production Planning

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Content

1 Introduction

1.1 Aims of the DIA-CVET Project

The aims of the Erasmus+ project «Developing Innovative and Attractive CVET programmes in industrial shoe production» are

- to develop, pilot and implement comprehensive courses for the Spheres of Activity (SoA) of foremen in industrial shoe production on European level; available in English (EN) as well as in DE, RO and PT,
- and to develop a sector qualification framework level 5 and 6 and to reference existing or newly drafted national qualifications from Germany, Portugal and Romania.

1.2 Manuals to Guide Tutors and Trainers

The purpose of the manuals is to prepare designated trainers for their role and to provide content and support. Due to the nature of the SoA of foremen, they do not include specific forms of training; but we suggest a blended approach. Successful Continuous Vocational Education and Training (CVET) programmes combine theoretical lessons with application of the acquired Knowledge, Skills and Competences (KSC) in real work environments. The tasks of a trainer are to

- impart SoA-specific KSC,
- demonstrate operations which the learners are expected to learn to perform,
- introduce the learners to each new task and supervise them during their first approaches,
- organise and supervise blended activities (i. e. projects),
- guide them towards an independent performance of the tasks of the respective SoA.

The manuals are not meant to replace a textbook. They are meant to provide support to the trainers to plan and execute their teaching. The trainers are invited to gather more information from other sources.

1.3 Refer your training to the business process of industrial shoe production

Industrial production is a complex process, where the Sphere of Activity, described in this manual, is embedded in the business process. Before you start the training on a specific SoA, please make sure that the learners are familiar with the other SoA of industrial foremen in shoe production.

For example, the learners should be introduced to the types of products the company manufactures and their intended use, the different customer segments, the distribution channels etc. They should be aware of the product creation and manufacturing processes, i.e. product design, pattern making, purchasing department, production planning, and all production departments to warehouse and logistics.

The production process (not part of DIA-CVET, for insights see: http://icsas-project.eu/) is in the core of the business process; the SoA of DIA-CVET play a preparatory, supporting or accompanying role (see Fig. 1).

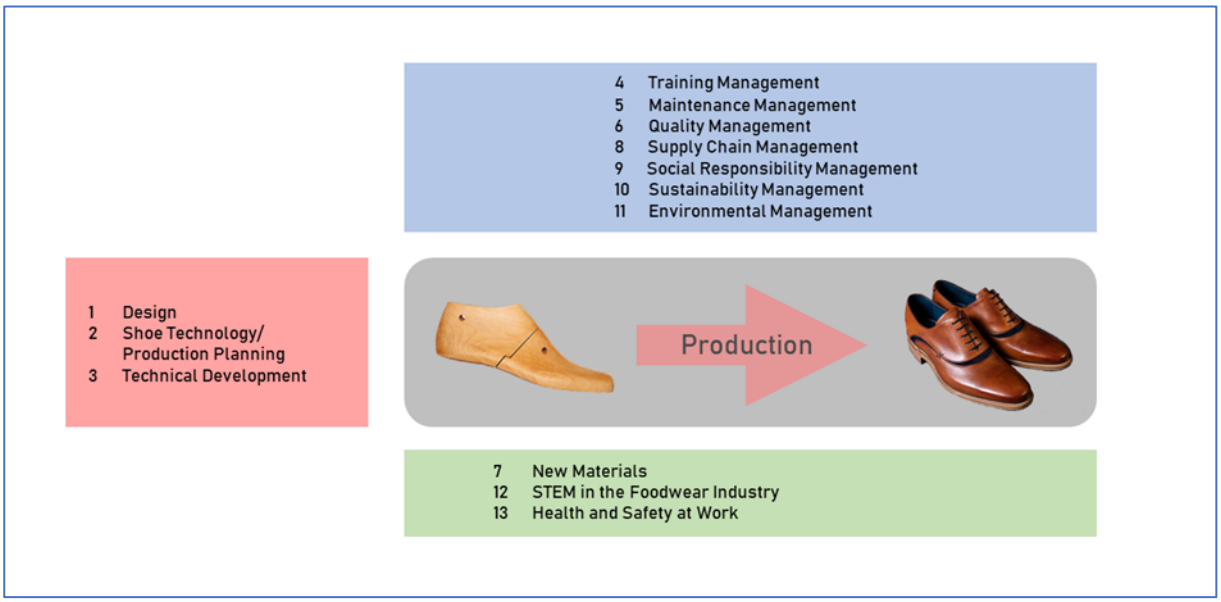

Fig. 1 Spheres of Activity of DIA-CVET and their relation to the production process.

2 Production Planning

2.1 Introduction

Current market conditions, with instability, increased competition and specific customer requirements, have called into question the traditional ways of production organization, increasingly resorting to flexible automation.

Gone are the days when the organization of work was marked by the rigid division of functions, fragmentation of tasks, specialization of knowledge, hierarchy and centralization of information.

With the aim of achieving the production of complex and quality articles, in accordance with customer requirements and through production variation in terms of products, volumes and processes, organizational aspects have become decisive in a new logic aimed at the implementation of production strategies based on automation on the one hand and flexibility on the other.

Nowadays, the trend is accentuated in the substantial increase of production in small series, prototypes, and a lot of diversification. In this context, market uncertainties and fluctuations are controlled by adaptability and flexibility parameters, based on competitiveness factors that, in addition to prices, consider quality, design, meeting deadlines and specific customer satisfaction.

In this context, the organization of production, and in particular the Planning and control of production, faced with the introduction of new and diversified requirements, underwent adjustments associated with the new logic required of companies, where the core of modernization is reflected in the development of the specific flexibility of each unit, in association with new forms of work organization and new information management systems.

Flexibility cannot, therefore, be considered a technical phenomenon, pure and simple, but rather a technical-organizational phenomenon. It refers not only to the use of flexible equipment, but also to the adaptability of people who exploit the new technological potential.

When we intend to follow the strategy of flexibility and quality, it could be wrongly thought that to achieve this objective, the acquisition of computer-assisted technologies will suffice, maintaining strict management methods with marginalization of the human factor.

However, when the results fall short of expectations, it is recognized, sometimes belatedly, that a flexibility strategy necessarily involves two aspects: quantitative employment flexibility and organizational flexibility. In the first situation, quantitative employment flexibility corresponds to operational flexibility, where new organizational principles, flexible structures and leadership styles open to participation lead to different practices of decentralization of production levels (division of large companies into autonomous units), task enrichment, group work and quality circles.

In the second situation, organizational flexibility is part of a logic centered on the human factor, according to which competitiveness depends not only on new equipment, but also, and mainly, on specifically human capabilities.

The reinforcement of the competitive advantages of the companies passes, therefore, by the search of adequate management methods, that consider in a comprehensive way aspects such as layout, planning and control, human resources, new technologies, productivity, quality. In this Manual we are going to talk about Production Planning.

2.2 Define Planning

Planning can be defined as the thought that precedes the action, that is, the activity that consists of establishing goals and setting organizational objectives, as well as preparing specific action plans and compliance deadlines.

Basically, planning is fixing the future and working day-to-day to achieve that future effectively.

When planning, the company is anticipating actions, it is determining its needs for materials, people and other important resources.

Planning must therefore be a structured and disciplined activity. Without these assumptions, it is impossible to achieve the goals and objectives set.

We can talk about:

- Long-term planning, where strategic issues are addressed. Usually performed at the top management level and considered as a guiding element for all functions and/or business areas of the company;
- Medium-term planning, where tactical issues are dealt with. Usually performed at department or business level;
- Short-term planning, where operational issues are dealt with. Usually performed at the function level (cut, sew, assembly).

Gone are the days when companies determined the selling price of their products or services based on the cost of production plus a margin (profit). The rules of the game have changed radically, and more and more the price is defined in the market, and in this way, for profit to be a reality, there remains the alternative of reducing costs.

To reduce costs, companies need to eliminate activities and resources that do not add value. The market is increasingly competitive, more unstable and aggressive. But that's where companies must compete...

Customers, for their part, gradually imposed their strength, demanding from their suppliers:

- more frequent deliveries and in smaller quantities;
- reduction of finished product stocks;
- price reductions, crushing suppliers' margins;
- reduction of response and delivery times;
- flexibility and innovation in processes, products and services.

Companies that fail to keep up with the pace of market evolution are irrevocably doomed to lag and disappear. To maintain a pace, at least equal to that of the market and its competitors, it is necessary for companies to adopt concrete measures.

Spending the day "putting out fires", "covering here to uncover there" is not a valid option. Companies need to adopt formal procedures for planning and controlling their operations.

Computer systems are an important but not sufficient tool, especially if the methodology to be used in planning and controlling operations is not defined first.

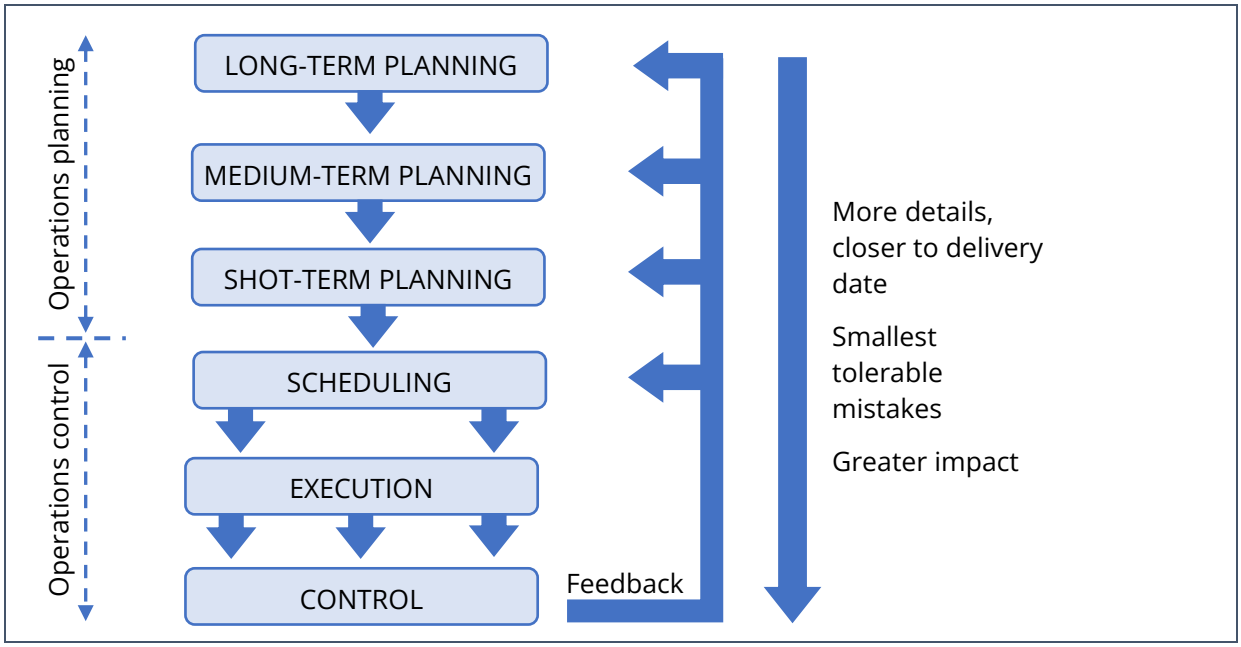

Fig. 2: Planning and control of operations

2.3 Planning and Control in Footwear

2.3.1 Characteristics of sector orders

After presenting the collections to customers, they send requests for samples. These may correspond to the models presented in the collection or to "variants" of these models. By variant is understood a model with some difference in relation to the model that gave rise to it, but whose moulds do not refer to alteration. There is also the possibility that the client himself presents models of his creation.

The request for samples and any subsequent changes may also be followed by the request for a confirmation sample.

At this stage, the customer sends his purchase order (N.E.). As a general rule, at the beginning of the season, orders refer to a reasonable volume quantity. Closer to the end of the season, new N.E. may appear with requests for shortages, that is, orders that are normally urgent that repeat models already ordered but in much smaller quantities.

The following trends continue to occur:

- The number of models and variants requested by customers is increasing;
- Given the uncertainty of the market and the consequent difficulty in making medium-term forecasts, customers take less risk in initial orders, ie, they order more models and less quantity per model;
- Consumer demands are higher in terms of design and innovation. As such, the traditional two collections per year "Autumn/Winter" and "Spring/Summer" are more faded, with new models being introduced a little throughout the year;
- Delivery times that used to be short only for out-of-stock orders are now practically short for all orders;
- Finally, the sale price is increasingly imposed by the market, not being complacent with companies that try to impute, in their products, costs derived from their bad organization and their waste of resources.

A customer purchase order can contain only one or several references. Reference means a perfectly defined model/variant to which an identification number has been assigned.

In productive terms, it is important to treat each reference individually, that is, as if it were an order.

The fact that a customer requests, for example, 5 different references with the same delivery time, does not oblige them to be manufactured simultaneously, not even in sequence.

It may be of interest to intermediate production to manufacture other orders.

It is usually preferable, whenever possible in terms of delivery times, to group together the manufacture of the same references and even the same models, even if they are of the same reference. The objective is to obtain gains in the operators' work rate.

Combining these two needs arises the concept of internal purchase order (N.E.I.). This consists of a document with characteristics suited to the production needs with regard to the customer's purchase order information. This document has the following basic characteristics:

- Each N.E.I. refers to a single reference;
- The quantities requested from this reference may be used for several customer orders.

2.3.2 Manufacturing plan concept

The minimization of the number of lasts to be used in the assembly requires that a range of sizes with the necessary quantities per size arrive at this section. In other words, it is not possible to make the assembly profitable if, for example, the sewing produces all pairs of size 40 first, followed by all pairs of size 41 and so on.

To avoid this type of situations, the concept of Manufacturing Plan (MP), also called Manufacturing Order (MO) emerged. The MP represents a production order for a partial order quantity.

Each internal order is therefore divided into a certain number of MP, whose quantities per size are proportional to the “weight” of that size in the total order.

The total number of pairs in the MP, similarly to the number of pairs per batch, must be determined taking into account the characteristics of the company, namely with regard to:

- Need for assembly cycle lasts
- Number of pairs per lot
- Average daily production
- Average amount of different sizes present in orders.

Let's see the influence of each of these factors on the number of MP pairs, with practical examples:

1. Need for assembly cycle lasts

If we have an assembly system that requires 150 pairs of lasts, for example, then the MP cannot be less than 150, so that each MP allows at least one assembly cycle to be produced.

2. Number of pairs per lot

If this quantity is 10 pairs/lot, for example, then it is convenient that whenever possible all lots have this quantity. At most, there will be one lot in each size for adjustment, if the quantity ordered is not a multiple of 10.

2.3.3 Manufacturing preparation

Between the arrival of the purchase order and the start of manufacturing, there is a series of procedures that have to be taken in order to prepare the manufacturing itself.

All these steps must be followed by the planner:

1. Ensure the existence of a technical file, operating range and line balance.
2. Monitor the supply of materials, from the issuance of requisitions
3. Decide which tools to use:
    - For cutting, whether cutting dies, moulds, or automatic cutting. Check even if the model is already scaled;
    - For assembly, calculate the lasts needed and check if there is a need for reinforcement in any size(s);
    - Check if there is a need for other tools, for example; leakers, stamps, etc.;
4. Program and ensure the execution of the test series
5. Verify the complete issuance of documents, labels and tags.

2.4 Scheduling of orders

The schedule consists of distributing the orders over the weeks, according to delivery times and the availability of resources.

The calculation of labor requirements is carried out by each section based on production capacity and production times estimated by the methods and times bureau.

To determine the capacity, it is necessary to study the process, the time it takes to execute the operations and the respective cost. And so, the installed capacity stands for the capacity of the area with the lowest productive capacity (known as a bottleneck) of a production line.

It is obtained by the combination of monitoring indicators (KPI's) of the 3M's (Men, Machines, Methods):

Equipment: which stands for utilization rate

Human resources: which is productivity

Methods: covering manufacturing time

There are, however, several other factors that must be taken into account, the most important of which are:

1. Supplies

If on the one hand, the dates planned for the delivery of the materials requested to suppliers are calculated by the planning sector, on the other, this sector may also be obliged (and this is frequently) to change its plan due to changes imposed by the supplier, on the date of delivery of the materials.

2. Tools

For example, the use of group of lasts whose total amount of pairs is less than the need for lasts of the assembly cycle, requires that this section has 2 models with different lasts for manufacturing. They should be 2 order models with relatively close delivery times and whose lasts, although different, do not oblige large adjustments to the machines, which would cause productivity breaks.

If there is subcontracting it is important to check if the tools (cutting dies or moulds in the case of cutting or lasts in the case of assembly) may be borrowed to the subcontractor without the risk of being lacking in the company.

3. Training plan

The versatility of the workers is extremely important for the correct functioning of a section. Such versatility can only be achieved if the company invests in training. A training plan must be prepared annually, the implementation of which, in the case of operators, must coincide with the low season in terms of volume of orders.

The planner has an important role in the elaboration of these training plans.

4. Preventive maintenance of equipment

Like the operator training plan, the preventive maintenance plan has to be coordinated with the manufacturing plan.

5. Work rhythm

It is known that the change of models causes breaks in the operators' work rhythm, namely in terms of sewing, since it is the section where the changes are more accentuated.

It is therefore in the best interest, whenever possible, to launch the same or similar models in production, one after the other.

6. Intermediate stocks

The planner has to consider the problem of intermediate stocks very carefully. On the one hand, high intermediate stocks give rise to high financial burdens with “in progress” and a low flow with consequences for the response time. On the other hand, with low intermediate stocks there is a risk that there will be ruptures and some of the sections may stop.

Some principles that minimize the possibilities of this happening are:

- Interleave low sewing time models with high sewing time models
- Bear in mind the need for a higher stock when subcontracting some operations such as special sewings, braiding, etc.

7. Subcontracting, overtime and flexible working hours

The subcontracting of any phase of the process should be seen as an alternative that can solve problems of momentary overload. A systematic use of subcontracting depends on the strategic decisions of each company, and there must be

clear rules for the planner on when and under what conditions this resource can be used. The same applies on delivery to the use of overtime.

The flexibility of working hours makes it possible to increase production capacity when the volume of orders is higher, compensating for a decrease in production capacity when the volume of orders is lower.

The Production Plan integrates all the programming variables of the order book to meet foreseen needs. It is the plan that uses the order information in conjunction with the product structure (material's list), existing stocks and average production times for each item to set a plan for production orders or order for each constituent item of the final product.

It identifies what to produce, how much to produce and when to produce or order to satisfy the independent demand dictated directly by the market.

2.5 Production control

Timely and reliable production control is essential for effective planning. Production control consists of monitoring in a quantitative way what has been produced in a given period of time.

There are from simple weekly control systems only for the product that is dispatched, to sophisticated computer systems that provide "on-line" (real-time) productivity data by section and even by operator.

The level of demand of the control system should be developed with the increase of requirements in terms of information needs, that is, there is no point in having complex control systems, for example, "online", if the data are only analyzed at the end of the day.

Often, for example, the production order is drawn up in such a way as to have a data collection system.

Based on the production control data, there may be a need to carry out a replanning in order to incorporate the accumulated deviations since the last (re)planning.

Another objective of production control is to obtain data to calculate productivity. For this to be possible, it is important to identify the number of operators present in each section.

2.6 Why does Planning fail?

Here are some alerts for the reasons why planning often fails in companies:

- There is a natural tendency to consider that everything in our company is more complex than usual;
- Inability to understand planning as a rational and complete process;
- Lack of decision-making power of the planner;
- Lack of training and information for the planner;
- Taste for improvisation, that is, there is no real commitment to the plan;
- Unrealistic plan;
- Tendency to plan mentally. The plan must be written and disclosed;
- The plan must be prepared in meetings where the people in charge are present and have an active participation. This is the only way to create a real commitment to the plan.

3 Information Management

Depending on the company (size, organization of departments, distribution of activities, etc.), part of the activities related to production planning may be included in other departments.

The management of information and communications within and outside the company, with customers and suppliers, and even between internal departments, represents an important tool for working and supporting correct business management.

To increase efficiency and better manage all information, companies use different software systems in production planning and control. The main categories of software are ERP (Enterprise Resource Planning), PDM (Product Data Management) and PLM (Product Lifecycle Management).

The main modules of an ERP that are related to Production Planning and Control are:

- Materials/Suppliers/Purchase Orders
- Stock management
- Models
- Customers
- Orders
- Production Planning
- Subcontracting Planning
- Documents for Production
- Production Monitoring.
- Documents for Shipping

A correct management and sharing of information, adapted to the characteristics of products and productions of each company, is therefore fundamental to increase its levels of flexibility, productivity and even quality.

An ERP method integrates information on inventories, process time, stock levels, replenishment times with commercial product delivery commitments.

It works inside a server and can modify the plan automatically, based on the results during the selected period.

Alert issues if delays endanger the goals to are aimed at (typically delivery date to the customer). In this method performance indicators (KPI's) are used to monitor progress in the execution of orders and correct any deviations in time.

Measurement indicators in ERP are typically those that are related to the number of parts produced, the processing time, and costs.

The actual results are compared with the theoretical estimates (planned). Indirectly, productivity indicators can be used.

4 Conclusion

Faced with the emergence of new strategic models, the organization of production in companies tends to depend not only on the type of technology chosen, but also on a new paradigm based on the creation of flexible organizational frameworks and investment in human resources.

Organizing production is thus a fundamental means to achieve specific objectives:

- Be more efficient, that is, use available resources in the appropriate dimension and without waste.
- To be more effective, that is, to achieve excellence in customer service, which implies aspects such as speed of delivery and product compliance.

There is no single “recipe” for achieving these goals. On a case-by-case basis, the best solutions and the best balance in the use of the best tools for the organization must be found. Production Planning and Control will be a fundamental ally here, in coordinating the factors that influence the company's performance and achieving customer satisfaction.

The most important conclusions are:

- The productive flows must be designed to maximize the efficiency of the taken measures;
- The Production Plan integrates all variables to develop a plan that allows you to respond to the needs of orders;
- To determine the capacity, you should study the process, the time it takes to execute an operation and the respective cost;
- The ERP integrates all variables and manages a plan that is updated periodically according to the obtained results;
- Performance indicators are used to monitor progress in the execution of orders and to correct any deviations in time.

5 List of Figures