

New Method to Improve an Already-operating Assembly-line or to Find Out the Best Possible Configuration for a New Assembly-line

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ABSTRACT

The survey we are going to present comes from the request to optimize an industrial product pre-assembly chain. Considering the good results we obtained, we've built up a methodology and several instruments dedicated to assembly chains where the human presence is still important.

The surveyed assembly line was made of an ever-moving conveyor belt with fixed workspaces along it.

The requested targets were as follows:

- Decrease the number of waste products and pre-assembled product fixes by the end of the line;
- Improve workers' comfort and efficiency;
- Improve assembly time by leading the line to the saturation point;
- Decrease raw materials employ (fixing tapes, adhesives, etc.)

There are many aspects to analyze (human factor, layout, equipments, work organization,...) but they are all linked to each other, as well as there are many factors, linked to each other, that can be changed or modified in order to reach the target.

The change of one of these factors, linked to each other, has effect on another factor, generating a reaction sequence on the system and you have to be in a position to foresee it on the whole.

Following the analysis, we showed the state of the art, carried out the data processing and the specification of the instruments that make possible an objective results forecast about the changes in the surveyed system.

INTRODUCTION

It's not easy finding an improving solution to an elaborate system, especially when there are many

different aspects that are involved, including the human factor, that plays a "heavy" role in this situation.

Any kind of changement or operation concerning any of the involved factor is subordinate to the pre-existing pre-assembly line: you have to mention exactly what kind of operation must be done, how to, and how much this operation produces economics incomings, also to the work staff.

The methodology we've identified to be the most effective to reach the target, takes into consideration the following aspects:

1. A detailed study about the pre-existing condition.
2. Data processing to decide where and how to operate.
3. Identifying the best possible pre-assembly process.
4. Verifying that the identified process is achievable by employing virtual reality instruments.
5. Comparing the pre-figured situation and the present one, identifying the potential performances and the economic implications from an objective point of view.

The ultimate purpose is developing an objective and repeatable methodology also by different situations too as well as re-usable computer processes.

MAIN SECTION

ACTIVITIES DESCRIPTION

The developed activities can be divided into three steps:

1. DATA-GATHERING

The analyzed factors were the followings:

- Line staff, analyzed through the personnel files, featureless, provided by the client.
- Features of the parts to assemble (shape, size, weight).

- Assembly mode/task analysis (including components supplying), task operating speed along the line through surveying and video recording the pre-assembly process during two work shifts, and through executives' files analysis.
- Working instruments and materials identified through pictures analysis and cataloguing of the workspaces equipments, and employed raw material quantities by shift starting and ending time.
- Line features and organization through staff interviews (employees, shift leaders, training managers).
- Quality check and waste products case history and fixed components frequency or case history (frequency, kind and time of fixing) through analyzing the non-standard assembled parts, and video recordings in the fixing area.



Figure 1: Example of video recordings in different work places

2. DATA ANALYSIS

The data analysis carried out by Carcerano Research Centre through video and audio recordings, and through the files and documents supplied by the client, detected all the pre-assembly chain problems.

The purpose of this step is representing the working process and split it into different activities.

We highlighted the involved people (Liveware), the equipments (Hardware), rules and required procedures (Software).

To each worker it is necessary to identify:

1. Assembly mode: splitting activity into different steps, description of every step operation;
2. Time needed to each step;
3. Space needed to each step;
4. Instruments that are employed in every single step;
5. Raw material used in every single step;
6. Interaction, connection with other steps, order of importance.

Information processing had to highlight potential problems linked to:

Staff work, for example:

- Rules and instructions do not support properly that particular activity;
- The way the activity is carried out does not comply with the rules or the worker's know-how (thus the training or the expertise) is not enough to carry out the activity properly;
- The information needed to carry out the activity is not available or not well-timed;
- The work distribution among the workers/to each worker is not proper to the activity that has to be carried out.

All this comes out by processing files and documents supplied by the client (rules, procedures, know-how), interviews, video and audio recording.

Technical choices concerning the line, for example:

- Problems connected to interfacing work instruments, their use is difficult, takes too much time or requires know-how that are not available or not suitable, or are even dangerous to use;
- Employed raw materials fulfill the requirements needed to the activity purpose;
- Aid-instruments support the activity
- The place and the space to equipments and instruments are suitable to carry out work.

All this comes out by processing interviews and video recording.

Technical choices concerning components to assembly, for example

- The components to assembly haven't got effective feedback to be placed properly;
- Components are hard to be moved because of their shape and size;
- The indicated fastening technique does not comply with the components;

All this comes out by processing product project data, analyzing carried-out products, defecting reports, video recording concerning fixing spaces.