**Integrated Product Design Exercise – Word Factory**

**Abstract**

The presented exercise works the differences between serial and integrated design approaches. The students are divided in to groups that populate different Word Factories. During two rounds the groups compete to produce more words. In the first round the game rules force a serial development approach, while in the second round an integrated approach is allowed. At the end of the exercise, the lecturer fosters a discussion to compare both approaches.

**1. Introduction**

New product design and development is the interface between the enterprise and the market, being responsible for the identification, and even the anticipation, of the market’s needs in order to propose solutions to fulfill those needs according to the company’s business model.

Although the marketing, design and development, and production activities were completely integrated during the artisan’s pre-industrial work, this changed due to the industrial revolutions, which were driven by mechanization, specialization, automation, and communication, respectively.

With the 1st and 2nd Industrial Revolutions also came the division of work into specific technical areas. The product development process mirrored the serial production line, thus adopting the serial approach as well. The mass production era split the technical areas of the product development process into separate departments (i.e., silos), based upon highly skilled people within them, but with almost no interaction among them. Within the PDP, a typical Serial Product Development through multiple departments is to finish their jobs as quickly as possible and throw them over the “wall” to the next department.

Integrated Product Development (IPD) embraces the challenge of bringing back the, where Product Development Process (PDP) should be capable of integrating the work and information produced by the several different actors, from the diverse knowledge areas required to design the product.

The game was developed with the objective of giving the students a hands-on experience showing the differences between the serial (sequential) and integrated approaches to product design. This game is also an alternative to be used as the “Waste Concept Practice 1” during the Lean Product Design and Development Master Course we offer (see the file “Using the book for teaching Lean Product Development (LPD)” also in the book’s online material).

**2. General Game Rules**

A “raw material phrase” is given by the lecturer at the begging of each round.

The student groups, following the specific dynamics from each round, can create words and phrases by using the letters that appear in the given phrase.

The quality criterion for the developed phrases is:

* Each phrase must have a verb;
* Each phrase must have – at least – three words;
* Each word used in one phrase cannot be used in another phrase;
* No word from the raw material phrase can be used in any phrase.

**3. Round 1 Dynamics**

The class is divided into factories. Each factory is constituted by 3 departments with – at least – 3 students in each department. These are: department of “words”, department of “phrases”, and department of “quality”. A manager completes the factory´s personnel. The lecturer orientates the students to place their chairs in a serial layout of as shown in Figure 1.



Fig.1: The serial layout of the factory of words

The lecturer handles the exercise’s rules description. These are the following:

1. A “raw material phrase” will be given by the lecturer at the begging of the exercise. Example: “That straight track is made of concrete”;
2. The employees of the department of “words” – only them – can make words out of the raw phrase such as “star”, “train”, “main”, “costumer”, “late”, “has”, “missed”, “the”. As long as a letter appears in the raw material phrase, it can be used as a seed for a word. The employees write the words into slips of paper and deliver them to the employees of the department of “phrases”. No communication is allowed among the departments. It´s only allowed among the employees of the same department.
3. The employees of the department of “phrases” – only them – can make phrases with the words delivered by the department of words. Example: “A late costumer missed the train”. They write the phrases into slips of paper and deliver them to the employees of the department of “quality”.
4. The employees of the department of “quality” evaluate the phrases according to the quality criteria.
5. No elaborate feedback information is allowed to the previous department. This department can – solely – accept or reject the written phrases. Then, they write the accept phrases in a clean sheet of paper and give them to the manager. S/he, by her/his turn, handles the “package” of selected phrases to the lecturer.
6. The 1st round’s duration is 20 min.

**4. Round 2 Dynamics**

A coffee break is welcome before starting the second phase of the practice.

After the break, the lecturer presents the students the rules for the second part of the practice:

1. A different “raw material phrase” will be given;
2. The quality criteria remains the same;
3. It´s up to the students to define:
   1. The layout of the factory;
   2. The way to improve communication;
4. The roles of the employees (ex. at the beginning of the exercise, everyone is temporarily employed at the department of words);
5. The manager (could be a different person from the 1st. round) draws in a sheet of paper, the strategy decided for the 2nd round of the exercise. The students are given 10 minutes to decide upon it.
6. The 2nd round’s duration is 20 min.

**5. Counting the Score**

At the end of each round, the lecturer collects all the “packages of phrases”, count them and draws in a white board – or similar – a table as exemplified in Figure 2. S/he asks everyone to embrace the role of a quality department employee, and start to read the produced phrases. All the students are allowed and incentivized to evaluate the phrases of the competitor´s factory.

In the first round, few phrases (around 7 or 8) are expected in total, and usually fewer valid phrases (around 4). It is expected that the results from the 2nd round outnumber the first part in both total number of phrases and of valid phrases. By asking the managers to explain the strategy practiced, the lecturer has the opportunity to draw the student’s attention to some key IPD features, such as:

* Team work;
* Complementary competences and skills;
* Co-localization and communication.



**Fig.2**: A way to register the outcome of the practice

**6. Final Remarks**

In the case of using this exercise for teaching Lean Product Design and Development, the role of observer must be added to the game. The observer will analyze the dynamics during the 1st round and identify the wastes in the process. Before the start of the 2nd round, while the groups are deciding their strategy, the identified wastes can be considered to support their decision. During the final discussion, the lecturer should also highlight some key LPD features.