

Hans-Heinrich Harms, Brunswick, and Michael Conrad, Karlsruhe

Simultaneous Engineering for the Development of Agricultural Machinery

Simultaneous (or Concurrent) Engineering, is a concept which should be normal nowadays. Then, without early and simultaneous involvement of all departments, specialists and potential external consultants, you are no longer able to develop these ever more complex agricultural machines. „Simultaneous“ means also, that you can be faster on the market, because all departments can contribute their expertise earlier, and you also have the opportunity to use the expertise of the various specialists as early as possible. Thus, the product quality and the market use is improved simultaneously. By the product accompanying calculation the economic parameters are available on time too. In former times, and with small machines, you could afford to have them designed and looked after by one specialist, nowadays this is no longer feasible.

Prof. Dr.-Ing. Dr.h.c. Hans-Heinrich Harms is leader of the Institute for Agricultural Machines and Fluid Power of the Technical University of Braunschweig, Langer Kamp 19a, 38106 Braunschweig; e-mail: h.harms@tu-bs.de
 Dipl.-Ing. Michael Conrad is Managing Director of the TECHNOLOGIE MANAGEMENT GROUP Produkt und Technik GmbH, Karlsruhe; e-mail: michael_conrad@t-online.de

Keywords

Simultaneous or concurrent engineering

With most enterprises, product development steps of are defined by ISO or internal system processes.

It is more or less a systematic description of product development activities. Task, competence and responsibility of the individual work packets are assigned to the appropriate departments.

This institutional procedure is always the same and contains a large number of routine cycles. This procedure is labelled through:

- sequential working through the individual process steps
 - different specialists work independently of each other
 - product requests distributed through several experts
 - partial optimisation for internal department requests
 - many iteration steps are necessary for product optimisation
 - number of redesign cycles affect all process steps directly cost- and time-intensive
- The profit shrinks by shorter product life-cycles.

The capital value remains in the minus area during the product-life-cycle despite putatively good sales. The product doesn't manage to amortise the invested capital (see Fig. 1).

Driving factors for SE

- Pressure of time
- Pressure of cost
- Pressure of quality

Central ideas of SE

The „simultaneous development of product and production equipment in an interdisciplinary project team with simultaneous inclusion of users and suppliers“ is the so-called „Simultaneous Engineering“ (SE). In the meantime this central idea is meant for all activities from the product idea to the market introduction.

The central ideas are:

- being faster in the market by shorter development time
- reduction of development time by organised working process
- reduction of bureaucratic formalism resulting in shorter decision ways
- early recognition of complex cohesions by integral consideration
- target marketing by intensive cooperation with users
- reduction of expenses for tools and equipment by integration of specialists in the development process
- risk minimization by accompanying project controlling (time, expenses, cost and product requirements)

It is important that all involved departments work on the task early and simultaneously and not sequentially. Aside from the integral consideration, the development time will be reduced.

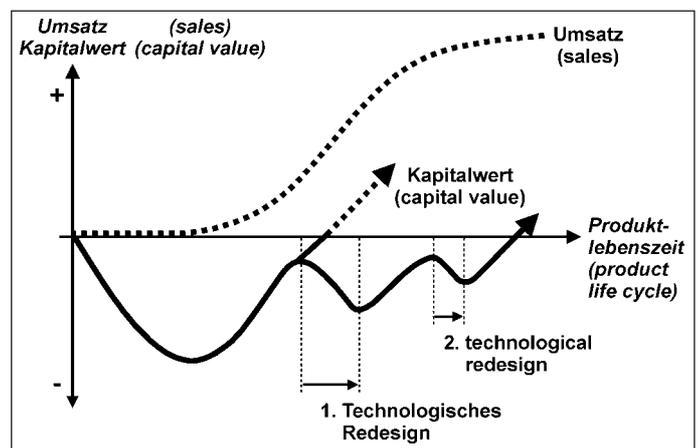


Fig. 1: Capital value development



Fig. 2: Self-propelled mower Big M (Photo Krone)

Thus it is possible to make all substantial decisions together with the people responsible for the product. It is imperative to be immediately informed of any target deviation.

Simultaneous Engineering - examples from the practice

With two practical examples of SE the main advantages are obvious. Both cases involve innovative, new products from the enterprise Krone.

Example 1:

The first self-propelled harvester: mower Big M (Fig. 2).

The complete time span, from the prestudy to market introduction, took 2 1/2 years, in which the first prototype was already proof-tested after a year. After this, the motto was „test, test, test“. The main development takes place in the field.

It was the unanimous opinion of all experts that this development period was at least one year shorter than with the normal development methods.

The real competence of the enterprise lay in the cutting works. Expertise regarding drive, hydraulics and electronics developed simultaneously with the development of the machine. The sub-suppliers responsible for the engine and cabin were involved from the beginning.

Example 2:

Self-propelled forage harvester Big X (Fig. 3) With regard to the SPFH „Big X“ an intensive market interview went ahead – as in the case of the mower „Big M“ – in order to hear about problems, expectations and ideas mainly from the users and to imagine the ranking of the requirements. Parallel to the SPFH, the new (12-row) corn cutter was developed.

Besides the product-strategic features, as i.e. : biggest performance category, hydraulic drive, 12-row (corn equipment), 40 km/h-licensing (street) the SFPH has further unique features. The benefit of „good listening“ to the users.

In this example, the time span from the vision up to the delivered serial product was also extremely short, because of parallel working of processes:

- 1st phase (time 1 1/2 years)
 - market research / interviews
 - concept study
 - product development
 - prototype 1
 - supply- & production concept
- 2nd phase (time 1 year)
 - test phase 1
 - modification from results of test phase 1
 - prototype 2 (preseries 4 pcs.)
- 3rd phase (time 1 year)
 - test phase 2 & presentation at Fair Agritechnica
 - production of equipment & tools
 - production of new assembly line
 - modification from results of test phase 2
 - 0-series (roll-out)

Not only was the development time short, but the product cost was also steadily controlled (target costing) by tight project management and the aim oriented systematic of SE.

Advantages of Simultaneous Engineering Methods

Shorter Development Times

by parallel sequence of operation and with that:

- reducing the development cost
- faster market presence „to occupy the market“!
- improvement of capital value

Target Marketing

by evaluation of the market and profit relevant functions and processes and their positional value compared to those of the competitors.

Cost optimised Solution

by construction accompanying calculations and early inclusion of the production and assembly managers, in order to optimise the tool and equipment cost and to avoid expensive modifications.

Summary

Knowledge in agricultural technology doubles in shorter time periods and thus reduces the product life cycle. Therefore it is necessary to develop new products in a shorter time. One method, proved in practice, is „simultaneous (or concurrent) engineering“, i.e. that products and production equipment are developed simultaneously in interdisciplinary teams and sub-suppliers are involved as early as possible. The main advantages of the SE-method are a much shorter development period, lower development cost and earlier market presence. Therefore the capital value increases enormously.

The contribution was presented as lecture at the VDI-MEG meeting Landtechnik 2002 in Halle and can be requested at the website www.tmg-pt.de under „Publikationen“.



Fig. 3: Self-propelled forage harvester Big X (Photo Krone)