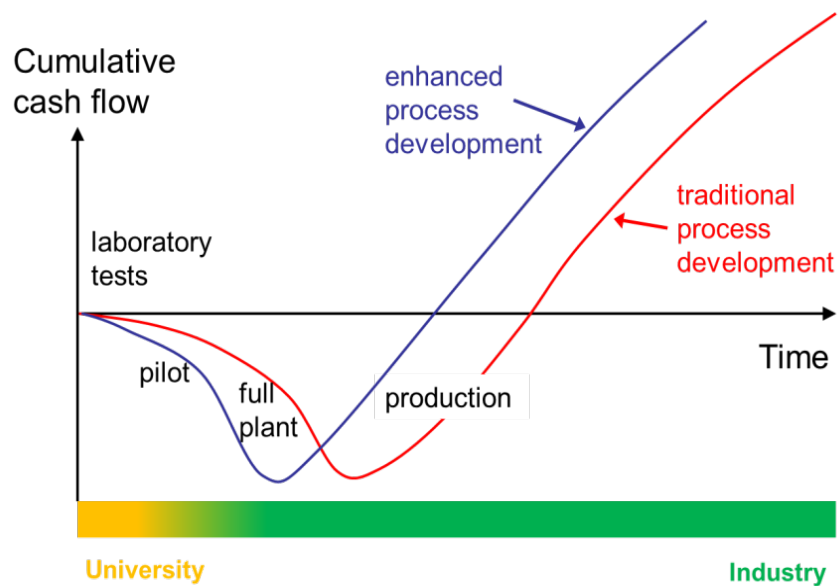




Modeling and simulation as tools for intensifying process development

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Increasing competition in all industrial fields requires intensified process development. In order to be successful in this, traditional process development based on heuristics and scale-up with small consecutive size increases in process units is too slow. Instead, a systematic methodology to speed up process development is needed. In the following, some guidelines how to succeed in this *enhanced process development* are listed:

1. Parallelization of experiments especially in small scale
2. Focus on fundamental chemical and physical phenomena, and isolated experiments related to these at initial stages. With these experiments, true physical parameters can be identified instead of lumped coefficients. This enables truly predictive models.
3. Building of phenomenon based, integrated models based on small scale experiment and literature knowledge.
4. Miniaturization and parallelization of pilot plants, microprocess technology
5. Extensive use of the developed process models for sensitivity studies, process optimization, and planning of new small scale experiments. Designing large units based on these truly predictive models

When enhanced process development and integrated modeling and simulation platforms are used, scientific knowledge accumulates directly upon the state of the art. Instead, with only heuristics and ad-hoc experiments, conclusions are shattered and do not accumulate systematically.

From the industrial point of view, the situation is even more crucial. It is well known that in any process development, there is a so called *valley of death*, when money is just spent on the development project before cash flow from the product sales is coming in. With the enhanced process development approach, the potential break-even point will be earlier. This gives competitive edge to the companies adopting this approach.