

A very brief introduction to the innovation-concept

"Individual innovations imply, by virtue of their nature, a "big" step and a "big" change. A railroad through new country, i.e., country not yet served by railroads, as soon as it gets into working order upsets all conditions of location, all cost calculations, all production functions within its radius of influence; and hardly any "ways of doing things" which have been optimal before remain so afterward."

– Joseph Schumpeter (1939, s. 101)¹

Innovation is a buzzword of our time. Rooted in the work by Austrian economist Joseph Schumpeter during the first half of the 20th century (Schumpeter 1911; Schumpeter 1942), it has received increased attention over the last decades.

Like any buzzword, the term innovation tends to be overused and filled with ambiguous meanings². Therefore this text aims to give a brief introduction to the innovation-concept from an industrial dynamics perspective. Understanding of the innovation concept and innovation processes is central to studies of energy systems and industrial dynamics.

Defining innovation

If we look to the definition of Merriam-Webster it states that innovation means "the introduction of something new" (which is not really differentiating an "innovation" from a "novelty"). We find an alternative definition from Swedish innovation researcher Per Frankelius:

*"My conclusion [...] is that **innovation** really means something 1) **new with high-level of originality**, 2) **in whatever area** 3) **that also breaks in to (or obtains a foothold in) society**, often via the market, and 4) **mean something revolutionary for people**."*
(Frankelius 2009)

An "innovation" is thus something that has an **impact** on markets or society, which is not necessarily the case with a "novelty".

Innovation as a process of creative destruction

Schumpeter describes the innovation concept as the fundamental drive of economic development. Schumpeter coined the popular expression **creative destruction** to describe how new technical innovations can transform existing industries and create new value by destroying previous

¹ Quote from Sandström (2010)

² In his book from 1968 the systems theorist Ludwig von Bertalanffy argues that his theoretical contributions were novel, but he did not want to use the word "novelty" because of the massive overuse and misuse of the word. If von Bertalanffy would have written his seminal book today instead of 1968 it is not unlikely that he would have claimed that his theoretical contributions were "innovative" instead.

economic structures and values (though not all innovations result in a *creative destruction* process).

"The opening up of new markets, foreign or domestic, and the organizational development [...] illustrate the same process of industrial mutation—if I may use that biological term—that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in."

– Joseph Schumpeter (1943, s. 83)

Radical or incremental innovation

The two most common ways to describe innovations in industrial dynamics are either as **radical** or **incremental** innovations.

Whereas **incremental innovations enhance existing structures and values** the radical innovations can create whole new market segments and often creates challenges, sometimes insurmountable, for incumbent companies. Therefore radical innovations put high demands on existing companies to approach new challenges in novel ways and acquire new technological and business related competence compared to what they previously had (Tushman & Anderson 1986; Henderson & Clark 1990).

Two examples of radical and disruptive innovations, from Sandström (2010), are the digital camera that replaced and pushed the classical analogue camera into small niche segments, and the digital calculator that replaced the mechanical calculator.

A short story about the company Facit

In Sweden there used to be a big firm specialized on mechanical calculators called Facit. Facit was an innovative company that constructed advanced mechanical calculators. To produce the fine-tuned Facit machines required the highest level of design and precision production skills. When the first digital calculators appeared they began to replace the more cumbersome mechanical calculators. They were also completely different machines compared to the Facit calculators, with electronic instead of mechanical components. Many of the highly skilled Facit engineers, with their great knowledge on precision mechanics engineering, had very little to contribute to a company producing digital calculators using electronic components. The outcome was that Facit failed to manage the transition from mechanical towards digital calculators and was forced out of business. Today few young swedes are familiar with the once so famous Facit-company. The company foremost lives on through its mascot the "Facitgubben", which has become a collection item.



Architectural or modular innovations

To complement the view on innovations as either radical or incremental Henderson & Clark (1990) introduced the concepts of **architectural innovation** and **modular innovation**. The core of **an architectural innovation is a reconfiguration of existing, established components** which connects and links the components in a new way. **In a modular innovation the core function of one of the components – or modules – is changed** while the connections and linkages between the components remain the same.

As an example of an architectural innovation Henderson & Clark used a ceiling fan as an example. If the fan is reconfigured, but with the same core components, to become a portable fan, then it is an architectural innovation. But if the ceiling fan is reconfigured to have a battery instead of a power chord, it is a modular innovation.

An interesting example of how powerful architectural innovations can be comes from the company Apple. Apple is often accused for not really inventing something new. And by looking at Mazzucatos (2013) analysis of the iPhone, it is clear that Apple's success came from reconfiguring different existing components into a new smartphone with little to no new inventions (i.e. modular innovations.) But still the introduction of the iPhone completely foiled the mobile phone industry and started a new life cycle for smart phones, showing that architectural innovations are powerful enough to launch a *creative destruction* process.

Suggested further reading

Henderson, R.M. & Clark, K.B., 1990. Architectural Innovation : The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. , 35(1), pp.9–30.

First chapter in Sandström, C.G., 2010. *A revised perspective on Disruptive Innovation - Exploring Value, Networks and Business models*. Chalmers University of Technology.

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