

IMPACT OF MEASUREMENT AND EVALUATION ON INNOVATION LEVEL

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Abstract

This article explores the situation in which an innovation project fails to achieve its full potential because the goal is lowered during the process.

When the gap between measured/perceived progress and goals/aspirations of an innovation project becomes too large, the goals will be lowered and opportunities will be lost. The hypothetical explanation suggested here, is that the progress is often perceived to be linear whereas the actual progress is often exponential and that this makes the gap between actual achievement and expected progress much larger. The hypothesis is explored by means of a single case study of a network-based innovation in the energy sector. The case supports the hypothesis, but further research is needed in order to conclude that the perception of progress in innovation projects should be exponential, not linear.

Keywords: innovation, measurement, impact

0. Background (chapter 0 is not included in original article)

Niels Bohr and Albert Einstein had during their meetings in the 1930s in-depth discussions whether or not it's possible to measure an object without affecting it. At the atomic level it seemed to the physicians that any measurement would always have an affect on the measured object. Therefore it's of vital importance that you - both when performing and evaluating the measurement - is sure of what is being measured, how you should do your measurement, what you will use the results for and finally that you uses the best methods and equipment for the measurements.

The quantum physics (nature's law for the smallest of smallest) makes a fitting analogy to the tendentious emphasis on measurement and the evaluation culture thriving these years. This is evident in the education institutes and in both the successful and unsuccessful innovation organisations. The qualitative measurement methods used in social studies are often put in contrast to the quantitative methods of natural science. But even the quantitative measurement of physics is included by the uncertainty principle of Werner Heisenberg; nature's smallest parts are acting very unpredictable, almost absurdly. The uncertainty principle sets limits to how accurate it's possible to measure both the position and speed of a quantum particle. The measurement of the position is inversely proportionately to the measurement of the speed. This means that the more accurate you can measure the position of a particle, the more inaccurate the measurement is of the speed. – and vice versa. The lack of any fixed results may be more natural to the humanists, since "speed" and "position" are terms made up and agreed upon by man because they are found useful in most situations. The cognitive perception of the atomic physics appear to make a complex net of problems that seems to run through all modern measurement of human activity including innovation systems.

The discussions about the measurement of physic phenomenon has forced researchers to give up the old idea of what a phenomenon is and instead define it as an indivisible unit of both observation and object. The Danish physic Niels Bohr emphasised that science always has to use complementary descriptions – this means to use two different descriptions that contradicts each other – towards phenomenon that are indivisible. At a lecture in Kronborg, Denmark in 1938, Bohr described the complementarity with examples from areas outside the phenomenon of quantum physics. He pointed out that it is not possible to examine biological life without destroying it: When manipulating and dividing living tissue, you will be destroying the exact thing you are examining. Or if you want to examine possible connections between the human nerves system and free will (if such a thing exists) it's impossible to avoid changing the neurological processes that is the foundation of free will. This lead to a central question: What and how much is destroyed in an innovation process by measuring e.g. halfway in the process?

Everything is to be measured

Today almost everything has to be measured and evaluated – and especially non-qualified measuring instruments have become popular. At the football pit the players estimates each other's performance without full understanding of the coach's strategy; at music, dancing and singing contests people vote by calling or texting their choice to the television channel and based on the different votes a winner is found. At courses the participants often evaluate without any knowledge of either teaching or educational principles. Experiences of wine, food, travels, service, TV etc, is evaluated without any consideration for the evaluators psychological, theoretic or practically background, this because measurement has become easy. The human brain's tendency to create patterns decides how we react and move in respect to all we see and observe. The measured is a strong indicator to the creating of new – or activating already existing patterns in the brain – that we will act by.

An example: If we when driving a car sees a light sign that measures the car's speed and displays it as being way beyond what's allowed, there is an immediately analysis in our brain. The analysis can from our previously experiences, saved as patterns, have different characters; whereas some are evaluating the risk of the speed, other evaluate if

there is any danger of losing the driving licence and others again if the flashing lights should be taken into consideration. But an analysis takes place that will result in some kind of activity – either a decrease of speed or a conscience neglect of reaction. The course is:

Measurement → Analysis → Activity

The analysis establishes a pattern that may be recalled the next time the driver meets the light sign and then it will be a part of the next activity.

Not all measurements are reflected by an analysis. An activity can be evaluated directly and a result can be reached as:

Activity → Measurement → Result

An example is the winner of the European Music contest. In the contest the activity (the music from the different countries) causes a result through the collection of text-voting or other kind of measurement. One of the countries wins primarily through the measurement method. Another example is the journalistically measurement of an activity where a “journalist interviews a journalist” as a method of measuring the activity. The result is shown directly on TV.

It's possible to talk about at least two types of evaluation: external and internal evaluation. External evaluations are often seen as a systematic control method in organizations – with the management as advocate or interested party - and with e.g. tendering of image as motivation (activity → measurement → result). Internal evaluations are formative and more development oriented in their use of the evaluations towards the objects that are evaluated. Formative evaluations are used in the midway evaluations of e.g. educational courses and innovations processes, where the focus is mostly on how to keep moving forward and less on the individuals achievement or the result (measurement → analysis → activity).

The external focus on the client/user perspective when asking users/students of their opinion will be insufficient as an internal evaluations method. Peter Dahler-Larsen, professor in method and evaluation in social science at Syddansk University, has found the following elements as being essential in an evaluation: According to Dahler-Larsen, every evaluation consists of seven factors:

- Actor/player (e.g. the innovator or student)
- Time (after ended activity)
- Method (e.g. questionnaire)
- Use (e.g. internal or external)
- Standard (e.g. what is good enough, quality)
- Criteria (e.g. satisfaction or profit)
- Evaluator (e.g. teacher, principal, ministry, director etc.)

According to Dahler-Larsen, evaluations are constituent. This means that the character, measurement method and criteria of a test or an evaluation are all parts in deciding the character of whatever is being evaluated. This is evident in the discussed PISA-tests: In Finland it became clear that one of the reasons why the students did so well in a

mathematic exam was because the teachers wanted their student to score high on the test and therefore adapted the teaching to the test.

“We get what we measure” is in short the conclusion of Einstein and Bohr’s dialogs and the measurement is therefore the essential ingredient, no matter if it leads to a result or an activity. An evaluation is thus very important and needs to be well thought through if it’s to be used for anything. The worst part is that the internal midway evaluation actually, as part of a long-term innovation strategy, makes things worse as stated in this paper.

1. Introduction

In order to legitimate the innovation projects, the project manager and the business unit responsible for the project need to document the effects of the innovation project. This leads to an essential interest in measuring and evaluating the success of the project (Kessler & Chakrabarti 1996; Tidd, Bessant & Pavitt 2005).

The progress flow in strategic innovation will often be assumed by management to follow a linear progressing curve (Lievegoed & Glasl 1997) – or an approximately linear curve (Greiner 1988) – with a fixed gradient consistent with the defined goal – roughly a straight line from the starting point to the expected ending point (Darsø 2001). A somewhat similar approach to linearity and forecasting the various phases of an innovation project can be identified in the stage-gate method by Cooper (1988).

However, by nature a lot of innovation projects are not marked by a steady development throughout the project period. Thus, the accumulated knowledge added to an idea in the beginning of a development process is rarely linear. The added knowledge as well as the undergoing value follows an exponential curve – or an approximate exponential function (Mikkelsen & Riis 1989). This may be similar to the learning curve effect for launched products partly explaining the shape of Product Life Cycle curve (PLC, e.g. Kotler (2006)).

If decision makers with a linear expectation carry out a mid-term evaluation of an innovation project and identify a gap to the actual (exponential) change curve, they potentially can draw two conclusions: They can close down the innovation project or they can adjust the goals of the project (and by this diminish the innovation level of the project substantially).

This paper is aimed at exploring the potential gap between the linear expectations of the company management and the actual exponential development of the innovation project. Thus, the purpose of the paper can be summarised in two research questions:

Is there a gap between the expected progress by decision makers in the company and the actual development in the innovation project?

If so, what are the consequences of the (potential) gap in relation to the further development of the innovation project?

The exploration of the potential gap between decision makers and the actual development of innovation projects will be based on a case study: A Danish inter-organisational, network-based innovation project within the energy sector. One of the

authors has been involved in this innovation project as an action researcher. He has been collecting data through 15 semi-structured interviews (one to two hour) with the focal organisation and the other participants in the project. In addition, as an active participant at the network meetings and as a sparring partner to the focal organisation he has collected extensive field notes. The data analysis is being carried out as triangulation, both internally among the researchers involved in the project and externally with the participating organisations.

The preliminary findings of the paper indicate that the focal organisation is experiencing substantial difficulties in keeping the participating organisations involved in the innovation process. Several of the partners feel a lack of concrete outcome from the network and respond by leaving the network at early stages. The paper will speculate about theoretical explanations for the empirical pattern observed and come up with suggestions for future research.

The paper will seek to generate some managerial implications for handling the innovation process. Understanding that the innovation project rarely is a linear process could prove to be a keystone in a successful innovation project.

2. The progression in innovation could be seen as an exponential curve

Beyond the innovation project level, innovation is sometimes described as a diffusion process communicated through a certain channel over time among the members of a social system (Rogers, 2003), spread through society in an S-curve (Rogers, 1962) which is similar to the learning curve effect for launched products partly explaining the shape of Product Life Cycle curve (PLC, e.g., Kotler (2006)). Games theory has simulated competitive diffusion processes, based on an innovation system as an exponential curve as a result of the cumulative nature. At the innovation project level, the added knowledge as well as the undergoing value follows an exponential curve – or an approximate exponential function according to Mikkelsen & Riis (1989). Olleros (1986) as well as Dosi (1984) describes that radical new ideas are not a result of incremental linear steps in a continuous process, but more a result of a series of discontinuous steps which later in the process becomes more and more cumulative as an exponential curve.

Bower & Christensen (1995) did the same with their Disruptive Technology described as an exponential curve breaking other curves (in 2003 the term was changed to Disruptive innovation (Christensen & Raynor 2003)). A lot of innovation projects are not marked by a steady development throughout the project period as well as the accumulated knowledge added to an idea in the beginning of a development process is rarely linear, and as knowledge is added to an idea over time the accumulated amount of knowledge may be expressed conceptually as a type of exponential curve.

3. Management system and expected progress in innovation processes could be seen as linear curves

The evaluation form to predict the flow in strategic innovation will often be assumed by management to follow a linear progressing curve (Lievegoed & Glasl, 1997) – or an approximately linear curve (Greiner 1988) – with a fixed gradient consistent with the

defined goal – roughly a straight line from the starting point to the expected ending point (Darsø 2001). A somewhat similar approach to linearity and forecasting the various phases of an innovation project can be identified in the stage-gate method by Cooper (1988). The expectation to progress in an innovation project is as described in the cases often regarded as linear curves regardless if it's economical, political or even anarchist motivated.

4. Comparing the two curves

This two approaches to change as a function of time is not comparative as the focus is quite different, but still they are compared every time an innovation process is in progress. The dilemma is showed in the figure below.

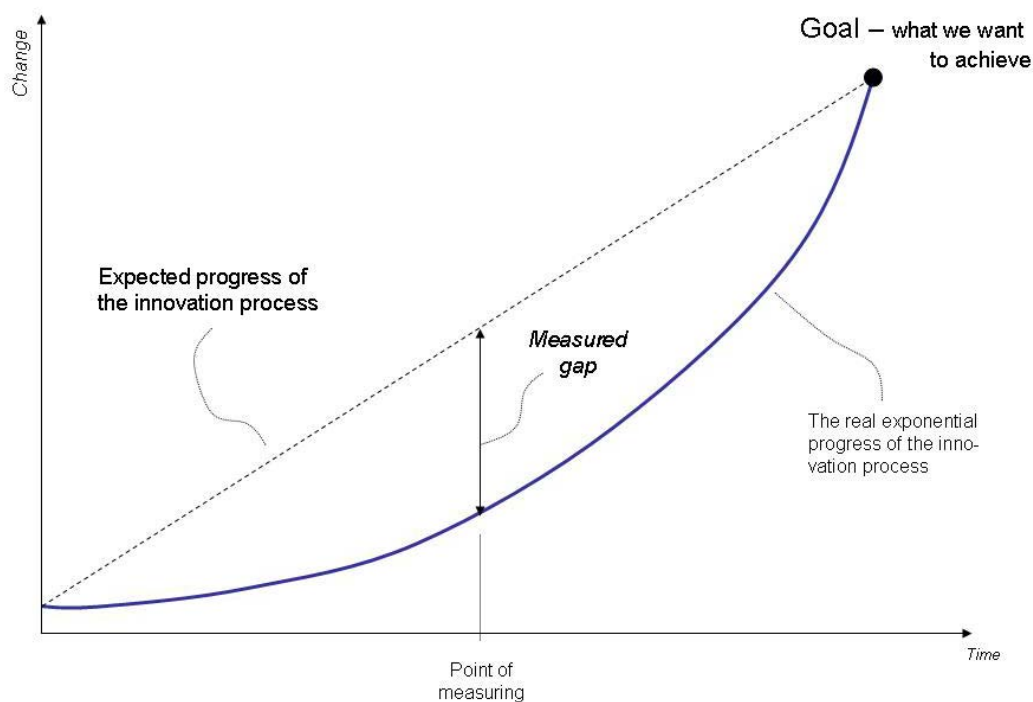


Figure 1. Measurement create a gap

The measured gap between the expected process and the real process usually has a tendency to be considered as being too big. The gap emerges from a result of two different measurement understanding of the result from the measurement and measurement methods, and do not necessarily show a difference in reality.

As for instance, in January 2004 a major Danish producer of medical devices organized a special innovation group to develop new product and business opportunities for the future. The main reason for the initiative was a realisation, that in some years their main business area potentially could disappear as a medical solution might be found to the problem. They assigned a group with the goal to double the turnover in five years (based on new businesses opportunities). After 1½ years the decision makers had a clear expectation to the result, that even though there might not be a increase in turnover of 30% there should be a considerable increase in turnover, which was not the case: There was several potential business opportunities, but none of them was yet to be verified as

potential successes, and in December 2005 the group was shut down, and a more incremental approach was chosen. The goal might not have been reached – impossible to know, as the decision was made as a result of the measured gap between the two curves. The adjusted goal seems to join the two curves at the measurement time to avoid the gap as showed in the figure below, which result in a potential new gap at the ending time.

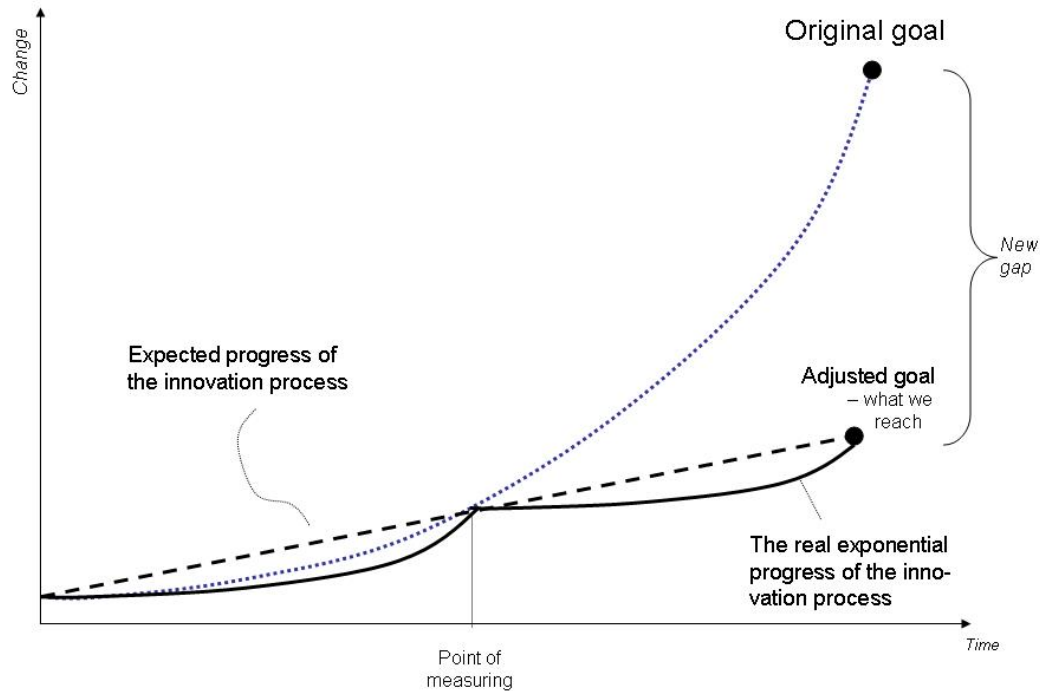


Figure 2: By destroying the gap a new gap appear

As a result of the measurement, the innovation aspiration is lowered.

Another example: In 2006 the Danish Technological Institute had their 100 years birthday – a day to be celebrate with several events. Also it should set the start for a new era with focus on the costumers. A new modern building with all modern technology was build ‘to explore Open Innovation’, where different specialists from different professions was placed, together with different companies with their innovation activities and researchers from different universities. For people placed in the building this was considered as being an experiment to creating new activities and to learn about how different knowledge areas and traditions could work together (activity oriented). The top management approach was a business model – a model which from the very start should show some effect. Thus, the top management was result oriented in their expectations to the new initiative. It was an explicit expectation, that different companies would place people in this environment and at the same time were ready to pay a considerable amount of money for staying in the environment. It was also an explicit expectation, that the offer would be popular, and it would be possible to choose between several people and companies. After 1½ year there have been generated several projects, several articles have been prepared as well as new potentials have been discovered, and the basic idea with cooperation between different professionals has showed a positive effect However the direct economical income as well as the expected rush has not been as expected. Different activities have been explored, things have been

modified, but the gap between the reached result and the expected result has led to the conclusion, that the activity should be closed to make room for innovation with a clear technological focus on a single topic. In the following section we will explore the problem in an in-depth case study.

5. In-depth case study of a network-based innovation project in the energy sector

5.1. Case description and Methodology

The case study concerns a Danish inter-organisational network within the energy sector. The network analysed is part of a comprehensive project consisting of six networks. This comprehensive project is presented below.

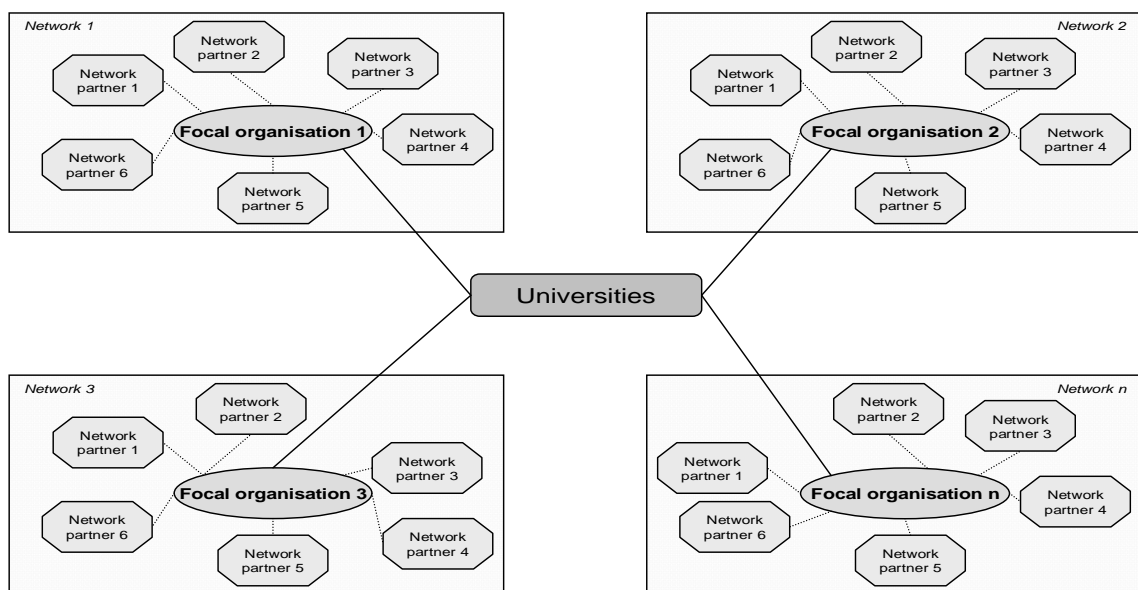


Figure 3. The case

The overall project was initiated by the Ministry of Science, Technology and Innovation and was aimed at developing new business models in inter-organisational networks. As illustrated above, the participating universities are cooperating with a number of focal organisations, which have all initiated a network.

5.1.1. Case Description

The energy sector network is one of the six networks of the overall project. The focal company has co-funded the project and will henceforth be described as the funding organisation.

The funding organisation is a profit-seeking company and one of the major IT solution providers for the utility sector in Denmark. It provides ERP systems to a number of the utility providers, and an essential part of these ERP systems is the processing of data from private household meters.

A new business idea was conceived in 2004 by the area director of the funding organisation's energy division. His idea was triggered by the fact that automatic metering solutions were being implemented in the majority of private Danish households. The implementation of automatic metering has positive effects for both the energy consumers (they no longer have to read and report their meters) and for the companies in the energy sector (the automatic metering produces valid information about energy consumption accessible to the companies). The area director envisaged that the access to the consumer data through the automatic meters might be an important way of expanding activities on the consumer market.

It soon became clear to the area director that his idea could not be realised without active participation from other companies in the development of the relevant services. This led the area director to formulate some ideas about establishing a network in an effort to launch new automatic metering services into the consumer market.

In order to initiate and involve relevant partners, the funding organisation and the researchers contacted potential participants by post in December 2005. The organisations that expressed their interest in joining the inter-organisational network were invited to the first network meeting in March 2006. This meeting was followed by three network meetings in August 2006, September 2006 and February 2007. These meetings resulted in a specification requirement to the solution which should be presented to the customers.

5.1.2 Methodology

The data, on which the present paper is based, is partly meeting observations and meeting minutes, partly in-depth interviews with the organisations involved in the process.

The researchers involved in the project participated in all network meetings. The duration of the network meetings was between four and eight hours. Two of the network meetings were documented on audio recorder and transcribed. The researchers made extensive field notes throughout the network meetings. Due to the fact that the funding organisation did not feel comfortable about having the other two network meetings audio recorded, these two meetings were merely documented through field notes. In addition, one of the researchers took part in the pre-meetings with potential partners. Observations from the pre-meetings were documented in field notes.

The researchers have carried out thirteen interviews with persons from eleven of the participating organisations. The interviews have been set up as explorative interviews covering a variety of aspects of the network process. The duration of the interviews was between 50 minutes and one hour and 55 minutes. The interviews were recorded and transcribed.

The researchers have employed various types of data analysis. They have carried out an 'external' analysis of the generated data. Through triangulation (Denzin 1978) of field notes and other sources of data, they have, furthermore, sought to establish a common understanding of the development. In addition to the external data analysis, the researchers have presented the perception of the development to the funding organisation and some of the other network participants. This external-internal

exchange of perceptions has generated new knowledge about the network development and has been used as valuable input to the case study analysis.

5.2. Analysis

The case illustrates to some extent a misbegotten innovation process. In spite of the extensive sum of resources, which the participating organisations represent, the innovation degree of the final solution (expressed in the specification requirement) is limited and the number of organisations involved in this implementation stage of the network is low.

The focal organisation is experiencing substantial difficulties in keeping the participating organisations involved in the innovation process and committed to the outcome of the network. The area director describes his perception of the attitude of the other participants in the network as a ‘counter motion’ to the visions of the focal organisation. He expresses his feeling of a lack of ‘buy-in’ from the other participants in the network.

The interview with the other participating organisations illuminate that the reason for this lack of commitment to the network and the innovation process is due to a sense of lack of clear indications of the focus of the network and lack of specific business plan:

‘Then they [the focal organisation] explained how it was and that was the point of departure. I don’t remember the model, but I remember the thing about the business case – or the story about the rationale – of the network. It was unclear when we started. We spend all the time at the meeting [the first network meeting] trying to establish the business case and still it was impossible to see. And it still is to me’

(Interview with the senior manager of one of the participating organisations, interview December 2006 (translation from Danish))

As a result of the sense of lack of business case, the senior manager did not show up at the next network meeting in August 2006. Instead he sent a more junior manager. And since the August 2006 network meeting the organisation withdrew from the network.

One of the other participants expresses a similar perception of the network development. He is responsible for the telemetry department of one of the major telecommunication company in Denmark. He saw a considerable potential in the network:

‘The vision of the network was that we should create the mother of all solutions...’

(Interview with the market responsible of one of the participating organisations, interview December 2006 (translation from Danish))

His felt disappointed after the first network meeting in March 2006. His evaluation of the March 2006 network meeting is rather critical:

‘Nobody could see the business case. It did not make sense [...] We did not achieve anything at the meeting’

(Interview with the market responsible of one of the participating organisations, interview December 2006 (translation from Danish))

The market responsible resigned from the following network meetings and sent his product manager in order to keep track of the progress and develop relationships with

potential customers. He defined her task as being defensive and not to participate in innovative processes of the network. The organisation resigned after the second network meeting.

However, the impatience was not just affecting the other participants in the network. The project manager from the focal organisation also became restive in terms of the development of the network. After the August 2006 meeting he agreed with the area director that they wanted to get a specific outcome from the network: They wanted to 'move down the funnel' and focus on only a small proportion of the organisations which thus far had been involved in the project. They invited three of the utility companies to a meeting and agreed upon a preliminary specification requirement of the solution. The number of functionalities was markedly reduced and the innovation degree of the sketched solution was very limited as showed in figure 2.

As becomes clear from the analysis, the innovation process has been hampered by both external and internal pressures. On the external side the participating organisations expect a business case at the first network meetings. When they realise that the focal organisation and the other participants in the network are not following a straight line in the innovation and change process, they abandon the network. Simultaneously, and to some extent provoked by the scepticism of the other participating organisation, the management of the focal organisation begin to hasten the development of the solution instead of accepting the exponential progress of the innovation progress. This approach of the focal organisation reduces innovation degree of the network (ending up in the 'adjusted goal' in figure 2) and hinders the realisation of the potential of the sum of the resources which the large number of network participants represents.

6. Conclusion

This paper is aimed at exploring the potential gap between the linear expectations of the company management and the actual exponential development of the innovation project. A gap appeared upon different measurement methods or/and expectations to progression or change.

The paper finds that the expectations are that progression is linear and that the actual innovation progress follows an exponential curve, which implies a risk that a gap between the two will appear - no matter when the measurement is done. A gap which result in three different scenarios:

- 1: The innovation project will be stopped as described in the cases
- 2: The goal will be adjusted as described in figure 2 to avoid the gap
- 3: New ways of measure and evaluate the progress in innovation projects by adjust the expectation, which need further research

Since the empirical evidence is drawing mainly on one case study more evidence will be needed to explore and confirm the idea presented in this paper.

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