

Renaissance of the Incumbents: Network Visions from a Human Perspective

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Abstract: Networks are omnipresent and universal. Today, networks often are associated with telecom networks because they play an important role in our economical and social life. However, the collection of interlinked sectors contributing to the GDP of our national economies, for example, forms a network too, as does humankind, our brain and language constitute evolving networks. Today, humankind is confronted with complex, border- and sector crossing challenges. Think e.g. of demographic, climate and mobility challenges. Finding that networks are omnipresent and universal presents an eChallenge for the ICT sector and a chance for the renaissance of the incumbents! They can play a significant role in re-uniting functionally decomposed societies to overcome the multi-actor prisoner dilemma's of today's national and intra-sectoral, conventional solutions that come to a grinding halt. "Trans-sectoral network visions" from a human perspective are then a condition sine qua non.

1. Introduction

Roughly 11.000 years ago, a major transition took place for humankind and its evolution. Nomadic families started to settle down during the aftermath of the last ice age and became colonists. The first villages emerged, hosting several families. Before colonization, nomadic tribes were entirely self-responsible, almost completely self-sustaining cohesive clusters performing all necessary tasks in order to survive as a group. One may consider such a tribe to have a collective nerve system guarding and controlling the prosperity and well-being of this relatively small human 'network'.

The early colonist era was characterised by the introduction of agriculture and cattle breeding laying the foundation for the first wave [1], the agricultural revolution. People commenced, for sake of efficiency, to divide up tasks. They learned to specialise in a branch or 'sector' of emerging specific new 'functions', such as farming, construction, mining, warfare et cetera, requiring a unique set of knowledge, skills and tools.

The outsourcing of tasks is based on trust relations and supported by transactions. People allowed other people to take over vital tasks they used to perform themselves. This transition initialized an important trend: progressing *functional decomposition* in economy and society. This enlarged the efficiency and thereby the scale of economy and society, growing from local all the way to global. Direct implications are increasing complexity of economic and societal processes accompanied by a strong growth of the vocabulary of our languages and the discovery of counting and abstract numbers providing the basis for the skill of writing [2].

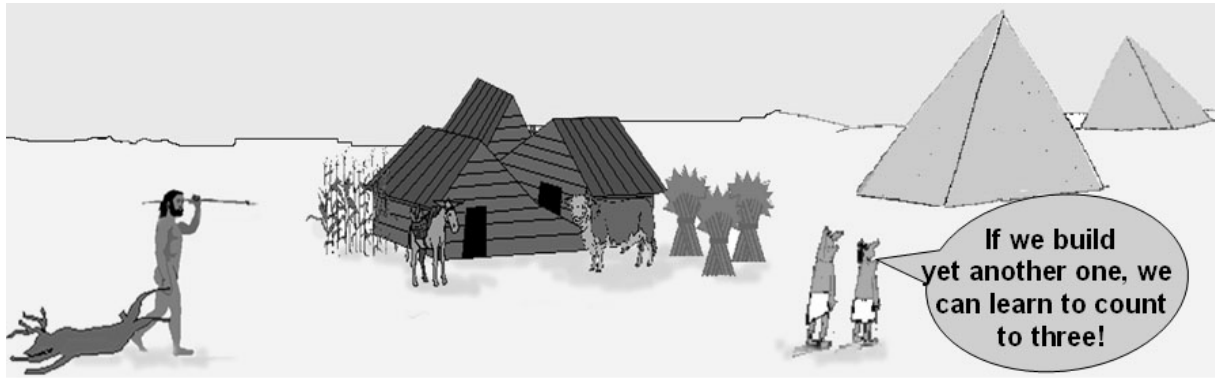


Figure 1: From Hunting to Counting

This ‘progress’ naturally invoked the second and third wave, i.e. the industrial and information revolution, respectively. Concurrently, we see a trend from *manual* labour being slowly overtaken by *brain* labour. Cognitive skills supersede manual skills with all kind of consequences [3]. Basic needs and activities to fulfill them are complemented with increasingly complex needs and sophisticated services higher in the Maslow’s Pyramid, see Figure 2. A constant factor in all three waves is the diverging movement of the functional decomposition and emergence of new sectors, enlarging the network of economy and society. However, there is a price that comes with this evolution. The increasing scales bring new complex challenges, because this ‘network’ growing with each wave seems not designed to cope with the network phenomena it evokes.

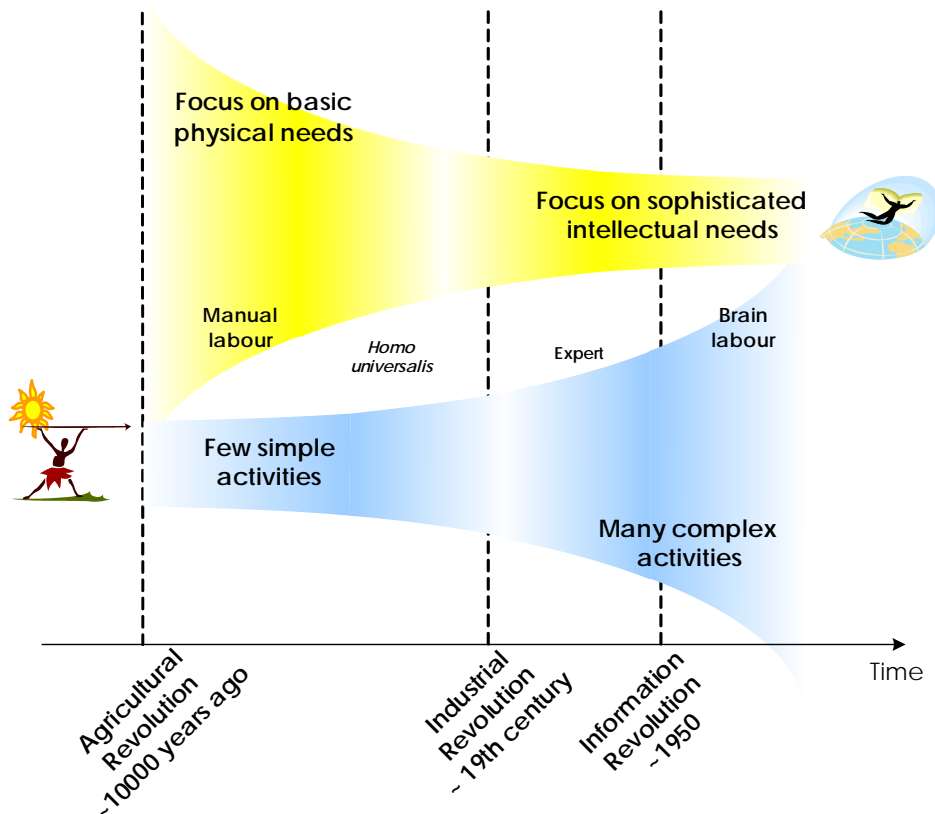


Figure 2: The Revolutions So Far

The network has grown from tight small-scale local networks and it gradually expanded and transformed into a large-scale network, enclosing a set of sectors that have often become internationally organized [4]. It appears that (the coherence of) the new network, which is obviously directly influenced by the number and quality of interconnections (links), also needs to be optimized in performance and QoS as a whole to deal with the

challenges as we face them in this decade. Today, the network resembles more the collection of a set of loosely and opportunistically interacting sector subnetworks [5]. Do we find ourselves now in a state of *functional over-decomposition*, beyond its optimum? Think e.g. of the transport sector and the congestion problems on our roads, the low efficiency and increasing costs in the healthcare sector, the environmental sector et cetera. Are we grinding to a halt? What can the ICT sector and its networks mean and how can the current status quo be improved? Could the ICT sector emerge as a central hub in this total sector-network? If so, what can be the role for incumbents? What co-operation is required with the regulators and authorities?

1.1 Transition from a Nodal View towards a Network Vision from a Human Perspective

In the development of incumbent operators, we detect in a time-condensed way, isomorphic evolutions as described above. During the aftermath of their ‘glacial period’, the incumbents transformed from monopolistic often state owned organizations to a set of loosely co-operating, commercially driven business lines using dedicated networks for telephony, internet and TV. Today, we see a starting secondary migration of these dedicated, vertically integrated networks towards next generation multi-service platforms to reduce costs, increase operational excellence and to facilitate the flexible introduction of new services in a coherent portfolio. This movement is a necessity if incumbent operators wish to play a role to overcome their functional decomposition and aspire to play a role in tackling the described complex challenges with unconventional ICT solutions. A congruent secondary migration seems required on the higher aggregation level outlined in the beginning of this chapter, i.e. the migration of the functionally decomposed, economy and society of monolithical sectors towards a horizontal integrated sector-network. The challenge here is also threefold; it deals with infrastructure, services and control (organization). Zooming into the sector network, we discover in each of the sector nodes not just an infra- and service layer but all seven OSI-layers. Network- and service management, say control, is a premise to make the *network* function as a whole.

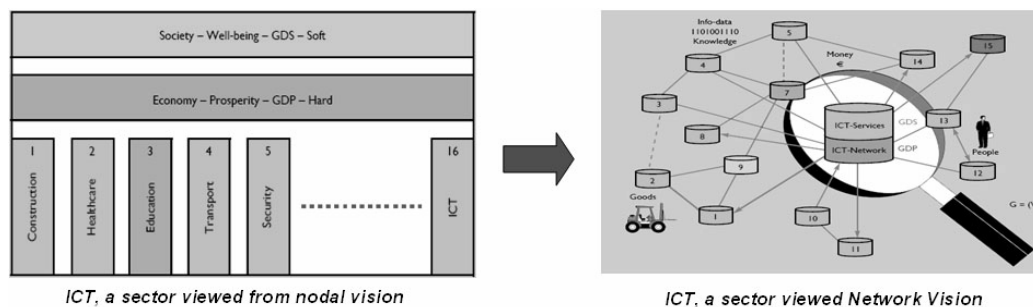


Figure 3: From a Nodal Vision to a Network Vision with the ICT Sector as a Central Hub

1.2 Telecom Networks Bridge All Kind of Nodes

The ICT sector could manifest itself as a hub in the sector-network strengthening and expanding its links towards other sectors, and thus slowing down the divergent forces in the sector network. It literally connects the sectors making all kinds of new combinations possible. The trans-sectoral services of ten thousands of sector sub-networks, i.e. sector combinations, then come within reach, see next chapter. Only in this way, the full potential of the network can be exploited. The economic value, as a measure for the status quo of prosperity, seems not sufficient as a measure to reflect the performance of the network as a whole. Could it be that we need a ‘soft’ counterpart of the GDP, as a measure for the status quo for well-being of the end-users of the network, say a Gross Domestic Service, GDS,

kind of measure [5]? If so, what is the weighing factor, how do they balance one another? Is this the key for network visions from a human perspective? We strongly believe so and support this later by two cases.

2. Sectors

As outlined above, on a macroscopic level, economy and society have decomposed into a number of sectors that together provide the foundations for our daily lives. We recognize this phenomenon on different aggregation levels [5], e.g. on company level.

Examples of sectors are: healthcare, education, transport and construction. A sector can be defined as *a collection of homogeneous activities*. In addition to the activities, sectors are characterized by their services, infrastructures and the players (actors) within them.

Many sector models exist. Currently, a clearly defined and commonly accepted international sector model does not exist. There is no consensus about an activity classification system. The United Nations are working on an international standard to define the sectors and their corresponding activities. So far their International Standard Industrial Classification of All Economic Activities, ISIC, discriminates 21 sectors (ISBN-10:9211614562; ISBN-13:9789211614565). Figure 4 below illustrates the relation between the number of sectors and the theoretical number of sector combinations, based on a set of 16 sectors. These combinations can be considered as the collection of all sub-networks of the sector network. With this vision, the full potential of the network can be exploited.

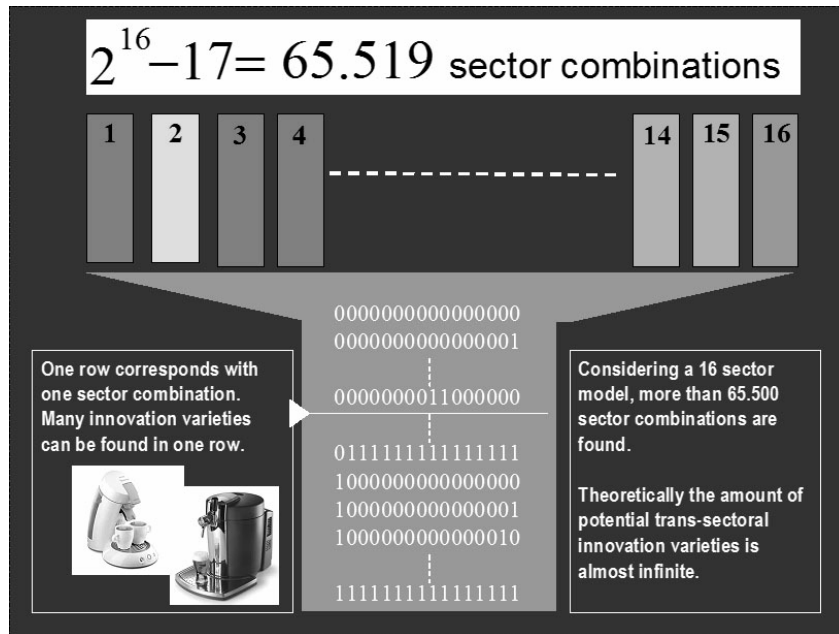


Figure 4: The Enormous Potential Trans-Sectoral Innovation Could Offer

The total theoretical number of sector combinations equals 65.519 for a 16 sector classification. The number of sector combinations can be easily derived using Newton's binomium or by studying figure 4. Note that seventeen rows are rejected because they are in fact no combinations (zero or one sectors involved respectively).

2.1 A Five-Sector Example

Classical examples of spectacular innovations that involve the actors of two sectors are *Senseo* and the *Beer Tender* (marrying Philips to Douwe Egberts and Heineken respectively). But also sub-networks encompassing five nodes to give birth to trans-sectoral innovations are already there. Such a typical innovation example is the case of the

healthcare insurance company VGZ. It is offering their customers a cholesterol friendly butter of Unilever at a lower price. The discount could be offered using an RFID tag interacting with the customers' Personal Network [8]. Involved now are five sectors: the trade, finance, industry, healthcare and ICT sector that all benefit, including the customers. The actors of the different sectors had to co-operate to find one and another in a five sector sub-network with a win-win situation for all participants.

2.2 Trans-Sectoral Innovations

Let us denote the number of *potential intra-sectoral innovations* as X and the number of *potential trans-sectoral innovations* as Y . Obviously, the value of Y always dwarfs the value of X . But, to actually realize the Y trans-sectoral innovations is far more difficult than implementing the X innovations. The former needs to overcome complicating factors such as the multi-actor prisoner dilemmas that almost implicitly accompany Y , whereas for the latter the factors reside in one single domain. Denoting Y' as the number of *feasible trans-sectoral innovation varieties*, this number will therefore be smaller than or equal to Y . Analogue to Y' , we define X' being the number of *feasible intra-sectoral innovations*. In figure 5 below, we qualitatively consider the domain of X' and Y' ; N denotes *the number of involved sectors per innovation*. Due to complexity and trust reasons, we expect the number of feasible trans-sectoral innovation varieties to drop exponentially when more sectors are

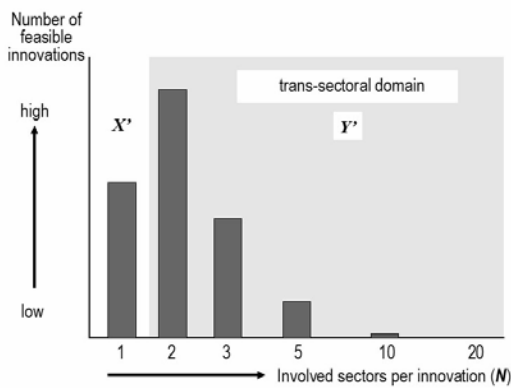


Figure 5: Indicative Innovation Feasibility Diagram

involved as N increases.

The value of Y' is influenced [9] by:

- Prosperity,
- Well-being,
- Infrastructure,
- Education level,
- Entrepreneurial climate,
- State of the art ICT means,
- The countries specific cooperation culture,
- Trust level,

3. Business Benefits

From the above, we found a diverging trend through time, the *functional decomposition*, leading to a set of loosely-coupled sectors that seem to be grinding to a halt. We already demonstrated the power of *trans-sectoral innovation* enabled by a second migration from a nodal towards a network concept. The latter opens a far richer set of truly qualitative and often disruptive innovations than the former that evokes mostly incremental, quantitative innovations within one sector. Next, we will try to illustrate that some major trans-sectoral innovations can be realized using the ICT sector as a hub in the sector-network in mentioned second major migration. We then look at all sub-networks that contain the ICT sector as a node and then count $2^{(16-1)} - 1 = 32.767$ sub-networks.

3.1 Current Incumbents' Cashcows are in Their Deep Autumn

As in all sectors two major roles can be distinguished, that of the infrastructure operator and the service operator. Incumbents realise that their dominant role of network operator does not suffice. Some disruptive challenges should be tackled in addition to expanding their portfolio with the classical services such as internet and TV services leading to Triple- or Multi-Play, simply to survive. They ought to take up a subtle 'director' role in the sector-

network emanating from a network vision. Only then, the ICT sector can become a hub in this network connecting emphatically their customers and simultaneously strengthening the company network to survive their “dog-phase”.

3.2 *Trans-sectoral expansion leading to a novel spectrum of services*

With the concept of trans-sectoral innovation, the fruits of thousands of sector combinations come within reach. We outline two concrete cases below.

3.2.1 *The Complex Case of FTTH*

It is obvious that *Fiber To The Home* is the preferred and future proof access network technology and architecture for the access network. However, why would an incumbent start today? The economical and societal fruits of FTTH fall ahead in time and laterally in other, often public, sectors, firstly in terms of cost savings and secondly in terms of new revenue streams that are generally not quantifiable today. So why take the role of the initiating actor and with it all the financial risks? Indeed, intra-sectorally, the business case looks bleak to say the least. If access capacity must be increased, go for the incremental way: *Fiber To The Curb* and save as an incumbent at least 400€per subscriber!

Let us calculate again using the Real Option Analysis rather than the Net Present Value Calculation [7], working with a network approach rather than a nodal approach, i.e. to make a trans-sectoral business case. We select the sector nodes linked to the ICT-sector and the actors within them. Next, we look at the impact on these nodes and model these using the option model. The results differ substantially. One will discover that other parties wish to co-invest in the passive tertiary access network, i.e. from curb to home, and there is a basis for future Public Private Partnerships. The problem still is how to deal with the ‘flows’ of new cost savings and new revenue streams in the network, i.e. how to avoid multi-actor prisoner dilemmas; in addition to the barriers raised by the (intra-sectorally organized) regulators and authorities. Exactly here lies the challenge for the incumbent operators.

3.2.2 *The Double Gray Wave*

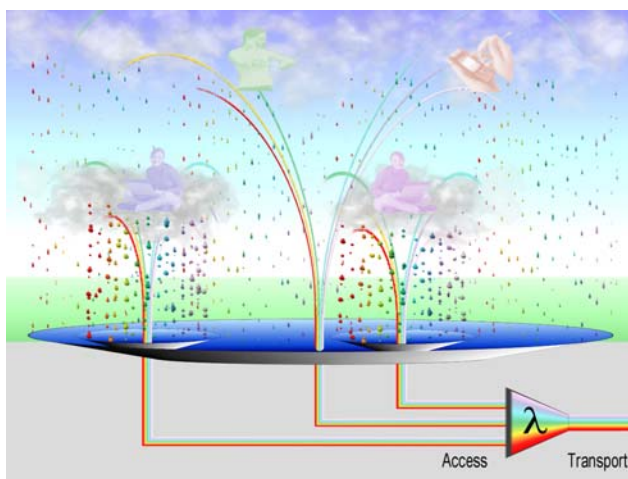


Figure 6: *Fixed and Wireless Ecosystem*

Only a few truly understand the huge impact of increasing average lifetime of human kind. Just let us enumerate the very strong increase during a period of two hundred years in the ‘record’ countries: 1850, the average lifetime was 45 years (in Norway); 1960 it was 77 (the Netherlands), 2002 it grew to 85 (Japan) and in 2040, it is predicted to be 93! The illness of this century therefore will be the disease of Alzheimer!

In Europe, already today, one out of every two baby-girls will surpass the age of one hundred years. In Europe, we

therefore are facing the double gray wave of the baby boom: numbers increase and people grow older. Intra-mural care will lead to exponential costs, thus we will definitely migrate to extra-mural care, requiring all kind of sophisticated and simple in-house ICT-solutions. We see that already today extra-mural care will lead to substantial savings. For example, in the Municipality of The Hague 230

Million euros can be saved if elderly people can live three years longer in their homes (source: Breedband in woonzorg contexten, Bert Mulder, lector Haagse Hogeschool 2003).

The extra-mural care will be required everywhere 'on the move', generating a spectrum of new services. This requires broadband radio access at home, at the office and in the public space for Personal Networks [8], another challenge for the incumbents! Therefore, it is necessary that the 'liquid bandwidth' offered by FTTH in the homes, can be tapped everywhere, by making the fibers surface in the public space to generate a host of mini cells with broadband radio access [10, 11]. A fixed-wireless ecosystem emerges, see figure 6.

4. Conclusions

In this paper, we analysed through time the divergent force of functional decomposition and its impact on our economy and society. Understanding and deepening the power of omnipresent and universal networks, we outlined new opportunities for ICT and telecom incumbents by introducing the concept of sector networks and trans-sectoral innovations.

What the incumbents are doing today with their migration to NGN's has its counterpart on the higher aggregation level of economy and society. Obviously, the relatively new ICT sector and its next generation telecom networks, enabling connections between all communicating entities, can play through the operators a crucial role in this migration from nodal to network models. We outlined the options and possibilities of the concept of trans-sectoral innovation theoretically and pragmatically, the latter by looking at two specific trans-sectoral cases that will have a major economical and societal impact.

We conclude that there is a true and double eChallenge for incumbent operators and its regulators, one is to perform a joint director role in overcoming today's multi-actor prisoner dilemmas and the second is to introduce the concept of a fixed-wireless liquid bandwidth ecosystem to support Personal Networks. Thus, operators may come to play a more important role in our society offering solutions beyond the intra-sectoral, conventional solutions and so preventing the sectors to come to a grinding halt.

Acknowledgements

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