Hanseth et al (2012)

We have in this paper presented the history of development, implementation, diffusion and use of ICT standards for information exchange between health care institutions in Norway since this activity started in 1987 and up till today (May 2012). We have identified three different strategies for developing standards. Our focus is on how each of these strategies enables and supports solutions that best contribute to the overall improvement of the health care sector through the development of new and improved medical services.

The general picture in the field is that the implementation and diffusion of standards have been very slow. This has been the pattern in most national strategies for ICT in health care. But we believe that in order to make the future of ICT standards more bright than their past, we need a critical examination of the strategies followed and the achievements.

The first strategy we identified, which we call anticipatory standardization, is the official and traditional one. To our knowledge, this strategy has not been seriously challenged officially by any actor within the field. The two other strategies we have identified are not recognized as such within the field; they are emergent strategies. By contrasting these strategies and their achievements, we believe important lessons may be learned both by practitioners and researchers.

The first and official strategy, anticipatory standardization, has delivered a number of standards specifications. But the standards, with their rather extreme focus only on replacing paper forms with similar information objects, turned out to be unattractive for application vendors as well as user organizations. One important reason for this was the fact that they could not be implemented in useful systems without substantial modifications and specifications of additional messages and protocols. This limitation was to a significant degree overcome in the second, the integrated solutions strategy. With the stronger focus on users' working practices and needs, this strategy has delivered more appropriate and complete set of specifications. But the implementation of the specifications has been a very slow process, mainly because of the complexity of the solutions specified and the organizational complexity of the coordinated implementation process the specifications require. When the standards are successfully

adopted, the existing paper based services are improved. But the benefits are definitively limited as they still mimic the paper based processes. And there is a high risk that the complexity of the standards and the solutions based on them soon will emerge as legacy systems resisting virtually all change efforts and accordingly represent a major problem when one tries to improve processes in ways enabled by ICT solutions. I.e. they may inhibit rather than enable or stimulate future service innovations.

We see the third standardization strategy, flexible generification, as being by far the most successful one in terms of delivering working solutions that also enable the innovation of new services that go beyond existing paper based practices. Moreover, the differences between this strategy and the others are even more striking when one takes the costs and time required for implementing the solutions. This is actually the only strategy among the three we have identified that enables and stimulates to real service innovation.

Developing a more detailed and general flexible generification strategy for eHealth will obviously require substantial work, and is outside the scope of this paper. We will briefly comment on two important issues for further research.

First, such a strategy needs to integrate formal standardization procedures into the overall development and implementation activities. Standards should be specified as the solutions are being made more generic. At the same time the standards need to be kept simple and flexible to adapt to the changing needs. Experimental development of solutions going beyond exiting standards needs to be stimulated. Such a model should be developed as a further elaboration and combination of the generification and flexible standard models presented earlier.

Second, one needs to acknowledge the relationships between the degree of standardization of the one hand and complexity and flexibility on the other. Health care is a highly dynamic and unpredictable environment and ICT solutions, including standards, need to adapt to this. Indeed, ICT solutions are important sources of this dynamic and unpredictability. This also implies that one has to give up the common held view, and which has been strongly present in the activities reported here, that the wider

the scope of a standard and the more detailed it is specified the better it is. The classic argument in favor of (compatibility) standards is that it reduces complexity. If you want to link your system to lots of others' you can just implement one standard when there is one. Otherwise you need to implement one integration module for each individual system you want to integrate with. This is true. But it is only a part of the truth. As the scope of a standard increases, so do also the number of actors being involved as well as the features of the standard (if it is to satisfy the users' requirements). So at one point the complexity increases more by expanding the scope of the standard then the decrease in complexity gained by enabling more systems to be integrated based on one and the same standard. And managing change is much about coping with complexity. The successful development, implementation, diffusion and use of ICT standards in health care (as well as other sectors) is to a large extent about finding degree of standardization which minimizes complexity and maximizes flexibility.

Braa et al (2007)

Many developing countries are currently engaged in strengthening their national HIS. This trend is reinforced by the launch in 2005 of the Health Metrics Network, a global initiative to support such efforts, and which is supported by WHO, the European Union, and a number of international agencies (http://www.who.int/healthmetrics). The challenge of coping with fragmentation, multiple data sources, and lack of standards is regarded as a key issue. An important contri bution of this article is to provide a strategy to standardize HIS and information infrastructures which are appropriate for the context of developing countries. In proposing a strategy for the development of information infrastructures for the health care sector, two issues related to complexity are of particular importance, and both are specific for developing countries. First, there is uneven development between rich urban and poor rural areas, characterized by the extreme differences in health service delivery and the avail ability of basic infrastructure. Second, there is the important role played by vertical programs (like HIV/AIDS programs), funded and partly managed by international donor organiza tions, in increasing complexity and HIS fragmentation. Our strategy contains two main aspects. First, create an attractor by building an actor network. In our cases, we describe how the use of a simple set of data standards (in South Africa), a data warehouse (in Botswana), and a soft ware program that made the data available to all user groups addressed a problem for a specific group of health workers. The creation of attractors enrolled and aligned a user group by providing the users with benefits (i.e., the solution must support existing work practices), and the standards were able to accommodate changes as the user base expanded. The cases also show that creating attractors in national priority areas, such as equity in South Africa and the universal cover age scheme in Thailand, are powerful attractors to drive change at the national level. Similar attractors are required at a global level to address workable solutions in the information systems arena to support initiatives to combat the HIV/AIDS epidemic and the attainment of the MDGs. The second aspect is to ensure that the emerging system of standards remain adaptive, a complex adaptive set of stan dards. This is done through a number of mechanisms, in cluding paying attention to use and change (modularization) flexibility, and the use of gateways to link different com ponents/standards. Scaling of standards in developing coun tries is enabled by flexible gateways between both computers and paper-based systems and between different computer based systems and by emphasizing the data standards rather than the technical standards. The limitations of this study relate

to the fact that the principles discussed, and the proposed strategy, have emerged as reflections on processes in the various countries in which HISP has operated. The applicability of these concepts needs to be tested outside the HISP network, and in different contexts, and as an explicit approach to strengthening infor mation systems. The case studies used here reflect mainly on initiatives in strengthening public health services; space limitations have restricted detailing experiences in for example hospital information systems. Aspects requiring further research thus relate to the explicit use of these approaches as components of interventions in new contexts, and a reflection on how these principles can be applied, or differ, in hospital contexts, and in contexts outside of the health sector.

Hepsø et al (2009)

Post-Enron legislation has underscored and boosted concern for increased accountability and traceability through more systematic and comprehensive documentation of relevant business processes. This applies also to the commercially vital work processes around production optimization in NorthOil. The recent introduction of a SharePoint-based eInfrastructure — subsuming the many fragmented, niche-based and specialised information systems — seems, on the face of it, an adequate response to these concerns.

Our story calls this conclusion into question. Through a historical reconstruction of the development of a SharePoint eInfrastructure in NorthOil, we critically examine the aspirations and practices of complete and comprehensive seamless integration of distinct functional, geographical, and technical components. We discuss the development of NorthOil's working eInfrastructure as an ongoing effort that must be understood in both a global and a local setting because decisions need to be traced historically in time. The production trajectories of oil and gas wells are maintained and constructed historically across technological platforms, disciplinary and geographically boundaries.

In our analysis, we have highlighted the persistent importance of the patchwork of the installed base of local, niche-oriented applications around production optimization. But this should not be misconstrued as suggesting that existing practices are somehow immune to the change efforts embedded in the SharePoint eInfrastructure. The NorthOil SharePoint story represents, rather, something of a middle position between overly ambitious agendas and accounts of transformational change (including the one motivating the introduction of SharePoint into NorthOil in the first place) and, on the other hand, overly conservative accounts of the durability and resilience of local practice. Rather than simply observing stubbornly prevailing local practices, what is emerging in NorthOil is closer to an amalgam of existing practices moulded with selective elements of the new eInfrastructure — a finding with important practical, managerial, and analytic implications.

One practically relevant implication concerns the discussion on taxonomies and meta-data, which is at the core of information management in NorthOil. The top-down generated classification schemes

provided by SharePoint have in some networks been worked around. Over-writing the default values specified, some communities are modifying — but not rejecting — the SharePoint search eInfrastructure. In a recent response to mounting dissatisfaction with the rigidity of SharePoint, NorthOil opened up free-text fields in the classification scheme of SharePoint. Similarly, the latest version of SharePoint includes Web 2.0 functionality. The coming of open architectures and Web 2.0 herald the availability and access to data whether stored on a shared drive, Lotus Notes, SharePoint, or any other system open to access given the necessary rights. Even though data access concerns may be partly resolved in this way, major issues around data management, quality, and information seeking/retrieval will remain. We have shown that the reliance on top-down, planned meta-data structures is too optimistic. However, we are not advocating fragmentation or that doing nothing is an option. Bottom-up folksonomies emerging from new Web 2.0 social software are emerging in pockets within NorthOil. Folksonomies are user-generated, therefore inexpensive to implement and can potentially develop into an emergent business taxonomy in areas like production optimization. As we see it, they can be an add-on to institutionally supported taxonomies, controlled vocabularies, and meta-data strategies in SharePoint, since such classification practices advocate and nurture local practices. Such bottom-up strategies also support the distribution of information classification to those professionals who are actually doing the work. We imply from our work that the development of a collabulary (blend of collaborative and vocabulary) is an option. This middle position is the compromise between the hierarchical meta-model and the folksonomy. Here, a team of classification experts collaborates with domain professionals in various parts of the business to create rich but more systematic content tagging systems. A collabulary of an information infrastructure would arise much the way a folksonomy does. It would be constructed primarily by domain experts close to practice, thereby capturing the benefits of folksonomies: low investment costs and a rich and practically-grounded vocabulary that is understood and makes sense in the contextual domains of the users. Having the necessary link to practice would also ease the capability to respond quickly to changes in classification practices — without the shortages of too simplified folksonomies.

An implication related to managing eInfrastructure development is that the introduction of systems like SharePoint at NorthOil seems to follow two integrated and repeated cycles. The first cycle involves an

attempt to control and get a grip on the heterogeneous information resources enmeshed in practice by imposing a structure in the form of shared drives, Lotus Notes, or SharePoint. These new structures create a new amalgamated order based on the new, attempted order and existing practice. However, since there will never be a perfect fit between these two, fragmentation tends to be the consequence over time. This is the second cycle. The implications for practice are that the existence of such cycles must be acknowledged in infrastructure development projects. As a management challenge, in general, this is about living with the paradoxes of taking control vs. cultivating the practices of the organization. However, the paradoxes here have gestalt features that force the execution into either the control or cultivation trajectory. Once the control trajectory is taken, the cultivation trajectory becomes hidden and vice-versa. If the trajectory of control is prevailing, the solutions tend to come up with more control, typically manifest as top-down initiatives. There is a deep seated formative context (Ciborra 2000) and strong connotations of order and mess (Monteiro and Hepsø, 2002) that structure these trajectories.

Accordingly, there needs to be some space for evaluation of existing practice in heterogeneous domains like the production domain in our case. This can be regarded as a simple comment, but still seems to be disregarded in many of these projects. As the aim of an infrastructure is necessarily often unclear and is an ongoing and changing target, measures have to be taken to involve a variety of actors, perspectives, and interests when situated opportunities emerge. The importance of seizing the opportunities that drift along clearly suggests the need for some slack. Being alert and seizing these opportunities require work and resources and points to the need to be open to compromises and not worry too much about creating a mess (Monteiro and Hepsø, 2002).

Analytically, our study implies promoting a view of working e-Infrastructures much along the lines of what Timmermans and Berg (1997) call "local universalities." Through their work on clinical protocols, they point out that minor and not so minor deviations are practiced routinely. At times the users go beyond the boundaries of the protocols, making ad hoc decisions and even repairing the deviations of others. An important point, however, is that such tinkering is not a failing, but a prerequisite for the protocol to function (ibid., p. 293). Working e-Infrastructures, then, transform both the new

eInfrastructure and local practices.

Monterio et al (2012)

In the context of processes of globalisation, Appadurai (1996) makes the observation that theorising lags significantly behind the empirically, unfolding phenomenon. This is not unlike the situation we are analysing. Business and public organisations have invested heavily to establish distributed yet uniform work practices, e.g. by introducing Enterprise Systems. As practice-based research makes clear, achieving identical ('best') work practices is unattainable. Still, had not managers, owners and investors after two decades of Enterprise Systems also recognised an interesting level of similarities in work practices, surely they would have fallen out of fashion? It seems to us that the unfolding, empirical phenomenon of technologically mediated efforts to promote similar work practices has yet to receive an adequatetheoretical account in information systems research.

In our use the notion of family resemblance is performative, pragmatic and political. Resonating with Wittgenstein's (1953) original insights, family resemblance of work practices is not about sharing certain attributes. Similarity is performed or crafted through the strategies we have discussed. The criterion for when sufficient similarity is achieved is pragmatic in the sense of directed or intentional. The filling in of a 2×2 risk matrix directs attention to those similarities that matter for the planning of the LWI (e.g. type of equipment to bring along). Moreover, the crafting of similarity is political. This is especially evident around issues of safety and risk. Whether compliance to uniform work practices improves safety, or whether safe operations and maintenance are better served by practices shaped by the local circumstances of the well, is discussed heatedly between OGC management and unions as well as national authorities.

Family resemblance of work practices is relevant to many organisations for reasons of economic performance, quality of service and safety to human life and the environment. A key practical implication from our study is that the crafting of family resemblance is ongoing and emergent rather than about nailing the exact balance between uniformity and localised work practices. More specifically, our study shows the importance of flexibly stepping up the degree of formalism and amount of resources in response to number, frequency and type of anomaly. As anomalies increase in gravity, so do the number of people, amount of time spent, format for deliberation/ arena and degree of formal documentation.

Rather than a fixed, institutional response, a dynamically modulated response relative to the gravity of the anomalies is required.