

Chapter XVI

Conclusion

THE AUTO-ID TRAJECTORY

This chapter is dedicated to identifying the main outcomes of the study and reflections on the future directions of the technologies that were under investigation. In concluding we have found that first, an evolutionary process of development is present in the auto-ID technology system (TS). Incremental steps either by way of technological recombinations or mutations have led to revolutionary changes in the auto-ID industry- both at the device level and at the application level. The evolutionary process in the auto-ID TS does not imply a ‘survival of the fittest’ approach, rather a model of coexistence where each particular auto-ID technique has a path which ultimately influences the success of the whole industry. The patterns of migration, integration and convergence can be considered either mutations or recombinations of existing auto-ID techniques for the creation of new auto-ID innovations. Second, that forecasting technological innovations is important in predicting future trends based on past and current events. Analyzing the process of innovation between intervals of widespread diffusion of individual auto-ID technologies sheds light on the auto-ID trajectory. Third, that technology is autonomous by nature has been shown by the changes in uses of auto-ID; from non-living to living things, from government to commercial applications, and from external identification devices in the form of tags and badges to medical implants inserted under the skin. This does not negate, however, the inherent qualities embedded in auto-ID technologies, predisposing them to be used in certain contexts. What we have witnessed especially in auto-ID is a movement we have termed the auto-ID trajectory: from bar codes to chip implants towards the *electrophorus* who will herald in the age of *uberveillance*. Convergence of embedded automatic identification technologies with location-based services will offer unprecedented capabilities, but these capabilities will come at a high price.

The Evolutionary Paradigm

The evolutionary paradigm has shown us that “history matters”. Auto-ID techniques built their foundations on top of past manual ID techniques, the simplest being facial recognition using human memory. By the 19th century fingerprinting techniques were being discovered and by the mid 20th century auto-ID technologies were being prototyped. What has happened since that time has been cumulative technical change at an exhilarating speed. This rapid change, however, would not have been possible if

the building blocks had not been cemented by first generation elementary breakthroughs. As more and more technological advancement occurred within the emerging auto-ID industry, and further support infrastructures, skills and tools emerged simultaneously, the use of auto-ID became widespread. Progress fuelled success and success fuelled progress. While the market in the mid 1960s was not ready for auto-ID, decade after decade thereafter, techniques permeated a diverse range of applications. A domino effect of new auto-ID innovations took place, revolutionizing the way people worked and lived. The conditions for entry were increasingly 'right' as ancillary technologies, like networks, storage devices and database software proliferated.

The auto-ID explosion was energized by up-and-coming niche technology providers who had a clear vision for their innovations. Bar codes in retail, for instance, were driven by stakeholders who could see both the potential impact the technology would make and the immediate path ahead. Understanding the sequence of events that shaped auto-ID was a major contribution of this study. Better understanding "what happened" means that efforts can be concentrated in the right places in the future. Rosenberg (1994, p. 23) describes the importance of historical analysis in understanding technologies. He pointed out that this type of analysis is not only relevant to historians but to economists and people in other fields.

Forecasting Technological Innovation

One of the downsides to exploratory predictive studies is that some researchers attempt to outdo one another with radical futuristic scenarios. This is not to discount that some of these scenarios will not happen 'eventually', however they neglect to use the evidence that is set before them to follow the path or direction of a particular technology, or set of technologies. This study puts forward the usefulness of using frameworks- like the systems of innovation (SI) based on evolutionary theory- to synthesize data from multiple disciplines to characterize and predict the auto-ID trajectory. The market today is so complex, that relying solely on one perspective, albeit technological, could prove severely misleading. What is required is an interdependence of sources (Drangeld, 1991, pp. 157-179). It was also intentional that predictions were not numbered or tabulated- they are present throughout the work and more pronounced in the final chapters when the technological trajectory of auto-ID was explored. The narrative style allowed for analysis throughout. None of the predictions venture beyond 2050 and most focus between the years 2010 and 2020.

Individual auto-ID techniques and their applications were considered separately at first, then as a single technology system, bringing together evidence that would indicate the direction of auto-ID in the short-term future. Among the factors explored in each case (in order of their prominence in that particular case) included: social, cultural, organizational, institutional, economic, regulatory, legal, political and technical dimensions. What was apparent was the time lag between auto-ID technical breakthroughs and developments, in for instance global standards, laws and user acceptance. Ethical considerations it was shown, were also consistently marginalized by technology and service providers until after auto-ID diffusion- an almost "let's wait and see what happens" approach. Regardless, the technology is set to become even more ingrained in our day-to-day practices, especially for critical-response applications. New auto-ID innovations are most likely to be variations or combinations of existing auto-ID technologies, although there will be particular leaps in the use of multiapplication smart cards, the accuracy of biometric techniques (especially multimodal biometrics) and RFID transponders for human application. The study has attempted to present the forces at play which will continue to set the course of the auto-ID technology system. Of great significance is the convergence of 'industries', including auto-ID and biomedical.

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