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ELECTRONIC COMMERCE STRATEGY IN THE U.K. ELECTRICITY INDUSTRY: THE CASE OF ELECTRIC CO AND DATAFLOW SOFTWARE

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Abstract

This paper analyses the strategic business and IT response of Electric Co, a large electricity company, to deregulation and increased competition in the UK electricity industry. In common with deregulation in other markets such as North America and Australia, the UK regulator has specified strict regulations on how power generators, distribution and supply companies should interact with each other, and with business and consumer customers. In order to compete effectively Electric Co has implemented a novel dataflow solution that enables it to connect diverse internal systems to the external marketplace. An overview of changes in the market is related to the business and IT strategies of Electric Co. The link between the high-level business strategy and the actual use of IT architecture and systems is the design and management of the business processes that dictate how information is shared throughout the supply chain. The implementation of the regulator's business process framework has been achieved through a novel use of a business process management solution. The major benefits are shown to be increased business flexibility. An outline of the broader implications of the research is given, in particular how developments in technical standards and business process management are related to communication theory and electronic markets.

Keywords: business process management, electricity industry, networks, flexibility.

1 INTRODUCTION

In 1990 twelve regional electricity companies were formed to supply business and domestic customers in the UK. Each Regional Electricity Company (REC) controlled a graphically defined market. At the same time there were just three major electricity generating companies: BNFL; PowerGen; and National Power. PowerGen and National Power used fossil fuels to produce 80% of the electricity and BNFL produced the remaining 20% using nuclear energy technology. Now we have a situation where Credit Suisse First Boston can trade on the future prices of electricity in the electricity wholesale marketplace and a grocery firm, Sainsbury's, can supply electricity to a domestic customer through cable owned by any of the distribution companies such as Scottish Power. There is now competition at every stage of the supply chain in the electricity market, and a wide variety of competitive strategies have emerged ranging from large organisations attempting to dominate a particular stage of the supply chain to niche operators that focus on a very specific customer set. A transition has occurred from a highly regulated set of regional monopolies to an open and competitive marketplace. For this to happen in practice, in tandem with de-regulation, individual companies have developed and used advanced information systems and common industry standards for information exchange. This information exchange has in turn enabled the free flow of information to support the rapid changes in industry structure and interactions between electricity suppliers and users that include large corporate companies, small and medium sized enterprises, and domestic users. The range of participants now includes traders, generators, distributors and suppliers.

Electric Co is one of the new breed of electricity companies that is competing in multiple geographic regions, and is supplying electricity to all types of customers from domestic to large industrial users. A major part of its success in competing to attract and retain new customers is its advanced use of information systems that support both its internal business processes and the exchange of market data with competitors. One of its key technology partners is Dataflow Software whose software forms an integral part of the IT infrastructure of the industry as well as the communication flows between Electric Co's internal systems and its economic partners, customers, competitors and the industry regulator.

2 DEREGULATION AND NEW TRADE AGREEMENTS

In March 2001 the UK government introduced New Electricity Trading Arrangements (NETA) in England and Wales¹. These arrangements were designed to increase competition in the electricity wholesale market, reduce the price of bulk electricity and ultimately reduce the prices that the end users would have to pay. Prior to this the arrangements for trading electricity, known as the Pool, were thought to be uncompetitive and open to manipulation. In October 1997 the Minister for Science, Energy and Industry asked OFFER³ to review the way that electricity was traded in England and Wales and suggest a number of improvements in areas that included reducing the price charged to the user and improving choice, quality and security of supply for electricity users².

OFFER's review of the Pool pointed to problems of over regulation that limited the effect of normal market forces such as competition in price setting together with supply-side and demand side price influencing. In short the Pool, one of the first examples of a wholesale electricity market in the world, was limited by the complexity of its bidding and price setting mechanism, the inflexibility of its regulations and openness to manipulation of its payment rules¹. The main proposal from the review

¹ "The New Electricity Trading Arrangements In England And Wales". Report by The National Audit Office for the House of Commons, 2003. London: The Stationery Office.

³ The Office of Electricity Regulation (OFFER) and the Office of Gas Supply (Ofgas) were combined in 1999 to form Ofgem.

² "What are the New Electricity Trading Arrangements In England And Wales?" Office of Gas and Electricity Markets (ofgem).

was that the trading of electricity should become much more market-based. OFFER recommended that the electricity market should operate more like other commodity markets subject to special requirements for physically balancing supply and demand in order to maintain the security and quality of electricity supply⁴. These recommendations led to the current trading arrangements known as NETA.

With NETA the value chain for the industry is now divided up into two main marketplaces (see Figure 1). These are the wholesale marketplace and the supply marketplace. The wholesale marketplace is made up of the six main generators: Innogy, London Electricity, Powergen, Centrica, Scottish Power and Scottish & Southern Electricity. These generators are vertically integrated into the supply marketplace, that is, they produce *and* sell electricity to end customers. The six generators have evolved from very different starting points. For example, Centrica was originally a supplier of electricity only and had no generation capabilities. Powergen started in the power generation field and has now moved into the supply marketplace. Other companies in the wholesale electricity marketplace are banks, who trade on the price and availability of electricity just as they do in other commodity markets. Many of the small electricity generators have particular niches, for example they may use green energy sources such as hydro-electric and wind power. The supply, or retail, electricity marketplace is made up of the six large, vertically integrated generators already mentioned above, several very large supply-only companies and tens of smaller companies. These smaller companies are frequently associated with well-known brands, or extensive customer networks, from sectors such as media, banking and food retail.

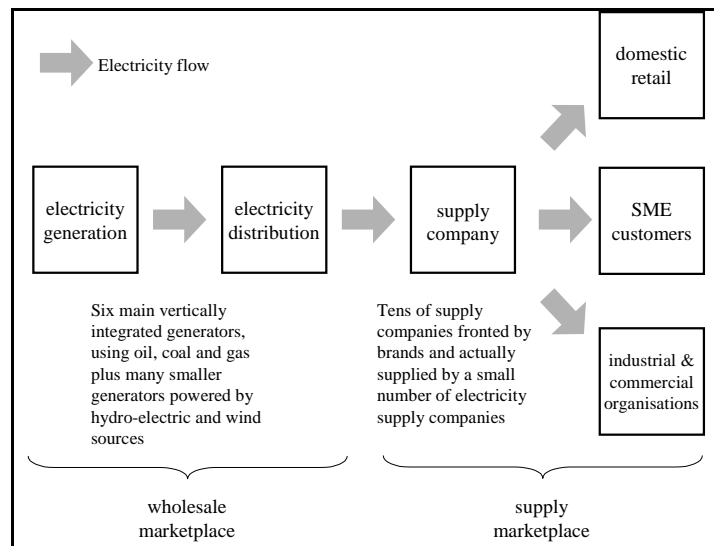


Figure 1: Elements of the English and Welsh electricity industry value chain in 2003

One significant outcome of deregulation was market instability caused by artificially high retail electricity prices normalising under more natural market conditions. This instability caused a significant drop in the wholesale price of electricity, which in turn led to financial problems for the generator British Energy and the vertically integrated generator TXU Energy. British Energy had to ask the UK government for financial assistance and TXU Energy sold its European subsidiary to Powergen. However, the UK's National Audit Office (NAO) has reported that overall "NETA has

⁴ These special requirements came from the fact that electricity is a commodity that very difficult and costly to store but supply cannot be varied instantaneously whilst demand can. So only balancing, rather than buffer stores, can be used to stop frequent small power cuts caused by high user demand volatility. In addition to this the government required that users should be shielded from short-term price volatility, which the financial instruments that are used within other commodities markets can also help with.

facilitated lower wholesale prices” and a decrease of “over 20% between the introduction of NETA in March 2001 and October 2002”. In the same period the NAO reported that electricity prices for industrial and commercial customers have fallen 18% and prices for domestic customers have less than this but still in line with the reductions in suppliers’ overall costs. Customers that switched suppliers secured an average price reduction of 17% but greater price reductions for domestic customers have been prevented by increases in supplier’s environmental costs and “the substantial costs of processing changes of supplier¹”.

3 THE CHALLENGE TO ELECTRIC CO AND OTHER ELECTRICITY SUPPLIERS

From the viewpoint of the customer, one of the biggest changes caused by NETA is to enable customers to change their electricity supplier whenever they wish to do so. This has created a responsiveness to demand side market pressures, and has vastly increased the number of customers who switch suppliers with the associated increase in the economic costs of market change, i.e. customer churn: losing existing customers and acquiring new ones. The UK’s National Audit Office found that from May 1999 to June 2000, “6.5 million customers - one in four - had saved money by changing supplier, and customers were changing at the rate of 400,000 a month.” (NAO, 2004). The right of electricity users to easily change their supplier and the resulting increase in customer churn has forced Electric Co to develop systems that can cope with large numbers of customer registrations and deregistrations. The Office of Gas and Electricity Markets (ofgem), the electricity regulator, specifies a whole series of service level agreements that electricity suppliers must meet in this new open marketplace.

In this industry the regulator, ofgem, specifies how every organisation operates. This specification describes all business processes and their input and outputs; the exchange of information and the information’s meaning; and the timescales of the exchange. The model of the whole industry’s business processes is described in the Master Registration Agreement (MRA) using data flow diagrams that are extremely complicated. Space constrains do not allow use to show even an overview but over 96 detailed diagrams describe more than 21 main processes and many sub-processes that contain main varied process steps. The MRA process diagrams are managed and maintained by the MRA Service Company (MRASCo, 2003). The business processes are modelled in Enterprise Modeller by Enterprise Modeller Solutions Limited. An overview of the electricity industry’s key business processes is shown in Figure 2 to demonstrate the complexity and detail of the regulatory framework and information requirements.

Each change in supplier starts a formal deregistration process in one supplier and a formal registration process in another supplier. Each deregistration and registration process requires a complicated set of inter-related activities to take place in a pre-defined format, sequence and time. Although in concept this is straightforward, in practice the data structures are quite complicated and the high volumes of data exchanged exacerbate the information exchange and internal process problems. Every month 400,000 customers change suppliers then suppliers have to process 9,600,000 deregistration and registrations per year. On a process level the cost of this from labour and potential errors is immense. For example, each registration or deregistration incurs labour costs from taking customer telephone calls to maintaining the information systems that process each transaction. The potential for damage to the supply company’s reputation from errors that reduce service levels is also immense because the registration process will fix a customer’s first impressions and a customer that has already switched supplier will have few worries in switching again. Even deregistration is dangerous to the supplier because a customer may try to deregister in order to miss paying a bill. A supplier that allows a customer to transfer to another supplier with an outstanding debt may then find it harder to get the customer to pay.

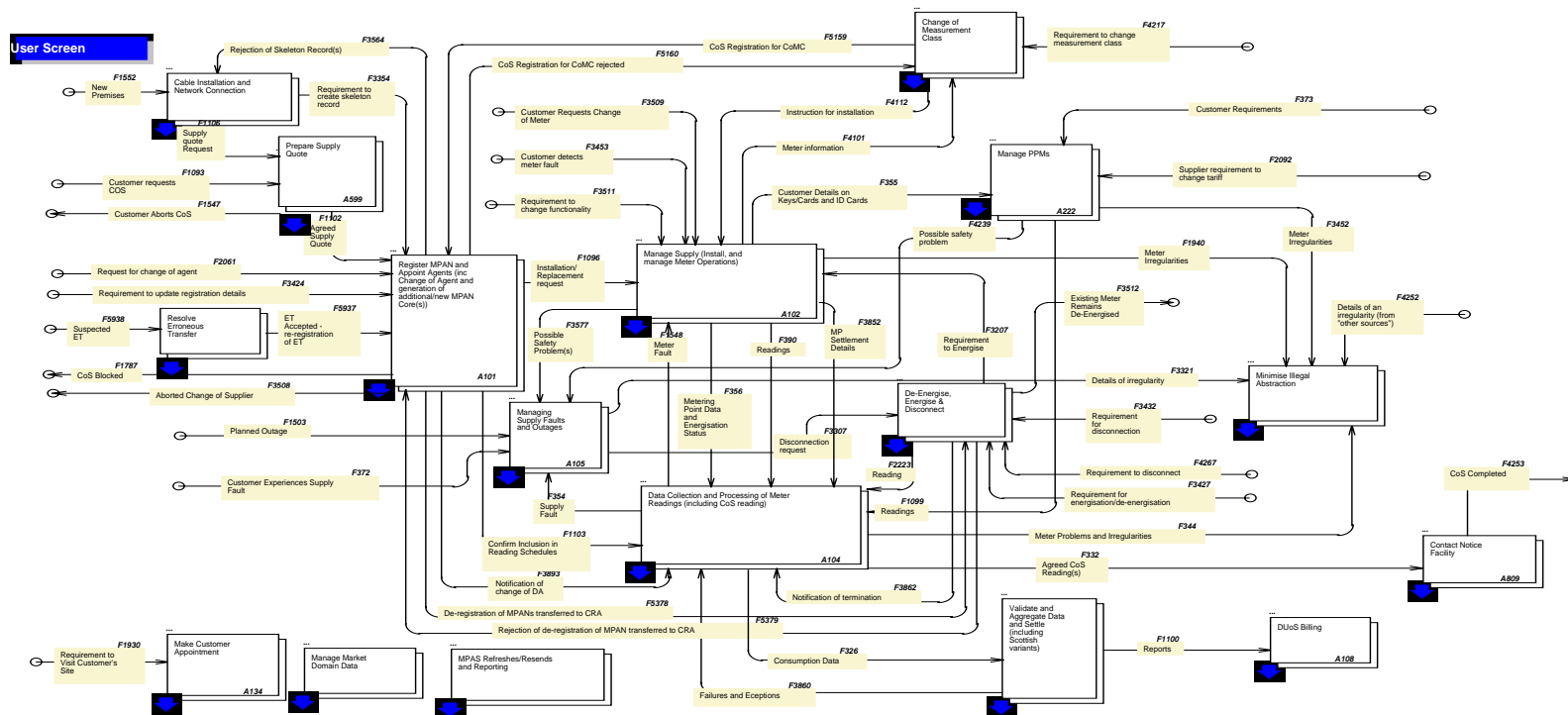


Figure 2: Overview diagram of the UK electricity industry key business processes, source: MRASCo

Within this overall framework, ofgem define what they call “Golden Threads”. These are all of the data flows and transformation that need to take place in order to enable a specific process, such as switching suppliers. The process diagram for switching suppliers is just one of the processes contained in MRA process diagrams. In Figure 3 we can see that Dataflow Software’s software manages the flows of data from and to the Data Transfer Network (DTN); between the Small to Medium sized Enterprise (SME) parts of Electric Co; and between Electric Co’s CRM and billing systems. Dataflow Software’s GateKeeper software provides data validation, routing, splitting and storage services together with a transaction history database.

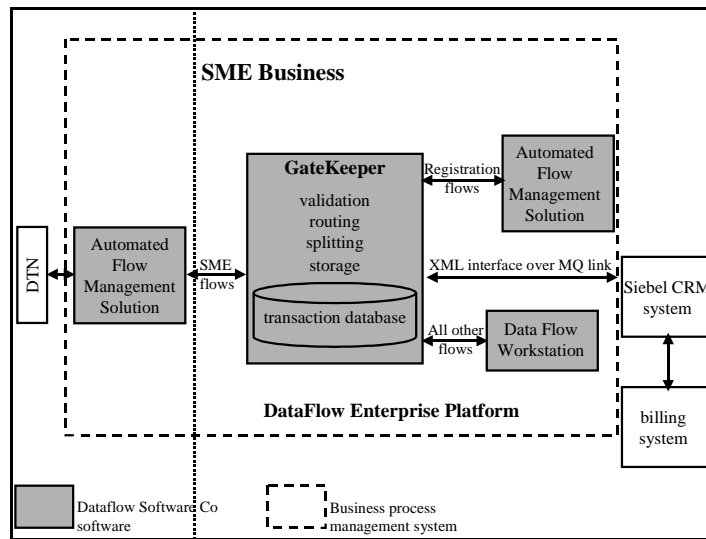


Figure 3: The data flows for Electric Co’s SME businesses (Dataflow, 2004)

4 ELECTRIC CO’S BUSINESS AND IT STRATEGY

Electric Co has grown rapidly since 1995 through the acquisition of four large electricity suppliers composed of two original RECs and two newer suppliers. Electric Co had the architectural legacy problem shown in Figure 4. Taking Electric Co’s SME business as an example, we can see that each of the four acquisitions had their own information systems supporting their own SME businesses.

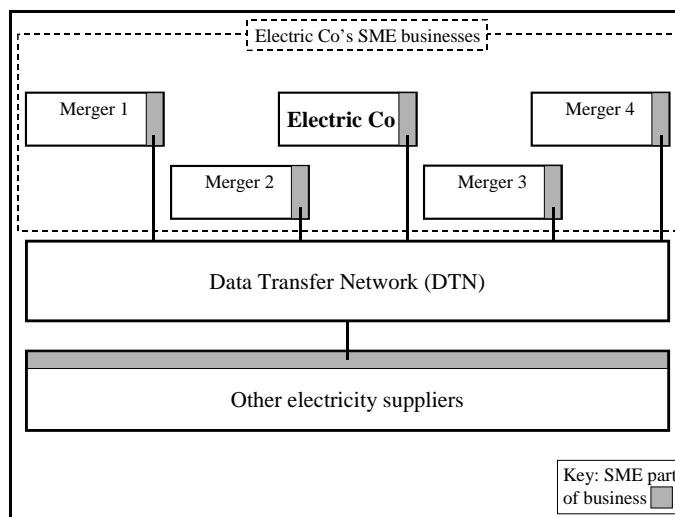


Figure 4: *Internal legacy system connection problem*

Initially upon acquisition Electric Co connected the separate SME systems via the Data Transfer Network. The DTN provided the interface for internal message passing in the same way that it was used as a medium for message passing to and from systems that were external to Electric Co. However, whilst this did support business processes, such as the registration and deregistration processes examined above, some of the issues associated with increased external data flows concerning customer and supplier changes still needed to be resolved for some of the internal business processes.

Dataflow Software's IT solution strategy was to use software to integrate the SME components of the various legacy systems through a single communications and validation point. The actual software used was a product called Gatekeeper Data Exchange, a part of their Dataflow Enterprise Platform (Dataflow, 2004). Gatekeeper integrated valid dataflows with different back office applications, such as Credit Checking, CRM, Billing and Registration, which run on different systems. Gatekeeper was able to do this because it was designed to use the governing industry data rules to translate between information systems in different organisations and different systems in the same organisation. This allowed Electric Co to consolidate its IT systems from a geographic architecture to a product/ market architecture. This gives Electric Co the strategic benefits of being able to operate as a single entity, and has led to significant cost savings in IT expenditure. It also improves the levels of customer service because the automation of business processes and the associated data flows reduces the error rates and increases the speed of information flows to and from customers and competitors.

However, given the huge volume of messaging associated with churn that all electricity suppliers need to exchange and process, Dataflow Software's system also provided Electric Co with an additional benefit: process automation. After using the governing industry data rules to integrate the dataflows transmitted between the different industry organisations *and their software applications* Dataflow Software took the next logical step and created Enterprise Automated Flow Management software that was able to automatically enact key processes because of its ability to process dataflows between the different back office applications used in the industry. All this software already obeyed the governing industry data rules and Gatekeeper already integrated valid dataflows. Dataflow Software were able to create a set of Automated Applications for customer registration and deregistration and other volume intensive business processes that used the data held within back office applications such as Credit Checking, CRM, Billing and Registration. Electric Co has successfully integrated its SME business using Dataflow Software's solution and will extend this competitive advantage to its Domestic and Industrial & Commercial businesses.

5 DISCUSSION

The Enterprise Automated Flow Management software is an example of business process management (BPM) software that includes elements of middleware but critically also contains process management capabilities. Bernstein (1996) defines middleware as "middleware services and/or frameworks" and a middleware service as "a general purpose service that sits between platforms and applications" (p. 89). The objectives of a business process management system, and of process modelling, are to facilitate human understanding and communication, to support process improvement, to support process management, to automate process guidance and to automate execution support (Curtis et al, 1992). Bernstein classes Database Management software as a type of middleware (p. 90) but Process Management software requires an internal process model for manual or automated process manipulation. BPM software is reliant on middleware for aspects of its execution but is obviously much more ambitious in terms of its scope and objectives. Smith et al¹¹ point out that the reengineering of business processes and natural business process changes create highly complex and unmanageable topologies in the "point-to-point" solutions of middleware companies (p. 5). Only a process-centric approach, modelled on the actual business processes concerned, can remove the need

for creating needless layers of complexity though the gymnastics of higher and higher order interface and protocol abstractions. BPMs, like Business processes, naturally execute across different systems and across different organisations but they are a direct abstraction of the user's focus of business concern rather than a fossilised record of the negotiation between the systems vendors.

We have used a parsimonious model based on the constructs strategy, business process, and IT systems architecture, to examine the formation of Electric Co's business and IT strategies. This model demonstrates the inter-relationships between Electric Co's business strategy of growth by acquisition, its complex regulatory environment and its use of a business process management system to implement it in terms of operational systems. The high level strategy and the complexity of the operational requirements are clearly related to each other through the business process linkage.

Electric Co must be able to automate the golden threads and manage them in a consistent manner. The deregulation of the electricity marketplace can be viewed as flexibility demands that can be categorised into three broad areas:

- structural flexibility – from the variety of other suppliers that suppliers have to connect with
- volume flexibility – from the amount of information that is exchanged between suppliers
- type flexibility – the variety of different information types that is exchanged between suppliers

In Electric Co the most important benefit from its information systems is to achieve structural flexibility in compliance with industry regulations. The new systems have also enabled them to grow their business and handle higher volumes of customer information whether new customers have been won through competition with rivals or acquisition of competitors.

6 CONTRIBUTIONS

The paper makes several theoretical and management contributions:

- the documentation of the changing environment of the UK electricity industry and challenges facing an electricity supply company in terms of information management;
- the contrast in use, form and functionality between middleware and business process management software;
- a simple but widely applicable model for examining business-to-business flexibility issues in e-commerce;
- an application of theoretical process modelling together with actual IT applications to manage business processes that cross between separate and newly merged organisations. This demonstrates the implementation of a model-driven process reconfiguration to drive the operational inter-application integration.

7 ACKNOWLEDGEMENTS

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