EXPLORING REGULATORY DILEMMAS: TOWARDS UNDERSTANDING THE SYSTEMIC CONSEQUENCES OF REGULATION AND REGULATORY INTERVENTION

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ABSTRACT

This paper builds on and complements prior work examining the dilemmas faced by regulators seeking to enhance service provision and market conditions in the health, telecommunications and mining sectors. In particular, it explores dilemmas and conflicts faced by regulators in addressing issues of universal service pricing and the use of price caps in the Telecommunications sector. The paper provides a constructive illustration of the mutually informing use of systems methodologies (such as Systems Dynamics (SD) and the Theory of Constraints (TOC) and associated systems representational tools (such as causal loop and conflict resolution diagrams), as a means of building recognition and understanding of the systemic and nested structure of such dilemmas; and as a means of providing an appropriate platform for decision making.

Keywords: Telecommunications, Regulation, Price Caps, Systems Thinking, Theory of Constraints, Causal Loop Diagrams, Systems Archetypes, Problem Structuring Methods, Multi-methodology.

INTRODUCTION

The task of the regulator in industry-specific regulatory regimes is complex. The regulator is typically charged with calibrating a complex market system comprising multiple participants, each with separate strategic and operational agendas. The degree of complexity means that it is unlikely that a single set of decision-making tools will be sufficient for regulators in the majority of regimes. Multiple tools may be necessary to support the types of decisions that must be made. Recent developments in multi-methodology therefore offer considerable promise of improved decision-making by industry-specific regulators (Mingers & Brocklesby, 1997, Nicholls et al., 2001; Davies & Mabin, 2001; Midgley, 1995). Some such work has sought to demonstrate how the tools, methods and systems methodologies collectively known as the Theory of Constraints (TOC) can be used to complement the use of traditional systems approaches involving Causal Loop Diagramming (CLD) and System Dynamics (SD) (Mabin et al., 2006; Davies & Mabin, 2004). Other work explores the benefits arising from the mutually informing nature of systems methodologies in addressing problematic situations (Davies et al., 2006). Elsewhere, issues of a meta-methodological nature have been addressed that relate to the use of TOC methods in multi-methodology (Cox et al., 2005; Davies et al., 2005).

As an example of the application of multi-methodologies in assisting regulators, we examine a recent regulatory dilemma relating to the New Zealand telecommunications sector – the provision of universal service pricing - by exploring the mutually informing benefits of using different problem representational devices and processes such as the Conflict Resolution Diagram (CRD) / Evaporating Cloud (EC) of TOC and the CLD of SD. We suggest that the benefits of our approach encompass enhanced understanding of the telecommunications sector in New Zealand, in particular, and of issues faced by industry regulators and telecommunications companies, in general.

The paper will first provide some background to the New Zealand telecommunications sector, specifically the history and nature of regulatory intervention, as a means of providing a context for understanding the specific issues facing the regulator with respect to decisions on universal services pricing. Subsequent sections will then outline and provide constructive illustration of use of the
individual representational tools, the CLD of SD and the EC of TOC, in structuring the problem situation. A final section attempts to draw together further insights which relate to the NZ telecommunications sector, its regulators and constituent companies, as well as the particular methodologies used.

NEW ZEALAND TELECOMMUNICATIONS REGULATORY HISTORY

Contrary to the trends prevailing in the majority of OECD countries throughout the 1990s, where regulated telecommunications providers of voice services became subject to extensions of those regulations into the provision of their new broadband products (OECD, 2003; 2005), between 1990 and 2001, New Zealand eschewed the industry-specific regulation of incumbent provider Telecom New Zealand Ltd (Telecom), in favour of light-handed regulation via generic competition law (Commerce Act, 1986). The solitary industry-specific regulation imposed related to and a simple set of price caps (prices could be raised by no more than the CPI index each year) and minimum quality requirements (the "Kiwi Share", later the Telecommunications Service Order) on the provision of local residential voice telephony services (Boles de Boer & Evans, 1996).

From 2001, however, following a change in government and a Ministerial Inquiry into the telecommunications sector (Fletcher, 2000), an industry-specific regulator, the Telecommunications Commissioner, was established, with a specific mandate to investigate and make binding decisions in a number of clearly defined areas (e.g. interconnection, number portability, local loop unbundling).

It is the requirement of affordable and accessible universal telecommunications services provision to all corners of New Zealand that this paper explores. Key tensions arising from the regulatory requirements surround the ways in which they will affect investment incentives. For example, making universal services pricing affordable also affect incentives to invest in infrastructure, where mandated lower prices for universal prices might adversely impact incentives to invest in infrastructure that would extend accessibility (Wallsten, 2006; Crandall et al., 2003; Aron & Burnstein, 2003; OECD, 2003; Howell, 2002). This is the 'dilemma' facing the regulator (in this case, the combined regulatory bodies represented by the Minister of Communications, the MED and the Telecommunications Commissioner).

The application of multi-methodologies discussed below was prepared at the time, 2011, when regulators were wrestling with the dilemma, and as a means of facilitating clear analysis and communication of the understanding of the problem situation, and thereby supporting enhanced regulatory decision-making. Whilst the analysis is undertaken at a macro level, the application illustrates the interconnectedness of important variables, and the predictable and otherwise emergent properties of the overall system.

With the benefit of hindsight, we demonstrate how the conflicts identified in the multi-methodology analysis, but not fully addressed in the regulatory decisionmaking, can have predictable downstream consequences.

A MULTI-METHODOLOGICAL APPROACH

The initial Causal Loop Diagram (CLD)

In this section, we provide an illustration of how relationships embedded in the universal pricing situation may be framed using a Causal Loop Diagram (CLD), deliberately presenting a macro or 'helicopter' view of the problem situation.

Usually, a CLD is developed by a process of surfacing variables as contributory causes or consequential effects of existing entities, and then by building on and extending links in iterative fashion until a sense of systemic wholeness and understanding is achieved. The CLD shown in Figure 1 displays how a price-capping response to concerns about price/quality relativity has impact beyond that which may have been expected for Telecom NZ. We note for loop B1 that:

As the price of services relative to quality increases, the regulator's perceived need to facilitate price competition grows stronger, driving up the regulator's perceived need to mandate price-capping, increasing the extent of price-capping that takes place,
improving the *affordability of universal services*, leading to increased *uptake of universal services*, and then lowering *concerns about the price of services relative to quality*.

Indeed, the initial *concerns about the price of services relative to quality* promotes action and effects within the loop B1 that reduces price, reflecting what is termed a Balancing (B) or negative feedback loop.

In addition, insights that emerge from the CLD show that whilst *price-capping* may have its desired and intended impact in the short term (loop B), it may also have unintended and unwanted effects on long term investment in infrastructure considered necessary to address and improve quality. For example, in examining the extended loop R1 (shown as thick black links), we find that:

As the *price of services relative to quality* increases, the regulator's *perceived need to facilitate price competition* grows stronger, driving up the regulator's desire to *mandate price-capping*, strengthening the resolve for *price-capping*, thus impacting adversely on the *willingness of Telecom to invest in infrastructure*, leading to decreased *investment in infrastructure*, undermining the ability to provide *affordable services*, and then closing the loop, further increasing *concerns about the price of services relative to quality*.

... suggesting that *price-capping* may lead to a longer term worsening of concerns about price/quality relativity (as indicated by both of the loops R1 & R2). As such, these observations not only raise the question of whether we should impose *price-capping* or not, but whether - if the government/regulator is committed to *price-capping* - it should also mandate investment in infrastructure. At the time of writing/submission, this would have been seen as politically infeasible.

**Figure 1 – Illustrative Causal Loop Diagram (CLD) for the telecom universal services case**

We note in observation that the CLD convention requires entities to be described in neutral mode, where possible. The + *S* and – *O* annotations then allow relationships to be described in the context of starting or changing conditions.

The + *S* annotation indicates that the more we do the action at the tail of the arrow, the more the effect at the head of the arrow. For example, the more we have X, the more Y is needed.

By contrast, the – *O* annotation indicates that the more we do something, the less the effect.

The double bar // across an arrow denotes a delay.

In passing, we note that, for purposes of exposition, our CLD does not incorporate the actions or behaviors of any of Telecom NZ's competitors – who, of course, may react in a similar way to Telecom. We also note that our CLD structure can be identified as a modified version of Senge's *Fixes that Fail* archetype – where a so called *Quick Fix* can make the problem worse in the longer term (Senge, 1999, 2006).
Yet, a weakness of our CLD is that although it captures the regulatory dilemma as it relates to price-capping as a Quick Fix, it does not capture other alternative options available to the Regulator, other than gradations of price-capping - including 'no price-capping'. We suggest that one such alternative regulatory action - to mandate investment in infrastructure - would create a dilemma for NZ regulatory decision makers, with such action considered to be politically infeasible. In order to shed light on such issues, we will now show how the conflict resolution process of TOC can help identify and structure a dilemma, and how it can aid attempts to resolve often inherent conflict between alternative plausible and seemingly mutually exclusive actions or options.

**Theory of Constraints (TOC)**

**Conflict resolution diagram or Evaporating Cloud (EC)**

TOC as an espoused methodology seeks to assist with the 'management of beneficial change' in organisations by using logic-based modelling and analytical tools in the belief that organisations as systems can be subject to on-going improvement aiding long-term survival. In many cases, such change relates to the resolution of dilemmas which may have been assumed to be too hard to resolve.

The conflict resolution process of TOC is known not only for the Conflict Resolution Diagram (Dettmer, 2003) that it generates, but also as the Evaporating Cloud (EC) process (Cox et al., 2003; Goldratt & Cox, 1992; Goldratt, 1990, 1994). This EC process seeks to resolve such choice dilemmas, and does so by linking it to the overall system goal, and also the assumptions that underpin the dilemma. That is, the EC process emphasises different features of the problem situation compared to the CLD in Figure 1, which is characterised by cause-effect relationships and causal feedback loops. The EC is constructed as a schematic portrayal of the dilemma, using necessity-based logic relationships, depicted here by arrows connecting the boxes in the diagram in Figure 2.

For our situation, the dilemma could be framed as whether or not to mandate price-capping, given the overall goal or objective of improving access to quality universal services.

**Figure 2 - TOC evaporating cloud for the Telecom Universal Services Dilemma**

The dilemma in Figure 2 would be read as follows:

… that in order to ensure the objective A to improve the access to quality universal services, the Regulator must B improve **affordability** of quality universal services …

… and in order to B improve **affordability** of quality universal services, the Regulator must D **place a cap on Telecom universal services prices**.

On the other hand, another view is:

… that in order to ensure objective A to improve the access to quality universal services, the Regulator must also C to improve **availability** of quality universal services …

… and, in order C to improve **availability** of quality universal services, the Regulator must D’ **not place a cap on Telecom universal services prices**.

Hence the conflict!

The EC representation frames the problem starting with what is believed to be two diametrically opposed actions or views (represented in boxes D & D’), and implicitly assumes that the apparent conflict can be resolved by a win-win solution. In order to find such a solution, we elicit those
assumptions or reasons why the relationships are thought to hold. Such assumptions are usually surfaced by using the constructive device of sentence completion, as follows:

*In order to ensure A, we must have B, because AB ….* finishing the sentence with an adverbial clause of reason. An illustrative subset of such assumptions relating to the logical relationships AB, BD, AC, CD’ and DD’ is shown here as annotations in the thought bubbles or clouds on the EC diagram (Figure 3A). These assumptions will sometimes provide a substantive rationale for the existence of the logical links between two entities; other times, they will be seen as flawed or weak.

Quite often, the link between A and B, is regarded as a long link – meaning that further clarification, information, explanation or reason, is required to make sense of, or validate, the relationship.

Figure 3A - TOC evaporating cloud for the Telecom Universal Services Dilemma with underpinning assumptions

Often when surfaced and articulated in this way, the reasons or assumptions may be seen as false, and the conflict *evaporates*. Even where assumptions are initially considered to be valid, they may often be addressed in a manner that invalidates or *evaporates* them, that reduces their importance or impact, and that allows for a resolution of the conflict. The best ideas or action choices surfaced by the EC process would normally be further developed and tested not just by using the EC, but also by using other TOC tools such as the *Current Reality Branch* (See Cox et al., 2005). Rather than pursue the normal dissolution/resolution/solution process of the EC in this paper, we will explore links to the CLD. In doing so, we note that the surfacing of assumptions, explanations or reasons for the existence of a 'long' link between say, X and Y, may often provide evidence of additional intermediate links. Here, whilst we foreshadow the importance of these intermediate links in building a solution to the dilemma using the full EC process, we would also normally use such links in building a second more comprehensive CLD – however, space precludes presentation of the more comprehensive CLD.

Instead, we offer some insights that emerge from recognising that entities B and C in Figure 3A, that is, *affordability* and *availability*, may also be recognised by some as being systems goals in their own right. Using the EC diagram, Figure 3B shows the dilemma that encompasses *affordability* as a second tier system goal. We note that to have A2 *affordability*, we must then have B *alignment of Telecom user expenditure to use resources.*
In a similar manner, Figure 3C shows the EC representation of the dilemma inherent when *alignment of Telecom user expenditure to use resources becomes* the system goal. Drawing on the perspectives offered by the systems representations displayed in Figures 3A, 3B, 3C, it is then possible to show (in Figure 4) the links and relationships between the three different dilemma, that is, between the three different EC diagrams. Indeed, Figure 4, as a presentation of three EC diagrams shows how the three perspectives (ECs) provide an example of the emergent systemic nestedness. In addition and in particular Figure 4, also demonstrates a common feature of what we may call *wicked* dilemmas that have conflict embedded at different levels of nestedness.

**Figure 3B - Capturing a Second Perspective on the Dilemma**
with an alternative system goal – relating to Affordability - surfacing assumptions

**Figure 3C - Capturing a Third Perspective on the Dilemma**
with an alternative system goal – relating to Alignment of User Expenditure and User Resources
The relationships shown in Figure 4 are also amenable to an alternative representation as a single diagram (Figure 5). It provides yet another perspective on nestedness and embedded conflict, and creates further insight about the nature of the conflict that must be addressed by the Regulator. It shows how the embedded conflict confounds around three different conceptual levels – individual users, user groups and the wider telecommunications sector – an insight which demonstrates that a systemic approach is necessary, and that tackling the problem at any one level may be problematic.
DISCUSSION AND CONCLUSIONS

We now outline how the different approaches have been harnessed and applied to the Universal Services dilemma; offering comment / insight on regulatory issues; and how they may be addressed.

Methodological Insights

We note, for example, that the CLD, shown in Figure 1, captures and communicates the interconnectedness implicit in the situation much more readily than the narrative. It can help build an understanding of the systemic nature of relationships, not only highlighting the dynamic nature of feedback, the existence of balancing (B) and reinforcing (R) feedback loops, delays and side-effects; but also distinguishing between individual (say, Regulator or Telecom) and systemic behavior, between seemingly predictable individual behavior and local outcomes, and the systems behavior that may be expressed as the unanticipated 'emergent' properties of the system.

We often find that construction of the CLD draws attention to particular patterns of behavior that arise from the interdependent and systemic structure of relationships. We may note that positive reinforcing loops (R) can lead to virtuous or vicious cycles of escalating individual behavior, and/or to outcomes that either get better and better, or persistently deteriorate over time. Additionally, we may gain recognition of how such individual or system behavior can lead to unintended, yet often patterned and predictable consequences – and therefore, how alternative actions may be assessed. (We note that the systemic structure evident in the CLD reflects the ubiquity of Senge’s archetype – the Fix that Fails.)

The CLD representation of entities and relationships, shown in Figure 1 is meant to be reflective of the perceived systemic reality of the situation facing the Regulator and Telecom NZ. However, we note that the initial plausible CLD may not necessarily capture alternative options; neither does it necessarily surface the system goal. That is, it does not capture any perceived choice for intervention, other than price-capping - and does not necessarily or explicitly present a choice dilemma of mutually exclusive options. Nevertheless, it does implicitly present action options for different modes and degrees of price-capping, and then maps the systemic consequences and interactions that emerge.

Whilst it may be claimed that identification of the core choice dilemma, which is the raison d'être for the EC, may be drawn from the initial CLD, we suggest that constructing the EC (See Cox et al., 2005) demands not only the identification of the dilemma - the alternatives available to the Regulator; but also identification of the overall system goal, and the explicit surfacing of assumptions and beliefs, all of which can then be mapped to a more comprehensive CLD, and lead to better diagnosis and understanding of the nature of chronic conflict faced by the regulators. However, such an amended CLD is not shown here. Instead, we have chosen to demonstrate how the EC process can be extended to represent the systemic and nested nature of the dilemma. In this case, the overall goal identified for our illustrative use of the EC was to improve access to quality universal services.

More generally, we suggest that iterative and mutually informed construction of EC and CLD diagrams is possible and desirable. We also note that the assumptions embedded within the EC, and supporting the EC logic, can surface as intermediate entities - causes and effects - within a more comprehensive CLD. Similarly, entities introduced to the CLD for clarity and completeness, can also be incorporated into the EC, forming part of the underpinning logic.

Despite its usefulness, one of the seeming drawbacks of the EC is its apparent simplicity and parsimony in presentation. However, the basis for such parsimony must be understood in terms of the EC's logic protocols, especially so, if the EC is to be used to its fullest extent or used in complementary fashion with the CLD of SD. We foresee benefits in using CLD representations to better diagnose and understand the nature of chronic conflict, captured in EC representations, and to better understand how and why the taking of any one action can undermine our ability to enact an alternative, when both are necessary requirements for the overall objective to be satisfied. Such understanding is necessary to build lasting solutions when confronted by dilemma or conflict, and is especially so, with respect to regulatory intervention in the telecommunications industry.

Our experience in using the EC process to guide development of CLD representations, and then using managerial insights from the EC to inform the development of insights from the CLD, has been, in the main, beneficial. The role of the CLD and EC as communication devices cannot be understated. Indeed, our CLD not only captures an understanding of the inherent dilemma about price-capping
faced by the telecommunications regulator, but also facilitates the development and communication of insights – especially those that relate to the need to mitigate the undesirable side-effects of other alternative actions, the need to deal with moral hazards, the threats to desired outcomes, as well as the need to ensure that intended effects eventuate. Such matters reflect the nature of regulatory dynamics.

The Nature of Regulatory Dynamics

Understanding the nature of regulatory dynamics requires understanding of the systemic nature of relationships; distinguishing between individual and systems behaviour; and recognising that the quick fix may have unintended consequences long term. Indeed, interpreting the CLD of Figure 1, we note that setting price caps may lower costs for users in the short term, in keeping with the system goals, and as shown in the balancing or negative-feedback loop B1, but undermine investment by Telecom and its competitors, long term - shown, for example, via the extended feedback loop R1.

As an aside, we would suggest that any rationale for Telecom NZ's willingness or unwillingness to invest would be likely mirrored in the behavior of its telecommunications competitors in due course, although this is not shown in the CLD which has not been extended to include other industry players or competitors. Similarly, we note that Regulator intervention which promotes and leads to greater investment in infrastructure may improve quality in the short/medium term, but would likely lead to a lowering of Telecom NZ's willingness to commit to price-capping in the longer term.

Additionally, opening up access to other competitors to compete below the price-caps in specific markets may boost competition and lower user costs in some markets short term, but again, may undermine investment by Telecom and its competitors in the long term. As a corollary, requiring greater investment in infrastructure to improve quality or broaden provision may lower willingness to commit to price-caps in the long term. It is considered that such enhanced insight about the nature of chronic conflict may be attributed to the development and use of different systems representations.

The Systemic Nature of the Universal Services Dilemma

The systems representations of Figures 2-5, highlight how alternative choices to the price-capping of universal services necessarily reflect the systemic and nested nature of differing needs surfacing at the level of individual users, specific user groups, and the telecommunications sector as a whole.

Here, we note that the nested nature of the dilemma facing policy makers and political decision makers is such that they are torn between addressing:

1. the specific cause of economic or financial benefit or cost faced by any individual user that is, addressing the level of the universal service price;
2. the needs of individual users in some holistic sense;
3. the needs of the wider user groups as a whole; or
4. matters at the level of the sector or societal level

Paradoxically, the representations in Figures 4 & 5, not only highlight the complexity and confounding nature of nested conflict, but also represent it in parsimonious fashion. Indeed, the clarity of such presentations provides some evidence of the degree to which the nested nature of conflict or dilemma gives rise to confounding issues and may confound understanding and responding to such dilemma. This is especially so if participants remain unaware of the level of nestedness at which they or some other actor may be attempting to resolve dilemma. It is not surprising then, that actors may talk past one another, or why the approaches deployed here, can be of benefit.
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