The dilemma of regulation

An oft-recurring theme of the efforts to restart the economy after the ravages of Covid-19 is the need to drastically reduce regulation. This is held to be essential for successfully "building back better" [1], "levelling up" (in the UK) and so forth. Regulation, it is held, is "holding back Britain's pent-up entrepreneurial potential",[1] and even preventing change in general.[2] In other words, it is imposing a kind of drag (friction) on the life of the nation, much as when second-class postage was introduced[3]—letters, formerly delivered on the same day or at the very latest the next day, now took several days—hence over a week to write and get a response. And it has been rightly pointed out that regulations tend to accumulate; they are hard to sweep away.[4] Regulations have even been weaponized, such as the EU directive stipulating that suction sweepers should bear a label displaying energy efficiency.[5] The great engineer I.K. Brunel famously opposed the proposed appointment of government inspectors of railways, with: "Railway engineers understood very well how to look after the public safety, and putting a person over them must shackle them. They had not only more ability to find out what was necessary than any inspecting officer could have, but they had a greater desire to do it" [2].

On the other hand deregulation, or poor regulation, can have severely detrimental effects on the environment and quality of life. This is particularly apparent with the built environment. On 24 June 2020 the UK Government announced significant deregulation of planning. The announcement was swiftly condemned: "the reforms would lead to a boom in thousands of tiny, poor quality 'homes' in unacceptable locations like industrial estates";[6] and "three quarters of housing developments should not have been granted planning permission due to poor or mediocre design quality. Further deregulation as proposed here would only make the problem worse".[7] The results of many years of more or less unrestricted development in London has led to a very unbeautiful skyline. Paris is now threatened with a similar fate, and many other places such as Beirut (once called "Paris of the Middle East") have long since succumbed. This seemingly inexorable and ubiquitous trend of urban uglification might also be due to a failure of regulation, which will be explored below.

Another striking example of deleterious effects of deregulation is the airline industry, which was deregulated (in the USA) in 1978 [3], and this lead has percolated worldwide. Apart from the highly deleterious human consequences [4], there are also consequences for operational safety [3] and ill-health among aircrew and passengers [5], due to economies in aircraft maintenance.

For many decades, however, regulation has been a central part of the discipline of cybernetics (Fig. 1). Appreciation of its importance may first of all have arisen through consideration of the imperative to survive in a changing environment, so apparent in the living world. Surprisingly, the only truly consequential attempt to apply this knowledge and insight to a real economy was the "viable system model" (VSM) introduced into Chile by Stafford Beer in the early 1970s at the behest of the newly elected President Allende [10]. Tragically he was overthrown in a bloody coup on 11 September 1973, before the system was fully operational. It could have been restored and completed by the new government under General Pinochet, but it was not—it was abandoned and destroyed. Humanity thus lost a unique chance to study the outcomes of perhaps the most fascinating economic experiment of all time. Truly this was regressive barbarism.[8]

Possibly one reason for the abandonment of the VSM in Chile was its association with the socialist–communist planned economies espoused in the USSR

---

1 J. Warner, *Daily Telegraph* (9 July 2020).
2 M. Kilcoyne (deputy director of the Adam Smith Institute), *Daily Telegraph* (30 April 2020).
3 In 1968 in the UK. Other countries subsequently followed suit (e.g., Switzerland in 1991).
4 *Vide* the fact that ration cards, a measure introduced during World War II, lasted until 1954 in the UK.
5 Apparently this directive was a result of lobbying by large continental European manufacturers of those sweepers. Testing to determine energy efficiency was to be carried out on the machines when empty. This disadvantaged the manufacturers of cyclonic sweepers (commercialized by Dyson in the UK) because their performance remains roughly the same regardless of how much dust has been collected, whereas the continental type collects dust in filter bags and the efficiency declines as the bags get clogged with the dust.
6 Daniel Slade from the Town and Country Planning Association.
7 Crispin Truman from CPRE, the Countryside Charity (CPRE; formerly the Campaign to Protect Rural England and originally the Council for the Preservation of Rural England, founded in 1926).
8 It may be noted that another original invention of Beer, team syntegrity [11]—a tool for strategic planning—does not seem to have been seriously implemented anywhere.

Received 30 September 2021

doi: 10.4024/13RA21E.jbpc.21.03

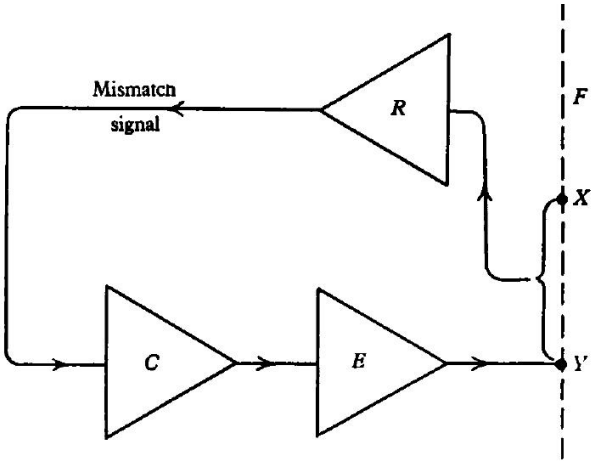

Figure 1. The minimum requirements for goal-guided activity [6] (cf. refs 7 and 8). System activity is represented by movement of point *Y* along the dashed line *F*. The active agent is represented by the effector system *E*, which is governed by the control system *C*, whose function is to select (out of a range of possibilities) from moment to moment what *E* shall do next. If there is a point (goal) *X* (fixed or moving) towards which we want the activity of the system to be guided, we mean that the interval between *X* and *Y* (or some time average of it) should be reduced to a minimum by the actions of *E*. The receptor system *R* gathers information about the interval and feeds it to *C*. This simple arrangement takes no account of delay in the feedback, which may induce chaotic behaviour [9].

and the member states of Comecon.[9] Such central planning was anathema to the laissez-faire, free-market economies of the USA and western Europe.[10] The central challenge of planning is to understand that there is a complexity ceiling above which it is nugatory to attempt an explicit detailed consideration of all factors (some of which are anyway unknown—the factors themselves, let alone their numerical values) [14]. The administrator, however, constantly seeks to simplify so that he can understand [15]—but his simplified model no longer corresponds to reality [16].

Britain today—and most other countries—are beset with regulatory bodies.[13,14] Many were created after the privatization of national utilities—one regulatory body for each utility. Given the neglect of any type of systematic thinking about the rôle of regulation (starting with Fig. 1), and the inevitable presence of delayed feedback, the effects of these regulators would be mostly comical, were it not for the really deleterious effects on the lives of millions of people.

Regulatory failure

In terms of Fig. 1, the regulator corresponds to *C* and the industry being regulated to *E*. *R* corresponds to the regulator's sources of information, which might be as varied as personal experience, dedicated surveys, the press and other media, correspondents and lobbyists. Regulatory failure can be classified under several rubrics:

I. Corruption

Many regulatory agencies—which are basically panels (committees) of experts (usually supported by a secretariat)—are populated by people from the actual industries being regulated. In many or perhaps most cases (e.g., the UK's Civil Aviation Authority, CAA; the Office of Gas and Electricity Markets, Ofgem) the body is funded by a subscription or other kind of levy paid by the industry being regulated.[15] Even if not current employees, committee members are likely to be former employees of the regulated industry, because that is where appropriate expertise is mainly to be found [18]; experts are personally known to each other and this makes it, perhaps only subconsciously but all the more insidious for that, hard to approve actions perceived as being hostile to the industry. In other cases, independent members of the panel may be blatantly lobbied by the industry [19]. Succumbing to such lobbying is not only dangerous because objectively expert views are set aside, but also because once it and its effects become known, it undermines public trust in the regulatory agencies.

Probably the construction industry is the one in which the most egregious examples of regulatory

[9] In German, the *Rat für gegenseitige Wirtschaftshilfe* (RGW)—the eastern European counterpart of the EEC (in German EWG—*Europäische Wirtschaftsgemeinschaft*—later became the European Communities and is now the EU).

[10] The difference between the two is not so great as may be supposed. Free markets require a minimalist degree of support from the State — defence from external threats, internal law and order (especially upholding the law of contract), and access to justice for all.[11] In that sense it is also "planned". The matter is one of degree, and whether there is a kind of phase transition (with the degree of planning as an order parameter) is still an open question.[12]

[11] These are essentially the minimal requirements of a government proposed by Herbert Spencer [12].

[12] The notion of phase transition (which originates with Hegel [13]) evidently interested Karl Marx, who famously posed the question, how much money does a man need to become a capitalist?

[13] The website www.regulation.org.uk has useful information about the history of regulation in the UK. Ref. 17 is one of the few books on the topic (regulation in the USA). Nowhere does one find a cybernetic analysis.

[14] The EU can perhaps best be seen as a gigantic regulatory system.

[15] An obvious absurdity that results from this arrangement is that the industry then sees itself as a client of the regulator and entitled to receive fulfilment of any services requested. For example, the UK Environment Agency levies a substantial fee on a company applying for an environmental permit, hence the company feels that it is entitled to receive the permit it has, in effect, paid for.

corruption are to be found. The tragic Grenfell Tower fire [20] has, thanks to the effort of the enquiry being chaired by Sir Martin Moore-Bick, resulted in the discovery of many definite examples. Not only did the actual building regulations permit the use of flammable cladding on residential tower blocks, but checks on the cladding actually used were virtually nonexistent, which doubtless emboldened the builders to substitute cheaper and even more flammable materials than those specified, pocketing the difference in cost.

In terms of Fig. 1, corruption is probably best represented as corruption of *R*—either its inputs or what is fed to the regulator *C*.

II. Incompetence

The UK's Environment Agency (EA, created in 1995), which is supposed to regulate activities bearing on the environment, is very frequently subjected to strong and, it would appear, entirely justified criticism. Many examples concern the management of water courses and the prevention of flooding destructive of residences and agriculture, of which there has been not a little in recent times. Whereas the rivers Welland and Witham, controlled by the EA, regularly flood, catchment areas in the Fens managed by local drainage boards (many of which were founded two hundred or more years ago), which regularly clear and dredge, do not. Jamie Blackett has remarked that EA officials "are simply incapable of understanding that ... most of our watercourses are now in some way artificial and need human action...",[16] and notes that its chief executive, Sir James Bevan, is a former diplomat. Yet time and time again, when EA decisions (and those of other regulatory bodies) are challenged in the courts, "the court should be very slow to conclude that the expert and experienced decision-maker assigned the task by statute has reached a perverse scientific conclusion" [21].

In terms of Fig. 1, incompetence is probably best represented as failure of the regulator *C* to control the effector *E*.

III. Ineffectiveness

Here too doubtless many examples can be found. Investigative journalism and academic studies have, since 2010, found evidence for garment factories in Leicester operating under illegal conditions. In 2019 the parliamentary environmental audit committee noted that factories were still "breaking the law to maximize profits". Very concrete allegations were made against, in particular, the fast fashion company Boohoo, but their response was "inadequate in scope, timeliness and gravity" according to Standard Life Aberdeen, one of Boohoo's biggest investors, which then sold its shareholding.[17]

In terms of Fig. 1, ineffectiveness is probably best represented as the inability of the effector *E* to affect system activity along the line *F*.

IV. Inertia

This is a kind of systemic incompetence–ineffectiveness. In general, regulation has no sense if whatever has been selected for regulation cannot be measured. For example, currently Ofgem regulates price, which is amenable to a clear definition and can easily be discovered. On the other hand, it is still difficult to measure ultrafine particles (nanoparticles, such as $PM_{0.01}$) polluting the air. Air quality regulations have been framed in terms of the relatively easy-to-measure PM_{10} (i.e., particles of diameter 10 μm or less). There is beginning to be concern about $PM_{2.5}$, although in terms of size alone these present a lesser hazard [22], but particle measurers consider it a great achievement that they can now quantify the smaller (fine) particles, hence the regulations are being reformulated to include them. Meanwhile ultrafine particle-producing installations can continue to pollute the air with impunity,[18] even while concerns grow about the health hazards from the smaller particles [23].

Measuring regulation

Despite the well-established theoretical framework (represented here by Fig. 1 and its legend), attempts to assess the effectiveness are of a very different stamp [24], having more in common with a literary narrative than a physical–mathematical analysis.[19] A cost:benefit ratio would seem to be amenable to quantitative measurement, but the powerful methodology of the J-value [25] is eschewed in favour of a somewhat vague qualitative approach that puts great emphasis on "indicators".[20]

The goal of measurement is, of course, to make the regulation better and, to be sure, the ultimate criterion of "better" is indeed the fulfilment of some societal goal, as

16 *Daily Telegraph* (18 February 2020).
17 Reported by B. Marlow in the *Daily Telegraph* (14 July 2020).
18 According to the PM definition, anything smaller than PM_{10} is included in the count, but since the usual devices measure according to mass, the contribution of one $PM_{0.01}$ particle is a thousand millionth that of one PM_{10} particle, hence negligible, yet the health hazard may be proportional to the number of particles rather than the total mass inhaled.
19 For an engineering example ("degree of output controllability", DOC), see ref. 25.
20 See also the two papers referred to in the Foreword of ref. 24.

is tacitly assumed in ref. 24.[20] The failures adumbrated in the previous section can be largely ascribed to inadequate capacity of the communication channels connecting the elements of the system. After that comes possible inadequacy of the information processing capability of the elements for dealing with whatever information is received through the channels.[21] Recognition of these inadequacies provides far-reaching hints for action to improve regulation.

There is always a balance between swiftness of information supply and delay. The sometimes catastrophic consequences of the latter have already been highlighted [9]; too-rapid response can also be deleterious.[22]

Clearly the regulatory system must have enough inherent variety to cope with the variety of its environment [29]; in reality the line *F* in Fig. 1 is an object of high dimensionality. This provides the justification for having a diverse (in its widest sense—diversity of creative intellect) workforce in any organization.

In the real world, with all its complexity, the best empirical approach would be to compare the system with regulation and without it. Such experiments can hardly ever be carried out (which makes the tragedy of the abandonment of one such experiment, in Chile, all the greater); at best with and without can be compared sequentially, as with Lenin's New Economic Policy (NEP). One could envisage successive refinements to constantly improve it. Ultimately it was abandoned, for ideological reasons and for the sake of achieving larger policy goals.[23] Observation is also valuable—one notes, for example, the huge success of the largely unregulated East India Company versus the highly regulated State bureaucracies of China and India—albeit that a definitive, quantitative analysis would appear to be a very difficult problem.[24]

In an ideal world, one would firstly decide on the overarching goal, and then devise the best regulatory system to achieve it. The closest the world has come to this is Allende's Chile. Had this experiment been continued, it would have had to be continually modified to enable it to adapt to a continuously changing world environment. One might argue that such adaptation is going on everywhere, thereby improving regulatory systems, but it would be strange to deny the advantage of injecting advanced knowledge for accelerating such adaptation.

The future

Regulation is fundamental for the survival of a system—be it a living organism or a society. One sees it in, for example, temperature control in mammals; even poikilotherms (ectotherms) have mechanisms of temperature adaptation [30,31]. Regulation is a means to adaptation, which in turn is a special case of directive correlation [7]. But, as Vickers has asked, is adaptability enough [32]? M. Ashby has developed "ethically adequate systems" [33], albeit without addressing the problem of *quis custodiet ipsos custodes?*—who or what will regulate the regulators? Perhaps the only answer to this is that the system has to be self-referential, as is the brain [34], or must ultimately defer to a supreme being, discovery of the thoughts of which therefore becomes the main life-goal of the individual [35].

A strong fear is that many of the Covid-19 regulations will persist long after the pandemic is ended, becoming instruments of State surveillance and, ultimately, oppression. As Bertrand Russell has remarked, civilization depends on a judicious balance between individual liberty and collective responsibility.[25] If unchecked, oppressive regulation would therefore spell the decline and end of civilization. Oppressively regulated states will decline relative to judiciously regulated ones, hence the danger from this source is small unless we move to a system of a single world government, as has been advocated to tackle Covid and future pandemics.

Although the means and efficacy of regulation are subordinate to any overarching goal, since there is no universal agreement about any such goal, we end up, in practice, being mainly concerned with regulatory mechanisms. Here the main problem requiring urgent solution is the fact that a governmental regulator is simultaneously the legislator, the executive (monitoring compliance), and a judicial tribunal (punishing offences). This is an affront to the basic constitutional notion of the separation of powers [36].

---

21 Here, the rôle of intuition as a sophisticated way of information processing should not be neglected.

22 The usefulness of the VU meter lies in its smoothing out of the abrupt peaks and troughs of an (acoustic) signal [27]. See also ref. 28.

23 It seems to be widely accepted that regulation is subordinate to political ends. For example, the UK Chancellor of the Exchequer ordered the Competition and Markets Authority (CMA) to "put competition at the heart of the UK economy" (reported in the *Daily Telegraph*, 6 February 2020).

24 For an excellent flavour of life within the Company, I commend Austin Coates' novel *City of Broken Promises* (Hong Kong: University Press, 2009). Although there was little formal regulation by the Company, activity was still regulated in the cybernetic sense—with the goal of something like Adam Smith's self-interest.

25 *Authority and the Individual*. Inaugural BBC Reith Lectures (1949).

While Covid triggered the present thoughts, even before the pandemic we were already moving towards an increasingly regulated society in order to arrest climate change. "Net zero" envisages an unprecedented intrusion into individual lives and liberties. Even without the scientific uncertainties around global warming [37,38] such State intrusion cannot be justified. Individual citizens should be particularly vigilant regarding the deployment of regulatory measures and falling into a state of overregulation.

J.J. Ramsden

Note added in proof: Special difficulties arise when the normally highly effective regulation by error [8] requires the construction of enormous infrastructure to correct errors. An excellent example is the regulation of the Nile [39]. Bringing this topic into the framework of the present discussion must, however, await a future treatment.

References

1. Ramsden, J.J. "Build back better"—a commentary. *J. Biol. Phys. Chem.* **20** (2020) 91–99.
2. Quoted in L.T.C. Rolt, *Isambard Kingdom Brunel*, pp. 217–218. London: Longmans, Green & Co. (1957). This happened in 1841.
3. Lind, J.M. Cabin air safety oversight in the airline industry. *J. Biol. Phys. Chem.* **21** (2021) 18–22.
4. Bennett, S. Aviation and corporate social responsibility. In: *Innovative Thinking in Risk, Crisis, and Disaster Management* (ed. S. Bennett), ch. 6 (pp. 139–171). Farnham, Surrey: Gower (2012).
5. Michaelis, S. Contaminated aircraft cabin air. *J. Biol. Phys. Chem.* **11** (2011) 132-145.
6. MacKay, D.M. Towards an information-flow model of human behaviour. *Br. J. Psychol.* **47** (1956) 30–43.
7. Sommerhoff, G. *Analytical Biology*, chs 2 & 3. London: Oxford University Press (1950).
8. Ashby, W.R. *An Introduction to Cybernetics*, part 3. London: Methuen (1964).
9. Pippard, A.B. *Response and Stability*, ch. 2. Cambridge: University Press (1985).
10. Beer, S. *Fanfare for Effective Freedom* (3rd Richard Goodman Memorial Lecture delivered at Brighton Polytechnic on 14 February 1973).
11. Beer, S. *Beyond Dispute*. Chichester: Wiley (1994).
12. "... not to regulate commerce; not to educate the people; not to teach religion; not to administer charity; not to make roads and railways; but simply to defend the natural rights of man—to protect person and property—to prevent the aggressions of the powerful upon the weak—in a word, to administer justice. This is the natural, the original, office of a government"—from H. Spencer, at the end of "Letter I", in *The Proper Sphere of Government*, the first of six essays on government, society, and freedom, originally published in 1951 as *Social Statics*; four of them were reissued in 1884 as *The Man versus the State*, and reprinted as *The Man versus the State, with Six Essays on Government, Society and Freedom* (ed. E. Mack). Indianapolis: Liberty Classics (1981).
13. Ramsden, J.J. Less is different. *Nanotechnol. Perceptions* **6** (2010) 57–60.
14. Banzhaf, W., Beslon, G., Christensen, S., Foster, J.A., Képès, F., Lefort, V., Miller, J.F., Radman, M. and Ramsden, J.J. From artificial evolution to computational evolution: a research agenda. *Nature Rev. Genetics* **7** (2006) 729–735.
15. Ramsden, J.J. The role of systems thinking in modern society. *Nanotechnol. Perceptions* **14** (2018) 90–98.
16. Allen, P.M. and Strathern, M. Complexity, stability and crises. In: *Complexity and Security* (eds J.J. Ramsden & P.J. Kervalishvili), pp. 71–92. Amsterdam: IOS Press (2008).
17. Goldin, C. and Libecap, G.D. (eds). *The Regulated Economy: A Historical Approach to Political Economy*. Chicago: University Press (1994).
18. The Countess of Mar. Organophosphates (debate). *Lords Hansard*, vol. 580, cols 1555–1556 (24 June 1997).
19. Robinson, C., Holland, N., Leloup, D. and Muilerman, H. Conflicts of interest at the European Food Safety Authority erode public confidence. *J. Epidemiol. Community Health* **67** (2013) 717–720.
20. Ramsden, J.J. A tragic fire in Kensington, London. *J. Biol. Phys. Chem.* **17** (2017) 43–46.
21. Lindblom L.J. Royal Courts of Justice [2019] EWCA Civ 1962 (19 November 2019).
22. Heyder, J. Deposition of inhaled particles in the human respiratory tract and consequences for regional targeting in respiratory drug delivery. *Proc. Am. Thoracic Soc.* **1** (2004) 315–320.
23. Ramsden, J.J. An appraisal of the UK's Health Protection Agency's document "The Impact on Health of Emissions to Air from Municipal Waste Incinerators". *J. Biol. Phys. Chem.* **18** (2018) 164–166.
24. Coglianese, C. *Measuring Regulatory Performance. Evaluating the Impact of Regulation and Regulatory Policy*. Paris: OECD (2012).
25. Xia, Y., Li, R., Yin, M. and Zou, Y. A quantitative measure of the degree of output controllability for output regulation control systems: Concept, approach, and applications. *J. Vibration Control* **27** (2021) (in press).
26. Thomas, P.J., Stupples, D.W. and Alghaffar, M.A. The extent of regulatory consensus on health and safety expenditure. Part 1: Development of the J-value technique and evaluation of regulators' recommendations. *Trans. IChemE B* **84** (2006) 329–336.
27. Chinn, H.A., Gannett, D.K. and Morris, R.M. A new standard volume indicator and reference level. *Proc. IRE* **28** (1940) 1–17.
28. Åkerman, N. (ed.). *The Necessity of Friction*. Boulder, Colorado: Westview Press (1998).
29. Ashby, W.R. Requisite variety and its implications for the control of complex systems. *Cybernetica* **1**(1958) 189–201; ref. 8, pp. 206 ff.
30. Huey, R.B. and Kingsolver, J.G. Evolution of thermal sensitivity of ectotherm performance. *TREE* **4** (1989) 131–135.
31. Guschina, I.A. and Harwood, J.L. Mechanisms of temperature adaptation in poikilotherms. *FEBS Lett.* **580** (2006) 5477–5483.
32. Vickers, G. Is adaptability enough? *Behavioral Sci.* **4** (1959) 219–234.

33. Ashby, M. Ethical regulators and super-ethical systems. *Systems* **8** (2020) 53.
34. Kaehr, R. and von Goldammer, E. Again computers and the brain. *J. Molec. Electronics* **4** (1988) 31–37.
35. da Cusa, N. *de docta ignorantia* (1440).
36. Wood, P.R. *The Fall of the Priests and the Rise of the Lawyers*, p. 244. Oxford, UK and Portland, Oregon: Hart Publishing (2016).
37. Galam, S. Global warming: a social phenomenon. In: *Complexity and Security* (eds J.J. Ramsden & P.J. Kervalishvili), pp. 237–245. Amsterdam: IOS Press (2008).
38. Holt, G.C. and Ramsden, J.J. *Climate Change from First Principles*. Basel: Collegium Basilea (2019).
39. Hurst, H.E., Black, R.P. and Simaika, Y.M. *Long-Term Storage*. London: Constable (1965).