Drivers and Effects of the Size and Composition of Telecoms Regulatory Agencies[1]

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Abstract:

How do the size and the skill mix of a regulatory agency affect the manner in which it functions, and its effectiveness in meeting its goals?

National Regulatory Authorities (NRAs) for electronic communications differ greatly from one another in terms of the number and the composition of their staff, particularly in terms of the mix between lawyers, engineers, and economists. The U.S. Federal Communications Commission (FCC) has recently acknowledged the need to strengthen its economics and engineering capabilities. What can be said about the "right" size and composition for an NRA's staff? How do staff size and composition impact the functionality and effectiveness of the agency? Could an NRA improve its effectiveness by achieving a more appropriate staffing level, or a better balance of staff skills?

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1. Introduction

How do the size and the skill mix of a regulatory agency affect the manner in which it functions, and its effectiveness in meeting its goals?

National Regulatory Authorities (NRAs) for telecommunications [2] (i.e. electronic communications) differ greatly from one another in terms of the number and the composition of their staff, particularly in terms of the mix between lawyers, engineers, and economists. The U.S. Federal Communications Commission (FCC) has recently acknowledged the need to strengthen its economics and engineering capabilities.[3] What can be said about the "right" size and composition for an NRA's staff? How do staff size and composition impact positively or negatively the functionality and effectiveness of the agency?[4]

Could an NRA improve its effectiveness by achieving a more appropriate staffing level, or a better balance of staff skills?

1.1 Motivation

In this paper, we are looking to understand:

- How the size and composition of an NRA's staff are a response to its needs; and

- How staff size and composition influence in turn the job that it does.

NRAs do not all have identical responsibilities. To the extent that staff size and responsibility are a response to the functional obligations of an NRA, different responsibilities should drive differences in staff size and composition.

- NRAs may cover multiple industries – for example, the German BNetzA regulates not only telecommunications, but also rail, energy, and post.

- An NRA may or may not also have competition law / antitrust responsibilities.

- The functions of the telecoms NRA may exist in a single agency, or may be split among several. In a number of countries, for example, spectrum management (which may tend to be engineering-intensive) is undertaken by a different agency than general telecommunications regulation.

- Finally, the character of the regulatory framework, and of the society as a whole, should play a substantial role. The European regulatory system, with its heavy reliance on analysis based on competition law and economics, might be expected to place a premium on a heavier mix of economists. A country highly prone to litigation, such as the US, might place a premium on lawyers.

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[2] In this paper, we use *telecommunications* as a shorthand way to refer to fixed and mobile networks, cable television, and all of the networks and services that Europeans refer to collectively as electronic communications.

[3] See "FCC Reform Agenda", by Mary Beth Richards, Special Counsel for FCC Reform, slide 19. "Reviewed our economist resources and have conducted a needs assessment (will hire additional economists); Reviewed our engineering resources and have conducted a needs assessment (will hire additional engineers)." See: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296363A1.pdf.

[4] See also "Electricity and telecommunications regulatory institutions in small and developing countries", J. Stern, 2001.

Having said this, however, one could just as well imagine that the size of the national regulatory authority has more to do with the number of lawsuits per year to which it must respond, or with the tax base of the country that supports it.

These are, then, possible *inputs* to whatever process drives regulatory staff size and composition. What are the *outputs*? How should one think about them? Is an NRA that has too few economists likely to produce flawed policy? Would a staff imbalance at middle management or senior management level have a different, possibly more pernicious, effect than an imbalance among the professional staff?

1.2   Methodology

We have (1) identified the functions performed by a number of NRAs; (2) identified the size and composition of these NRAs based on questionnaires to the NRAs themselves, supplemented where needed by e-mail correspondence; (3) developed a range of comparative measures; (4) used a notional model of the telecommunications regulatory to consider the likely effects of skill set imbalances (e.g. too many lawyers, or too few economists); and (5) made broad assessments of the ways in which staff size and composition influences NRA conduct and effectiveness.

Our questionnaire sought clarification of the responsibilities of the particular NRA, and asked for a breakdown of (1) senior managers, (2) middle managers, and (3) professional staff into (1) lawyers, (2) engineers, (3) economists, and (4) other. We received comprehensive responses from Canada (the CRTC), France (ARCEP), Germany (the Federal Network Agency, or BNetzA), the Netherlands (OPTA), Peru (OSIPTEL), Spain (CMT), Sweden (PTS), the United Kingdom (Ofcom) and the United States (the FCC).[5] We also had dialogue with the New Zealand Commerce Commission (NZCC). For Spain, suitable data were already publicly available. For the United States, we had to issue a formal request pursuant to the Freedom of Information Act (FOIA), which the agency then responded to promptly and fully. All other responses were purely voluntary on the part of agencies concerned. Most of the agencies noted that the data were inherently imprecise, for reasons that are noted in Section 1.3.

We had (wrongly) assumed that most NRAs would have this information readily available. In reality, a number of them had to undertake fairly significant data analysis exercises.

1.3   Inherent limitations

We think that our results are quite interesting, and in some cases surprising, but they must be viewed as merely indicative rather than conclusive. For numerous reasons, the data are not entirely cross-comparable. So far as we can see, short of a (prohibitively expensive) comprehensive and standardised survey of multiple countries, it would be impossible to generate perfectly cross-comparable results.

First, there are definitional questions. What constitutes "professional staff"? Who are the "senior managers" of a given NRA? Is an "economist" someone who has a degree in economics, or a closely related discipline, or could it also be someone who works as an economist but has a substantially different degree?

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[5] The authors would like to express their thanks to the many NRAs that kindly and promptly responded to our requests for information about staff composition (see Section 1.2 of this paper).

How should one deal with professionals who have degrees or other qualifications in more than one of the disciplines?

The *quality* of regulatory staff surely also plays a role in regulatory effectiveness. It is for this reason that Ofcom, for instance, intentionally pays on a scale well in excess of typical regulatory salaries. We did not quantitatively address staff quality in the study, because we felt that the level of effort required to make meaningful comparisons would have been prohibitive.

We also would have liked to have made broad comparisons of NRA effectiveness, based ideally on quantitative metrics, but for a variety of reasons we stopped short of doing so. First, it would have been challenging at best due to the lack of solid, quantitative metrics for regulatory effectiveness. Second, simple correlations to outcomes (such as the degree of competition in the telecommunications market) could easily be misleading, inasmuch as the linkage of NRA size, structure and quality to outcomes in the broader society is unlikely to be strong – NRA effectiveness is surely a factor, but it is one of many. Finally, and perhaps most significantly, given that the NRAs were kind enough to voluntarily provide us with a wealth of data, we simply felt that it would be uncharitable and inappropriate to be picky in looking for faults.

At the end of the day, we would acknowledge that these results raise nearly as many questions as they answer. That should probably be interpreted as suggesting that this could be a fertile area for further study.

1.4 Structure of this paper

The next section of this paper, Section 2, provides a brief survey of the literature on the size and composition of regulatory bodies in general, and telecommunications regulatory bodies in particular. Section 3 discusses the degree to which the staff size of the regulator relates to the job that it has to do (including C. Northcote Parkinson's tongue in cheek suggestion that there might be very little relationship at all). Section 4 provides a notional model of the manner in which a national regulatory authority crafts and implements regulation, with an eye to identifying likely pathologies in the event that a regulator does not have the right staff mix at a given stage of the process. Section 5 summarises the data that we obtained from various national regulatory authorities. Section 6 provides concluding observations.

2. Literature Review

Taken as a whole, there does not seem to be as well developed a literature on this subject as one might expect. For detailed citations of those that we have identified, see the References at the end of this paper.

One of the best known studies about staff in electricity and telecommunications regulatory bodies was written by Stern (2000). Stern analyses staffing requirements for regulatory bodies and the difficulties of obtaining staff with the appropriate skills. For a number of countries, the study shows the number of staff and the functions of national telecommunications and electricity regulators. In terms of staff composition, the study discusses the skill levels of the regulatory staff for a few countries. The study notes that in the case of telecoms regulators, "developing countries (and transition economies) typically have a larger supply of engineers but very limited supplies of experienced economists, lawyers and accountants." To alleviate the lack of sufficient regulatory staff, Stern suggests the use of consultants, the assistance of multi-national regional regulatory agencies, and the use of multi-national regulatory collaborations.

The ICT Regulation Toolkit, published jointly by the World Bank's infoDev unit and by the International Telecommunications Union (ITU), provides a few figures about the staff size and staff composition of telecommunications regulators for the years 2003-2005 (ICT Regulation Toolkit, 2005). Information about the gender composition of regulatory staff is also provided. A comparison of staff composition between the regulators of Colombia, Peru and the U.S. shows, for instance, that the percentage of economists/accountants/business employees in the U.S. FCC is notably lower than that of the Peruvian or Colombian regulators.

Thatcher has compared the behaviour of a few independent regulatory institutions in Europe. Thatcher (2007) compares the strategies followed by the French and British regulators in the licensing of 3G mobile networks in 2000, whereas Thatcher (2006) offers a discussion of the different approaches taken by regulators in Britain, France and Germany regarding the implementation of European sectoral regulation.

Finger and Voets (2003) makes a qualitative assessment of the impact of a few telecommunications regulators on the following items: market shares of incumbent, choices for the consumers, availability of services, end-user prices, quality of services, and information to the consumer.

In order to study the independence of a telecom regulator, Wu (2004) makes an international comparison of the procedure followed by several regulators to deal with other state institutions, the industry and consumers.

A few studies argue the necessity of including economic analysis in regulatory decisions. A study by the United Nations Conference on Trade and Development states that "requiring economists to be among the commissioners leading authorities or members of tribunals, may also help competition law incorporate economics" (UNCTAD, 2009). Hahn & Tetlock (2008) points out that the regulatory process could be improved with a better use of economic analysis.

In addition, a number of individual NRAs have produced useful documents, typically during periods when they were re-thinking their own structure, the recent work at the US FCC being a case in point. Several in-depth internal assessments of the creation of Ofcom from several pre-existing regulatory agencies provide a particularly rich source of information and insight.

3. Factors that influence staff size and composition

This section considers the factors that might shape the size and composition of NRA staff. It serves both to provide background, and to lay out our hypotheses.

3.1 The mission of the telecommunications regulatory authority

One might begin by saying that the mission of the telecommunications regulatory authority is to regulate telecommunications, and this is of course true; however, it is by no means the case that every national regulatory authority regulates *only* telecommunications. The German Federal Network Agency (BNetzA), for example, also regulates post, energy, and rail transport. In most cases, a cross-sectoral regulatory authority uses at least some of its staff in a cross-sectoral way, which will tend to mean that it is not able to provide a meaningful breakdown of its staff solely relevant to electronic communications. Any comparison of staff size and composition consequently needs to bear in mind that the size may not necessarily be a response solely to telecommunications regulatory requirements.

In some instances, the National Regulatory Authority also has some or all of the responsibilities of the National Competition Authority (NCA) as well. In New Zealand, for example, regulation of telecommunications is one of the many functions of the New Zealand Commerce Commission, which functions as the NCA for all sectors. Ofcom in the UK has NCA responsibilities solely for telecommunications.

Even within *ex ante* regulation of telecommunications, different NRAs have different allocations of authority and responsibility. Some NRAs have responsibility for spectrum management, while others (e.g. ARCEP, CRTC) do not. Some NRAs (e.g. the FCC) have responsibility for media regulation, while others (e.g. the BNetzA) do not.

3.2 Factors that could influence the staff size

In the abstract, one would expect the size and skill mix to be driven by the job to be accomplished. An NRA with a large job to do (however defined) should in principle need a larger professional staff than an NRA with a small job to do. As a concrete example, an NRA like the German BNetzA, which regulates not only electronic communications but also energy, post, and rail, might need a staff that in normalised terms is several times larger than an NRA that deals only with electronic communications.

The complexity of the regulatory process clearly also plays a role.

Staff size might also be driven by a significant degree by activities at the implementation and enforcement level, and especially by the amount of litigation that the NRA must engage in. This should not be solely proportionate to population. Some countries are more prone to litigation than others, as evidenced by a relatively high number of lawyers per capita (e.g. in the United States). The amount of litigation could also vary with the number of nature of competitors, and with many other factors.

NRA staff size could perhaps have more to do with the tax base available to support the NRA (i.e. big country, big NRA) than with the nature of the underlying task; however, the NRA's job in a small country would not appear, at first blush, to be proportionately less demanding than in a large one. This could perhaps be a concern in the European

Union, where small Member States are obliged to follow the same regulatory process as large ones.

One could also ask whether the level of staffing bears any relationship at all to workload. The size of the NRA might instead be a manifestation of *Parkinson's Law*. In a tongue-in-cheek essay published in the *Economist* in 1955, C. Northcote Parkinson suggested that the number of employees in a bureaucracy rose by 5-7% per year "irrespective of any variation in the amount of work (if any) to be done."[6] Staff growth in this humorous, cynical model has everything to do with the manager's desire to be promoted, and nothing at all to do with workload.

Figure 1 summarises these influences on NRA staff size.

Figure 1. Factors that influence NRA staff size.
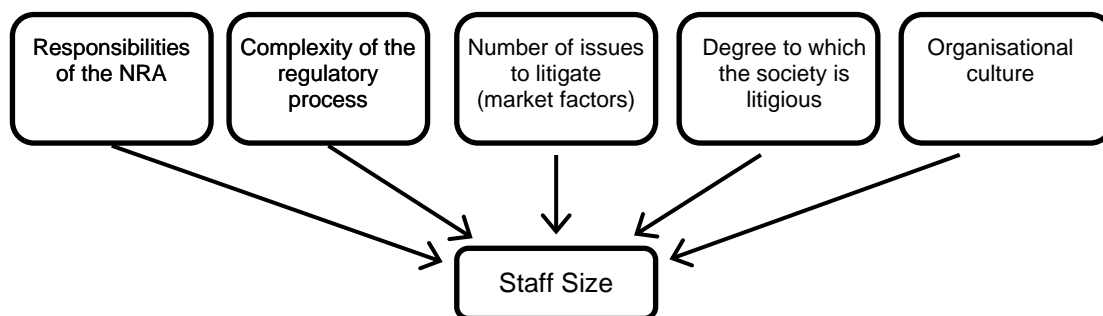
It is clear that quality will suffer if an NRA is under-staffed. It may well also be the case that quality suffers if an NRA has *too many* staff, or *too many of the wrong kind of staff*, to the extent that the effect of competent staffers is diluted. There may be too much chaff, and too little wheat.

3.3   Factors that could influence the staff composition

At the outset, we had a number of hypotheses as to how an NRA's responsibilities might influence its choice of staff composition. Some of these are supported by the data, but others are not.

First, we hypothesised that countries that operate under the European regulatory framework for electronic communications, or under systems inspired by it, would tend to need more and better economists than other countries. The European system imposes certain critical regulatory obligations only on network operators that possess *Significant Market Power (SMP)*. European NRAs must have economists who can conduct the necessary market analysis. Our results appear to support for this view.

Second, we hypothesised that NRAs that also function as National Competition Authorities (NCAs) would have a greater demand for lawyers and economists than those that do not.

Third, we hypothesised that NRAs who perform spectrum management would need more engineers than those who do not. Our results might possibly support this view – for example, we find that the United States FCC (which is responsible for spectrum management) has more than 250 engineers, while the Dutch OPTA (which is not) has only four engineers. But other factors clearly come into play as well. The French

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[6] See http://www.economist.com/business-finance/management/displaystory.cfm?story_id=14116121.

ARCEP, for example, has a high proportion of engineers even though it is not responsible for spectrum management.

It is possible that the size of the agency affects some skill sets more than others. For example, it might be that a large country requires a great deal of enforcement and litigating, but that the effect required to create regulations in the first place is to some degree independent of the size of the country. If true, this would imply that a large country needs a large number of lawyers (for enforcement, see Section 4.2), but does not necessarily need a correspondingly large number of economists or engineers.

There may also be a tendency for staff composition of professional staff to be influenced by the composition of senior or middle management. For example, senior management of the U.S. FCC contains not a single economist.[7] There may be a tendency for senior managers to hire the professionals that they know that they need, and to put less focus on skill sets that they themselves do not possess and may not fully understand.

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[7] The FCC does, to be sure, have a Chief Economist and a Chief Technologist, and occasionally brings in an outside expert to advise the Chairman. They are usually on loan from academia for one to two years. One of our authors (Marcus), who served in just such a capacity from 2001 – 2005, notes that these positions are not decisional, and had little influence on hiring or on policy in general. Under a different Chairman, they might possibly play a different role today.

4. How staff composition might influence regulatory effectiveness

In Section 3.3, we discussed factors that could influence different NRAs to choose significantly different skills mixes. In part, it can be viewed as a response to differences in organizational mission and requirements; in part, it reflects societal and cultural values; and in part, if may also reflect path dependencies. These factors are relatively straightforward. Expressing and measuring the ways in which differences in staff composition result in differences in the effectiveness of different NRAs, however, is not at all straightforward.

We have chosen the following procedure as a means of conceptualizing the likely effects of appropriate, or less appropriate, staff composition:

- Begin with a conceptual model of how regulations are created and maintained.

- Assess the staff mix necessary to support that model in general.

- Consider the failure modes that are likely to be associated with each possible instance of inappropriate staff composition.

This section of the report presents those analyses, in that sequence.

As noted in Section 1.3, we have chosen to stop short of identifying specific shortfalls in individual NRAs.

4.1 A conceptual model: How are regulations created and maintained?

The Canadian government has published a short, cogent summary of their regulatory process.[8] In this section, we present a simplified notional or conceptual version of the Canadian model, with Canada-specific details simplified and presented in a more abstract fashion.

We believe that this abstract, conceptual model corresponds reasonably well to the regulatory process in all of the countries that we are studying, and that it probably corresponds fairly well to the regulatory process in most if not all developed countries.[9] We would note, however, that the Impact Assessment phase tends to be formalized to a far greater extent within the European Union, and in countries such as Canada that follow European models, than in other regions or countries.

The key elements or phases of our simplified, abstract regulatory process, based on the Canadian model, are:

- **Planning and Analysis:** The NRA identifies a possible need for a new regulation. It then assesses the regulatory proposal to ensure that it is necessary, and that non-regulatory means or instruments are not better suited to address the

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[8] See the discussion of "Governor in Council" regulations at:
http://www.tbs-sct.gc.ca/ri-qr/processguideprocessus-eng.asp

[9] For the European Union and the EEA, this claim reflects our review of the Framework Directive (2009) and the European Commission's Impact Assessment Guidelines (2009). For the US, it reflects our review of the Communications Act of 1934 as amended, and the Administrative Procedures Act. For New Zealand and Peru, the statement reflects the authors' experience in both countries (cf. Marcus (2005); Bleisch and Marcus (2009); and Marcus, Rendon et al. (2009)).

issue identified. The NRA begins to document a description of the proposal, alternatives considered, a benefit-cost analysis, the results of any preliminary consultations with stakeholders, and any requirements for compliance and enforcement mechanisms. The NRA considers and enhances these materials internally until it tentatively determines that the regulation appears to be appropriate, and that a formal consultation with the public is warranted.

- **Drafting:** The NRA drafts the regulatory proposal as a consultation document.
- **Public consultation, revision, and enactment:** The NRA allows for public scrutiny and comment on the proposal. The NRA either addresses public comments in a revised regulation, or provides reasons why a given concern could not be addressed. If the proposed regulation still appears appropriate, it is enacted.
- **Implementation and enforcement:** Some regulations are effective only when supporting institutional arrangements are put in place. Most require the NRA to be prepared to litigate, or to take enforcement actions against firms that violate the new regulation.

The process can be viewed as depicted in Figure 2.

Figure 2. Phases of the regulatory process.
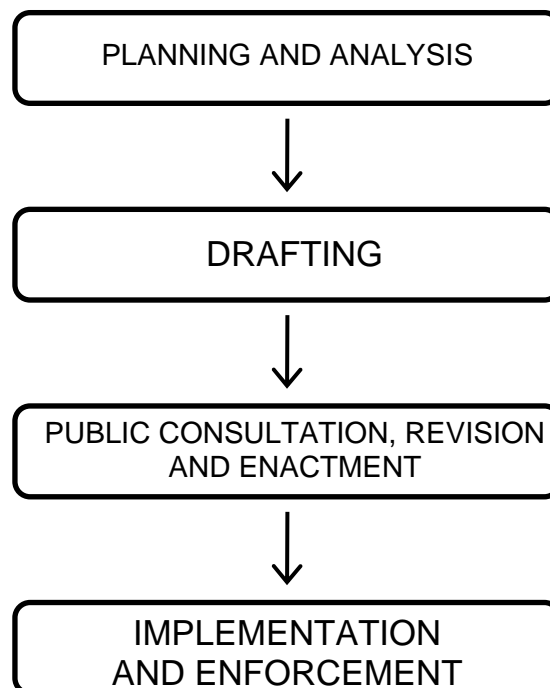
4.2 What skill sets are needed at each stage of the regulatory process?

The Planning and Analysis phase clearly calls for substantial policy analysis expertise (which does not exactly fit our lawyer/economist/technologist taxonomy), and for significant economic expertise. Impact assessment in particular is primarily an economic task. Depending on the subject matter, engineering expertise may play a significant role. Legal expertise is important as a means of assessing the likelihood that

a proposed measure is likely to be legally sustainable, and may play an important role in assessing the form that the ultimate procedure is likely to take; however, the planning stage is not in essence about law.

In the Drafting phase, law would be expected to be preeminent. Policy analysis plays a secondary role. Economics and engineering will tend to be clearly in supporting roles, in that the drafters will require input from these disciplines.

The Public Consultation, Revision and Enactment phase will tend to draw on a wide range of skills. To the extent that a measure needs to be revised in light of stakeholder feedback, policy analysts, economists and engineers will need to be involved. Imposition is again primarily the province of the lawyers.

Implementation may or may not be a significant activity, depending on the nature of the regulatory measure enacted. Many measures require systematic phase-in and implementation. The operational aspects of this phase are likely to require project management skills, and possibly engineering skills. Enforcement is largely the province of the lawyers, supported as necessary by engineers and economists. Given that information asymmetries that typically exist between regulated incumbents versus regulators, it is important the staff mix in the enforcement phase include economists who are trained to look at financial data with a critical eye.

In general, and for a typical proceeding, we would expect the phases to require very roughly the levels of involvement shown in Table 1 of economists, engineers, and lawyers, on a scale of 1 (lowest involvement) to 4 (highest involvement).

Table 1. Different skills are needed in different phases of the regulatory process.

	Economists	Engineers	Lawyers
Planning and analysis	4	2	3
Drafting	1	2	4
Public consultation, revision, and enactment	3	2	4
Implementation and enforcement	2	2	4

4.3 Caveats

We would note at the outset that our conceptual model of the various skill sets required by a telecommunications regulatory authority represents an enormous over-simplification. We have focused on three skill sets whose importance is widely recognized. At the same time, we have ignored other skill sets as a matter of convenience, typically because these skill sets do not correspond to a single well-defined academic specialization (e.g. policy analysis, or project management).

We also note that we implicitly assume that professionals have a single specialization, and that their academic training reflects this specialization. Clearly, the best experts in this field are good at many things, not all of which are reflected by their academic training alone. A lawyer may very well have a good understanding of economics, for example – indeed, for an expert in competition law, it is pretty much *de rigueur* to have a solid grounding in relevant the principles of economics.

Moreover, we have not attempted to address differences in the quality of experts. A crackerjack lawyer might understand economics much better than a mediocre economist.

Nonetheless, we think that training of professional staff predisposes them to look at certain issues in certain ways. A typical lawyer may understand economics, but will not

necessarily have a solid grasp, and will not necessarily understand economics at the level of a trained economist. Moreover, we hypothesize that an expert's training predisposes him or her to look at issues through the window of a particular world view.

4.4 What failure modes are likely if the staff mix is inappropriate?

What failure modes might one reasonably expect if the staff mix is inappropriate?

Likely failure modes include: (1) too few people overall; (2) too many people overall; (3) too few lawyers; (4) too few engineers; and (5) too few economists.

Too few people overall would presumably result in substantial delays in creating new regulations, and possibly in regulations of poor quality. It might results in difficulties in legally sustaining regulation, and in an NRA that cannot hold its own in defending regulations against industry. It could also result in any or all of the failure modes associated with having too few lawyers, engineers or economists.

A regulatory staff that is large, but of insufficient quality, could potentially produce similar failure modes.

What about a regulatory staff that is *too large*? The consequences are not as obvious *a priori*. The effects of competent staffers might tend to be diluted – if there is a lot of chaff, the value of the wheat may be harder to spot. There is presumably some optimal size for the NRA, as a function of the NRA's mission. Relative to the speed with which the NRA can produce regulations, and the quality of regulations produced, there is likely a "saddle point", a level of staffing that is optimal. An NRA that has too many employees might very well take longer to produce regulations (due to the complexity and inefficiency of internal interactions), and might produce regulations of lower quality for similar reasons.

An NRA that has too few lawyers is likely to experience delays and/or quality problems in drafting regulations. It might experience difficulties in carrying out the public consultation process. It is likely to have difficulties enforcing regulations, and might be more prone to being reversed by the courts.

The failure modes associated with too few engineers are less clear. An NRA with too few engineers might experience difficulties in imposing or implementing regulations. For technologically involved regulations – typically involving areas such as Internet, or spectrum management – an NRA with engineering deficiencies might have a tendency to implement regulations that are inappropriate for technological reasons, or to have difficulties with enforcement due to gaps in their technical understanding.

A lack of economists is likely to lead to problems with planning and with impact assessment. Regulations that fail to improve societal welfare, or whose costs exceed their benefits, might nonetheless be introduced. These failure modes are closely related to those that might flow from having insufficient policy analysis capability. The lack of economists can also cause problems in implementation and enforcement – commercial parties generally know their costs and revenues far better than the regulator, i.e. there tends to be an information asymmetry. In the absence of skilled economists, the NRA may be willing to accept questionable economic interpretations.

5. Country-specific analysis

This section provides the quantitative results of our survey work. Section 5.1 summarises overall indicators of staff size and composition. Section 5.2 reviews the scope of NRA responsibilities, which vary significantly across the NRAs who responded. Section 5.3 discusses staff size and composition in relation to other societal indicators. Section 5.4 provides a useful way to visualise the balance of skills within an NRA.

5.1   Overall breakdown of staff skills

First, we note that the breakdown of staff into senior management, middle management, professional staff and administrative is, perhaps not surprisingly, quite diverse from one NRA to the next, as shown in Figure 3. Senior management generally constitutes 10% or less of NRA staff. Administrative are in most cases between 10% and 30% of staff. Some countries had difficulty distinguishing between middle management and professional staff, and therefore do not appear in the figure.
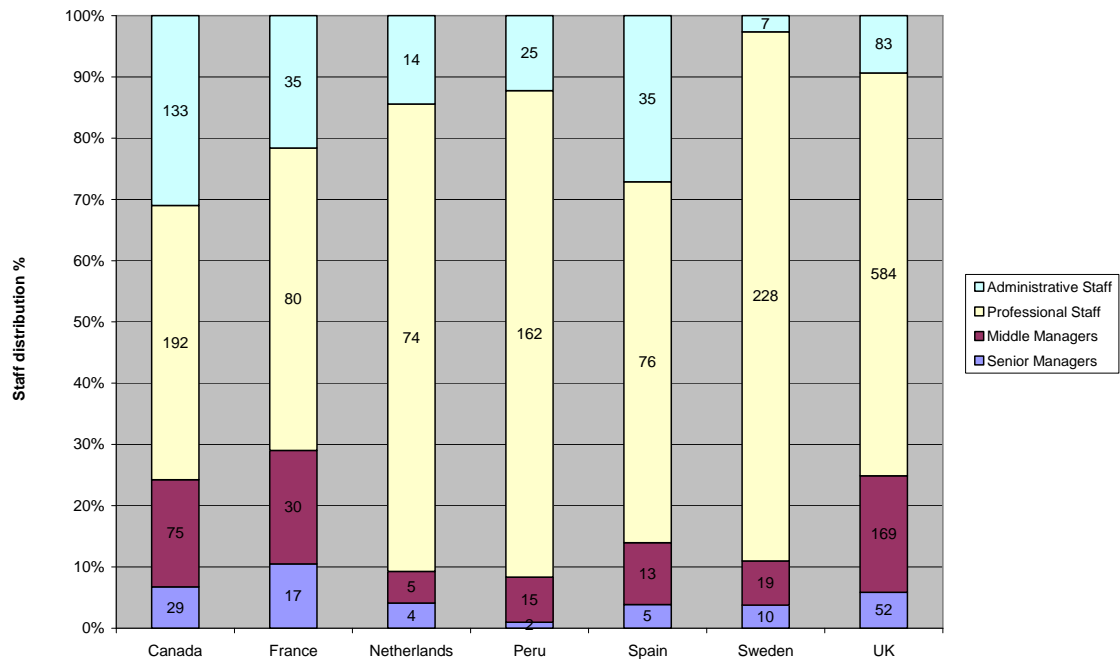
Figure 3. Staff distribution

Figure 4 depicts the distribution of professional staff among lawyers, economists, engineers, and other. The UK and Canada classified a very high number of professionals as "other". For that reason, Figure 5, which provides only the breakdown among lawyers, economists and engineers, is possible more useful, even if it depicts only a small fraction of the professional staff for the UK and Canada.

In these charts, the difference between Europe and North America is striking. The European countries have 20 to 43% lawyers, while the U.S. has 63%. The European countries have 20 to 51% economists, while the U.S. has 6%. Canada, to the extent that one can trust the data, appears to follow the US pattern, while Peru generally follows the European trend. It is also worth noting that France has far more engineers than lawyers.

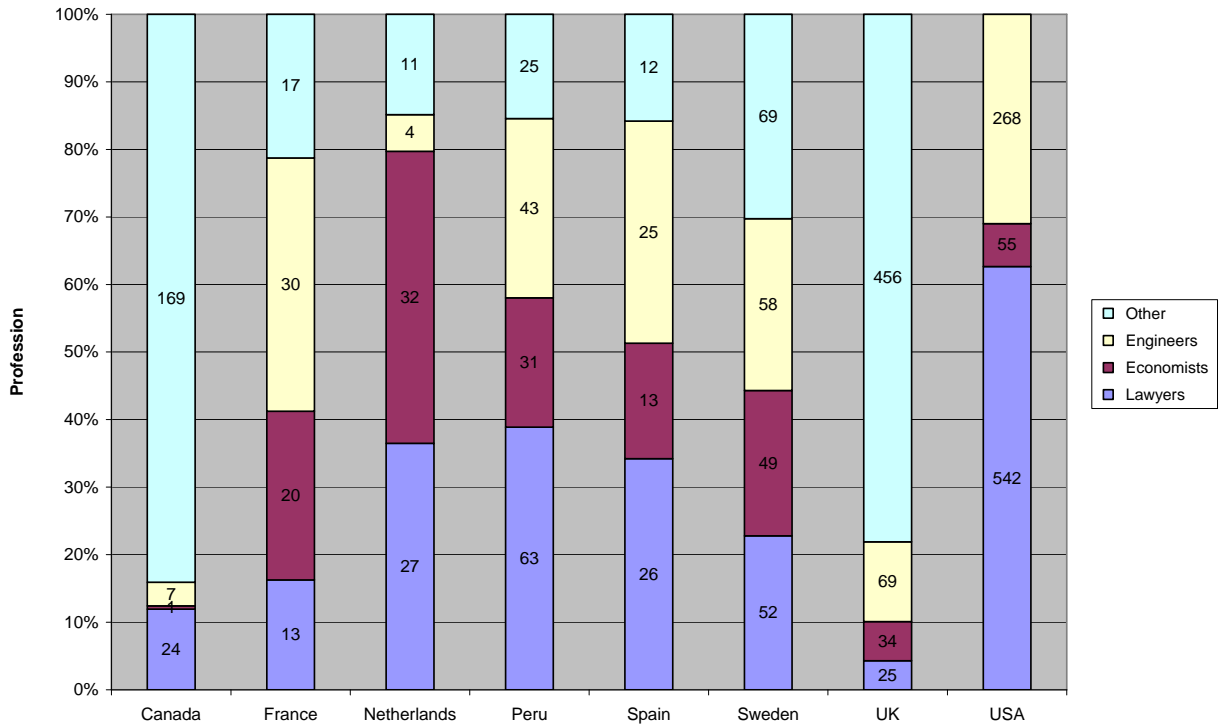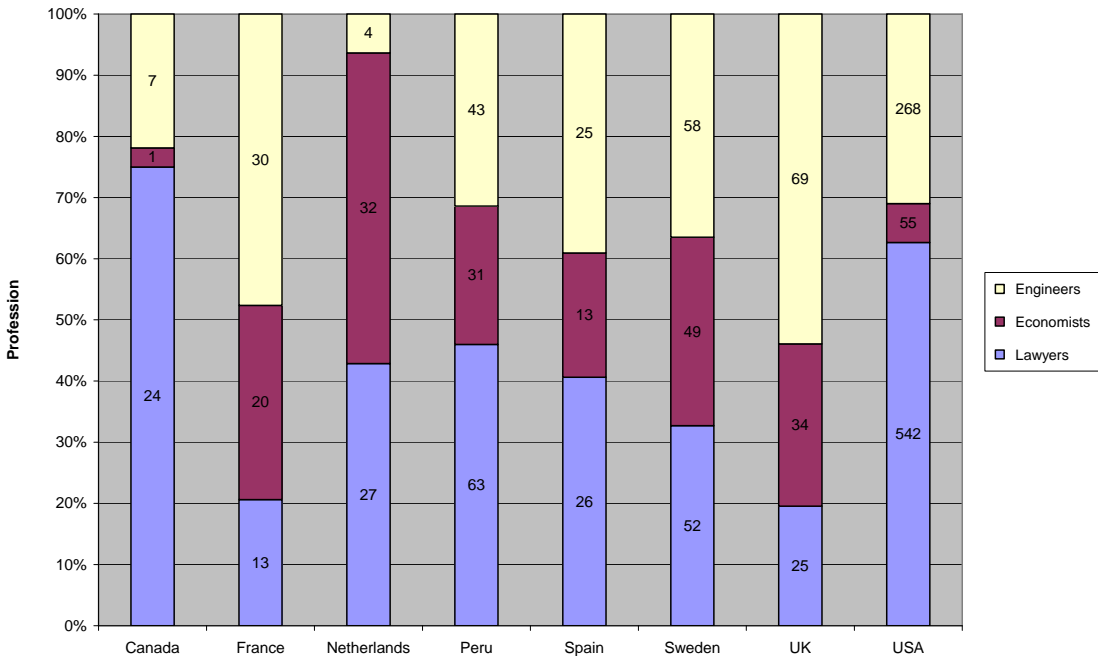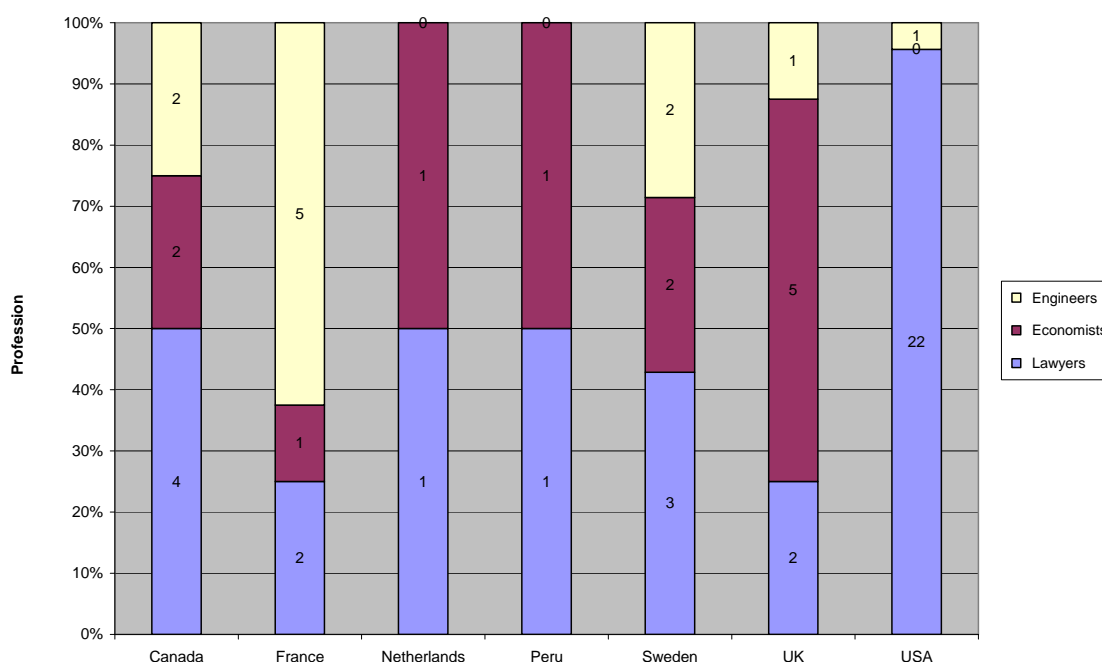**Figure 4. Distribution of professions among professional staff**

Figure 5. Distribution of professions among professional staff (no "other").

Considering the breakdown of professions solely for the senior managers, as shown in Figure 6, we find a particularly striking result.

Figure 6. Distribution of professions among senior managers (no "other").

Many countries maintain roughly the same balance between lawyers, economists, and engineers at senior management level as at the level of professional staff. This is also true of France, where the engineers are again pre-eminent. What is particularly striking is that the U.S. FCC's senior management team contains only one engineer (presumably the head of the Office of Engineering Technology), and not a single economist![10]

5.2   Agency Functions

Table 2 provides a summary of the information provided by the agencies in regard to their respective functions. It serves largely to confirm our expectation that the scope of work performed varies significantly from one NRA to another. This implies that one cannot directly compare the sizes or compositions or their respective staff without considering these differences.

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[10] In our FOIA request to the FCC, we did not identify the Chief Technologist or the Chief Economist as senior management (appropriately, in our view). Had we included them, it would have added only one economist and one engineer to 23 other professionals, and thus would not have changed the percentages very much.

**Table 2. Functions of National Telecommunications Regulatory Bodies.**

	1. Apart from the telecommunications services, does the agency deal with the regulation of other utility services (such as energy, postal, rail)?	2. Does the agency function as a National Competition Authority (NCA)	3. Does the agency function as a National Spectrum Management Authority (SMA)?	4. Does the agency have rules that provide access to bottleneck facilities (e.g. last mile access)?	5. Does the agency perform licensing / authorisation of network operators and/or telecommunications service providers, or does some other agency deal with that?	6. Is the agency responsible for universal service?	7. Does the agency directly provide consumer protection in regard to telecommunication services?
Canada	no	no	no	yes	yes	yes	yes
France	yes, postal service	no	yes	-	yes	-	-
Germany	yes, electricity, gas, postal and rail markets	no	yes	yes	yes, but this is only a registration process	yes	yes
Netherlands	yes, postal service	no	no	yes	Yes, but this is only a registration process	yes	yes
Peru	no	yes	no	yes	no	no	yes
Sweden	yes, postal service	no	yes	yes	yes	yes	no
UK	no	yes	yes	yes	yes	yes	yes

5.3   *Other societal indicators*

We considered overall NRA staff size in relationship to several indicators, but none seemed to reliably predict staff size.

If one were to somehow correct for the different missions of different NRAs, one might expect population to be a good predictor of overall staff size. In this case, staff served per NRA employee should be roughly constant. In fact, we find disparities on the order of 10:1, as shown in Figure 7. Differences in mission surely play a role (for example, in the apparently low ratio of population to NRA staff size for the German BNetzA, which is probably fully explained by the fact that the agency regulates multiple sectors). Even so, the overall spread of the population per NRA employee numbers is large, and is probably not fully explained by national population or by GDP (both of which correlate with the size of the tax base in the country in question).

Figure 7. Population per employee

Population per employee
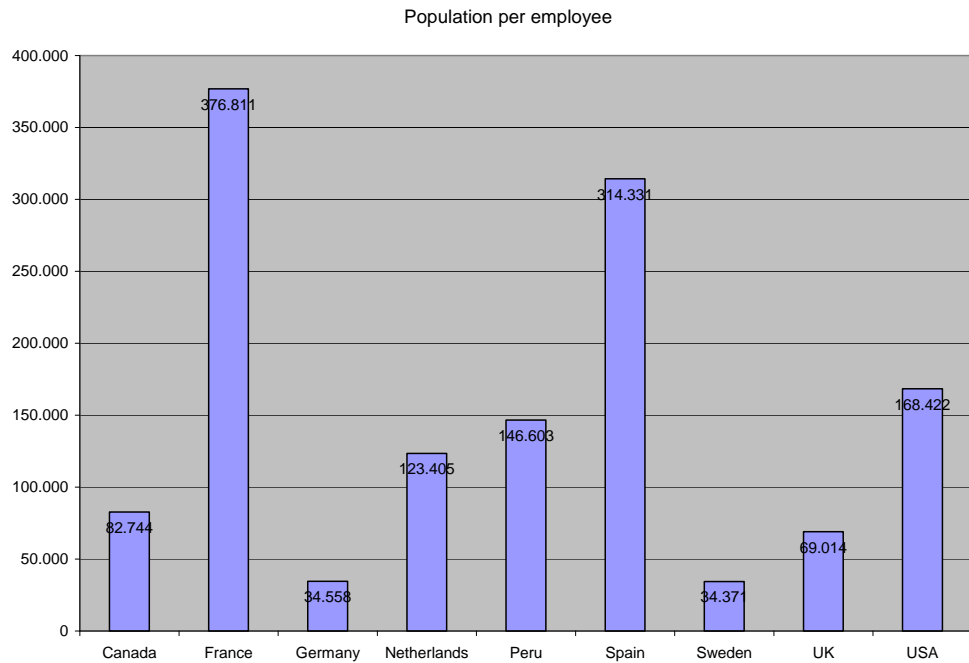
We obtained rough estimates of the number of inhabitants per lawyer from various publicly available sources. This turns out to be an useful and interesting predictor of staff composition, as can be seen in Figure 8. The United States, where lawyers predominate in the composition of the FCC, also has a very low number of inhabitants per lawyer (i.e., a high number for its inverse, a lot of lawyers per capita). Many of the European countries, where the number of inhabitants per lawyer is fairly constant, are also fairly constant in the fraction of their respective professional staffs that lawyers comprise. France, however, which as we have seen has a relatively low number of lawyers, also has a relatively high number of inhabitants per lawyer.

This relationship is probably rational. A low number of inhabitants per lawyer is probably indicative of a litigious society, which is possibly a concern for the society as a whole. For the NRA, if it implies a high risk of litigation, then it is rational to have a richer mix of lawyers on staff.

Figure 8. Inhabitants per lawyer in the country
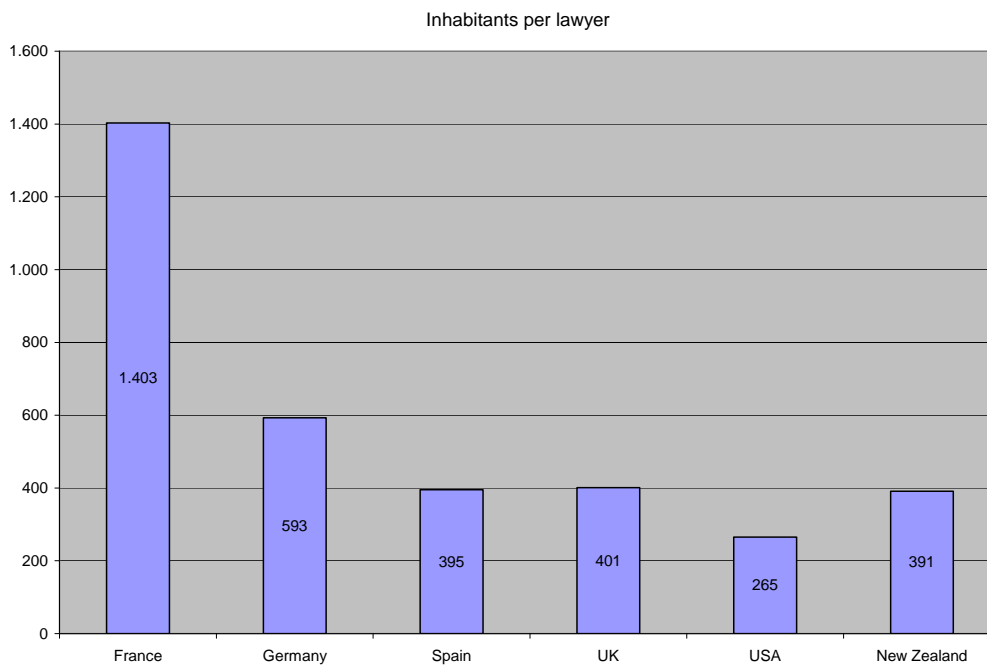
Inhabitants per lawyer

Figure 9 and Figure 10 depict the number of fixed and mobile lines, and the number of broadband subscriptions, per 1,000 employees. Again, if these were a reliable linear predictor of overall staff size, one would expect these numbers to be somewhat constant. We see nothing in the data to suggest that this is the case.

Figure 9. Number of fixed and mobile lines per 1000 employees

Number of fixed and mobile lines per 1000 employees

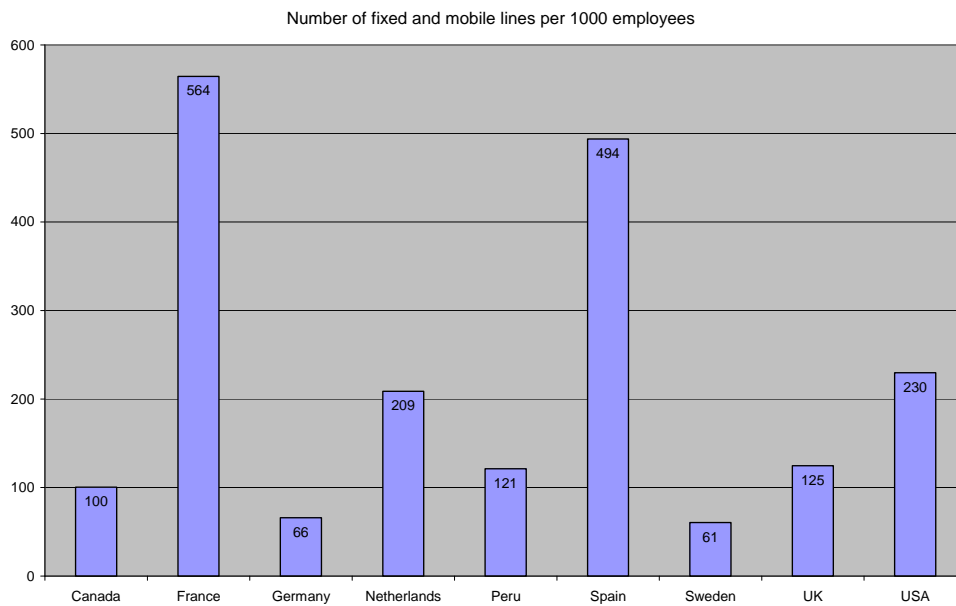**Figure 10. Number of fixed broadband Internet subscriptions per 1000 employees**
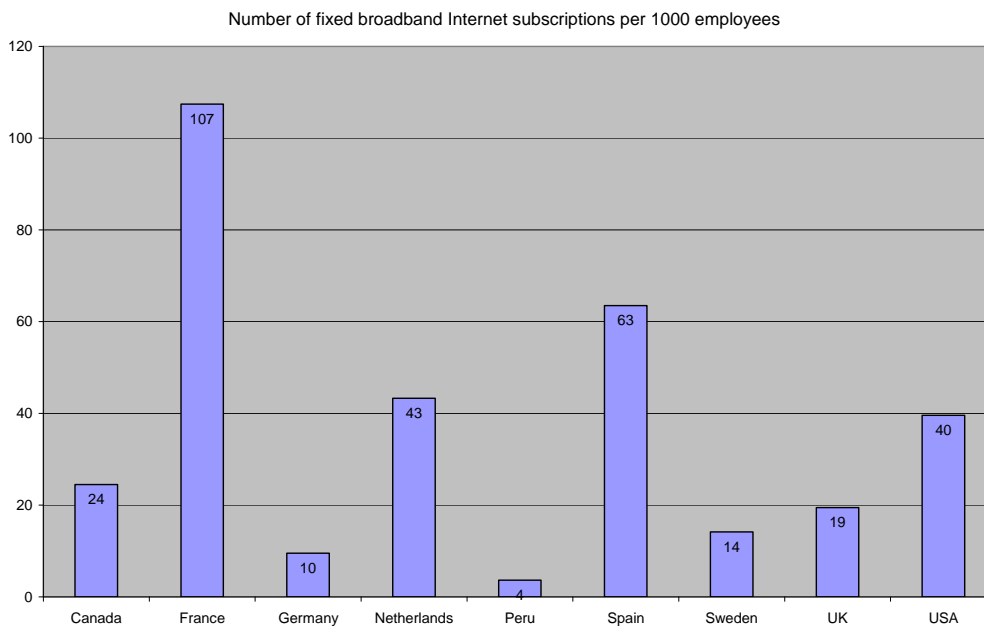

Number of fixed broadband Internet subscriptions per 1000 employees

5.4   Visualising the staff composition mix

If one were to assume, as we do, that a balance is needed between lawyers, engineers and economists, then it is natural to explore ways to graphically depict balance, and to identify lack of balance.

We think that radar graphs, as depicted in Figure 11 and Figure 12, could be a useful tool for visualisation. The balance that is common in many European countries will appear as a triangle that is nearly equilateral. The tendency of some countries to have disproportionately many lawyers or engineers is immediately visible.

Figure 11. Staff composition in the category professional staff, excluding "others".
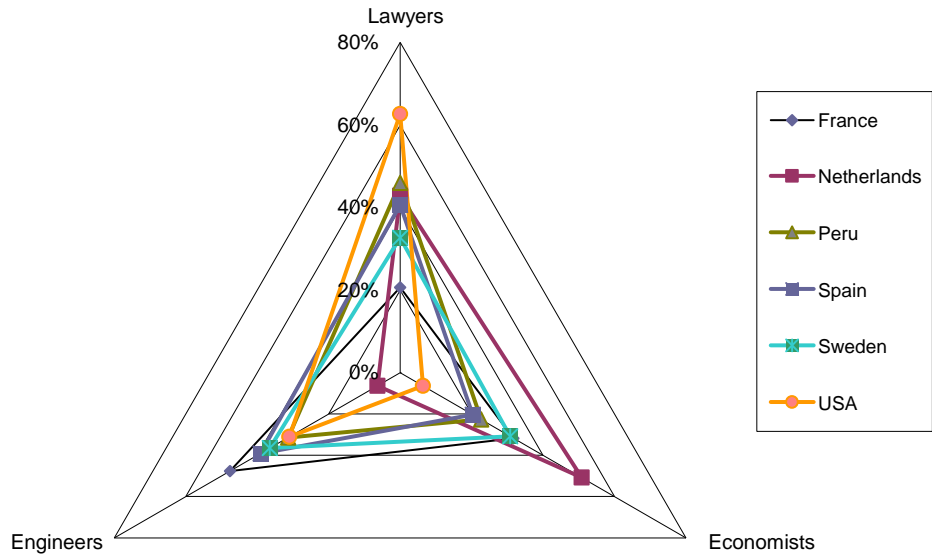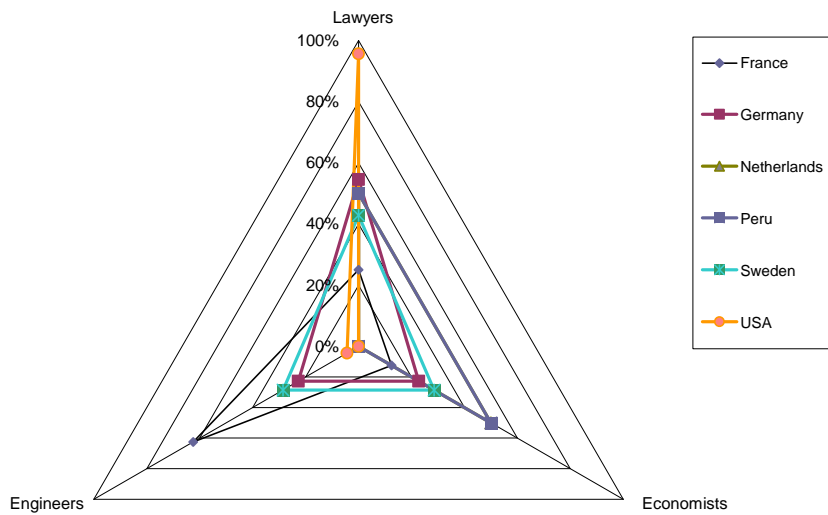

Figure 12. Staff composition in the category senior manager, excluding "others".

6. Observations and conclusions

In the course of collecting information from multiple NRAs about the size and composition of their respective staffs, we found some results that were surprising, but many others that could have been anticipated. These results should be viewed as indicative or suggestive rather than definitive, inasmuch as it was impractical in the course of this small, unfunded study to fully standardise the definition of terms in order to achieve fully cross-comparable data.

- The roles and missions of telecommunications NRAs are highly varied. Some have substantially greater scope than others.

- The "proper" size of a particular NRA is influenced by many factors, including the mission of the NRA, the size and complexity of the markets that it regulates, the tax base of the country that it serves, and the number of cases that it has to defend in court. We have not identified a reliable relationship of NRA size to any of the obvious indicators.

- The mix of economists, engineers and lawyers can vary greatly from one NRA to another.

- Countries that have a high ratio of lawyers to inhabitants tend to have a relatively high fraction of lawyers relative to economists and engineers in their NRA staff mix, and vice versa. This is particularly true of the United States (many lawyers) and of France (many engineers, not so many lawyers). To the extent that the high ratio of lawyers to inhabitants implies high litigation risk for the NRA, this choice might possibly be rational, at least to a point.

- In many European countries, about a third of staff falls into each of these categories. France has somewhat more engineers than its neighbours, the Netherlands significantly fewer.

- The U.S. FCC has itself already acknowledged a need for more economists and engineers, but the details were striking. The professional 63% lawyers, 31% engineers, and just 6% economists. This probably represents far fewer economists than would be appropriate for a country as large and complex as the United States.

- Particularly striking was the skills distribution among senior managers in the United States, where of 23 senior managers who were categorised for this study, 22 were lawyers, only one was an engineer, and none were economists.

In considering the likely effects of staff inadequacy or imbalance, we found it helpful to start with a notional model of the (telecoms) regulatory process, which we derived from a helpful description provided by the Canadian government.

Likely failure modes include: (1) too few people overall; (2) too many people overall; (3) too few lawyers; (4) too few engineers; and (5) too few economists.

Based solely on our thought model, not on empirical study, we consider the following to be likely:

- **Too few people overall** would presumably result in substantial delays in creating new regulations, and possibly in regulations of poor quality. It might results in difficulties in legally sustaining regulation, and in an NRA that cannot hold its own in defending regulations against industry. It could also result in any

or all of the failure modes associated with having too few lawyers, engineers or economists. A regulatory staff that is large, but of insufficient quality, could potentially produce similar failure modes.

- **Too many people overall** might lead to dilution of the effect of competent staffers. An NRA that has too many employees might consequently take longer to produce regulations (due to the complexity and inefficiency of internal interactions), and might produce regulations of lower quality for similar reasons.

- An NRA that has **too few lawyers** is likely to experience delays and/or quality problems in drafting regulations. It might experience difficulties in carrying out the public consultation process. It is likely to have difficulties enforcing regulations, and might be more prone to being reversed by the courts.

- An NRA with **too few engineers** might experience difficulties in imposing or implementing regulations. For technologically involved regulations – typically involving areas such as Internet, or spectrum management – an NRA with engineering deficiencies might have a tendency to implement regulations that are inappropriate for technological reasons, or to have difficulties with enforcement due to gaps in their technical understanding.

- Having **too few economists** is likely to lead to problems with planning and with impact assessment. Ill-considered regulations that fail to improve societal welfare, or whose costs exceed their benefits, might be introduced. The lack of economists could also cause problems in implementation and enforcement – in the absence of skilled economists, the NRA may be willing to accept questionable economic interpretations from commercial parties.

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