Governing innovation: asset specificity, opportunism and the fundamental transformation

Darcy Allen
School of Economics, Finance and Marketing, RMIT University, Melbourne, Australia.
darcy.allen@rmit.edu.au

Abstract. This paper proposes a new approach to innovation economics based on Williamson’s (1985) operationalization of transaction cost economics in terms of uncertainty, asset specificity and opportunism. Our contract-theoretic approach seeks to redefine the innovation problem as one of economic organization rather than its classical formulation as a choice-theoretic problem of market failure. By focusing on the very early stages of the innovation process, prior to the formation of firms and markets, we show how nonstandard forms of contracting—such as multilateral relational contracts and cooperation in the commons—can be understood as efficient governance mechanisms to deal with the hazards of opportunism induced by individual investment in idiosyncratic assets under conditions of extreme uncertainty with group pooling of the results of discovery. Such a contract approach emphasizes the role of private ordering rather than government ordering in resolving the innovation problem. We further show that the discovery of a market opportunity is analogous to Williamson’s ‘fundamental transformation’, implying distinct forms of governance ex ante and ex post market opportunity.

Keywords: transactions costs, innovation, governance, asset specificity, opportunism.

JEL: D02, D23, D71, D80, L24, O31, O38
1 The true cost of innovation

Innovation, as Joseph Schumpeter (1942) explained, is the essential fact about capitalism. Innovation is the mechanism by which entrepreneurial firms compete in markets and the engine that drives economic growth and development. But innovation is also itself an economic activity. The innovation process involves using, coordinating and exchanging resources. It is important, then, to inquire into the nature of innovation economizing and organisation, which is the fundamental task of this paper.

Together, Nelson (1959) and Arrow (1962) gave us the modern view of innovation as an economic problem by formulating it as a public goods investment problem. The economics of innovation, they explained, are of the ‘competitive production’ of new information of ‘uncertain value’ that is ‘easily appropriated’. From a social welfare perspective this predicts suboptimal private investment in discovering new ideas (Romano 1989) – a market failure deep in the engine of market capitalism.

Government interventions were thus rationalised, proposed and applied to restore a socially efficient level of investment in innovation. These applications form the institutions of innovation policy which all intervene by variously: strengthening intellectual property rights; funding direct or indirect subsidies to private firms; designing systems of innovation institutions; and through direct public provision (Nelson 1993, Jones and Williams 1998, Martin and Scott 2000). Innovation policies all seek (either directly or otherwise) to re-supply the ‘missing innovation’ through the creation of monopoly rents, transfers, or public supply, in effect meeting these costs. But a different approach to innovation economics can be constructed by focusing precisely on the nature of such re-supplied costs.

By taking a contract-theoretic rather than choice-theoretic approach (Buchanan 1975) we can distinguish between two different sorts of innovation costs: production costs—what the entire market failure investment problem focuses on—and transaction costs—that have not hitherto been a key to innovation economics (cf. Teece 1986, 1996), despite being foundational to new institutional economics (North 1990; Williamson 1985, 2000). Moving analytic focus of the innovation problem to the transactions costs of innovation shifts the space of solutions. Choice-theoretic solutions arise from government, while contract-theoretic opens up to governance (Williamson 1979, 2002). We have thus moved from public ordering solutions to the innovation problem, to private ordering solutions.¹

This is a new approach to innovation economics—a ‘new innovation economics’ if you will—builds on a transaction-centred and thus contract-centred view of innovation. In the new innovation economics economic activities organized about innovation processes are so as to economise on transaction costs. This ‘transaction-centered’ view of innovation may at first seem oblique because it

¹ Following Williamson (2005:2), we view governance as “predominantly concerned with ongoing contractual relations in which continuity of the relationship is a source of value.”
contrasts with the more familiar ‘technology-centered’ or ‘production function-centered’ view (e.g. Romer 1990). But in the transaction-centered view innovation requires organisation. And that organisation does not come for free. Economic organisation has costs associated with contracting, especially relating to uncertainty. In the technology-centered view, however, the only costs are resource or factors of production costs. In equation [1] below, this approach assumes the transaction cost component equals zero.

\[
\text{Innovation costs} = \text{production costs} + \text{transaction costs} \quad [1]
\]

In ‘new innovation economics’ we assume that the transaction cost component is significantly non-zero – but which may be reduced through governance apparatus’. To approach this governance problem we apply and modify Williamson’s (1985) conception of the economic institutions of capitalism. Thus the contributions of this paper are threefold. First, we conceptually explore the movement from innovation autarky to innovation contracting – garnering the need for economic organisation. Secondly the ‘discriminating alignment hypothesis’ is applied—by dimensionalising both the ‘transaction costs’ and ‘governance modes’ of innovation transactions—to ex ante and ex post entrepreneurial discovery of market opportunities. Finally, we argue the ‘innovation commons’ (Allen and Potts 2015) are an economic organization that economises on the specific ex ante market opportunity transaction costs. The innovation commons economises on transactions costs in the early stages of a new technology when entrepreneurs face radical uncertainty over the nature and value of a market opportunity, yet faces a fundamental transformation (and thus collapses) when a market opportunity is revealed.²

2 Governing innovation from ‘autarky’ to ‘contract’

Oliver Williamson (1985: 11) once explained that “any issue that can be formulated as a contracting problem can be investigated to advantage in transactions cost economizing terms.” We make use of this motif by investigating the contractual origins and source of the ‘innovation problem’ – defined as the entrepreneurial discovery of market opportunities through the coordination of Hayekian knowledge. But our new contract approach must first be differentiated from more standard approaches to the innovation problem. To do so we differentiate ‘innovation autarky’—characterised by a producing function model of the firm and a focus on market failure and monopoly—from our new approach of ‘innovation contracting’—which is concerned with transaction cost economics, asset specificity, opportunism and the contracting under uncertainty.

Figure 1 below distinguishes between a ‘science of choice’ approach to the innovation problem (innovation autarky), as a theory of innovation in markets with firms as black-box production functions for new knowledge, and a ‘science of contract’ approach (innovation contracting), which focuses on innovation as a governance problem in contractually combining specialized resources to create new knowledge (see Williamson 1985: 24; 2002: 173). This section precedes our analysis of ‘innovation in groups’—a much more interesting governance problem—which begins in section 3.

Much work in economic growth theory uses a production function based model of the firm (e.g. Lucas 1986, Romer 1990). The transaction cost based model of the firm, however, is used to analyse the economic organization of R&D activity in consequence of what would otherwise appear to be an anomaly of widespread vertical (and increasingly horizontal) integration (Richardson 1972, Globerman 1980, Nelson and Winter 2009, Teece 1986, Pisano 1991). Schumpeterian economics examines why Research and Development (R&D) tends to be vertically integrated inside the boundaries of the innovating firm in terms of dynamic transaction costs (Langlois and Robertson 1995) and dynamic capabilities (Teece et al 1997, Langlois and Foss 1999, Winter 2003). The mechanism design and information economics based literature examines behavioural constraints and institutional failures in the market for ideas (Gans and Stern 2010). Transaction cost based analysis of horizontal and vertical research joint ventures, and of relational contracting models of R&D, have developed into network governance models of so-called open innovation (Chesbrough 2003, Dahlander and Gann 2010) and user innovation (von Hippel 2003). The property rights approaches (Hart and Moore 1990) have sought to analyse R&D in an incomplete contracts framework (Aghion and Tirole 1994).

But all of these approaches tend to axiomatically begin with the innovating firm in a competitive market and then, summoning a shallow transaction cost economics logic, ask what other forms of
institutional and organizational governance might be more efficient—such as vertical integration or innovation networks. We propose an alternative perspective that begins prior to the innovating firm: innovation autarky. This state of high uncertainty is what George Shackle (1972, 1983) called ‘unknowledge’ pertains before an entrepreneurial opportunity has crystalized. ‘Knightean uncertainty’ requiring entrepreneurial judgment is a constraint to entrepreneurial action (Knight 1921, Foss and Klein 2012). In this original position of innovation autarky a technological and entrepreneurial prospect exists within the mind of a single individual, but as yet no contractual or organizational form extends from that individual. The individual holds a new idea, but the idea is a long way from a well-defined economic opportunity, or yet an innovating firm. Innovation autarky thus begins with the absence of organization yet retains the potential for it (Potts et al 2015b). The question is then one of economising.

One of the more enduring of the popular romanticisms in modern science is the idea that the lone genius is the prime mover of history, culture, society, and, as with Joseph Schumpeter’s innovating entrepreneur, the economy. With the creativity powered innovation engines spinning freely in the market, the only real question concerns which way they point and how throttled they are. A ‘competitive innovating firm’ is an isomorphism of lone genius. The lone genius chooses a level of effort while the innovating firm chooses a level of investment that will be conditioned by the incentives they face.

Modern innovation economics has operationalized this approach by finding the limits to innovation in the market incentives that constrain or displace these otherwise perfect engines (Romano 1989, Baumol 1996). This, as we will explain below, is the market failure paradigm of innovation economics in which the private choices of competitive firms always fall short of the socially optimal level of innovation investment. Such a market failure theory seeks to remediate through a raft of interventions collectively known as innovation policy in which resources are redirected by government to where the market failed to put them.

But this ‘choice-theoretic market failure investment problem’ is not the only way of formulating the innovation problem. Innovation may equally be formulated as problem of economic organization—the ‘lens of contract’ rather than the ‘lens of choice’ (Buchanan 1975, Williamson 1990). In the contracting approach, the economic problem of innovation arises because autarky (i.e. the lone genius) is usually a very poor organizational solution to any economic problem, including the production of new ideas. Effective innovation requires organizing with others to form groups—communities, clubs, teams, departments, firms, networks, clusters, commons, and so on—in order to exploit specialization in the entrepreneurial discovery process. New ideas require bringing other ideas together and testing them under diverse conditions—a process rarely best done alone. The innovation process (and thus ‘innovation problem’), we propose, requires organization under an appropriate
governance structure so as to access and coordinate dispersed knowledge. Thus from the contract perspective, the ‘innovation problem’ is first and foremost a problem of economic organization under uncertainty.

A major conceptual implication of this new innovation economics is redefining the innovation problem in terms of markets versus organizations and governance. Innovation is no longer a pure allocation problem of choosing an optimal level of investment. The root economic problem in innovation is now whether to proceed alone to produce a new idea, and then to take that to market (Katz and Shapiro 1985, Gans and Stern 2003), or whether to organize with one or several others to develop the new idea into an opportunity.

In this section we have outlined two paths to the governance of innovation. The first path, *innovation autarky*, black-boxes the innovating agent as a production function for new ideas, ignoring organizational and governance considerations. The *innovation autarky* path is choice-theoretic, emphasizing that no meaningful trade or exchange occurs at the level of innovation production. The value of the innovation is either embodied as a new technology or a commodity, or is exchanged once property rights are attached to the idea. Endogenous growth theory and neo-Schumpeterian economics proceeds along the market line. Consistent with this approach, the innovation policy recommendations are all within the market-failure and monopoly (imperfect competition) paradigm.

The second path, *innovation contracting*, recognizes that the production of innovation involves the organization and governance of specialized resources, capabilities and information. This governance line has mostly been developed in organizational theory-based approaches to innovation. Organization can refer to a range of contractual forms: it may be a loose and informal peer group (Williamson 1975: ch 3); a user community (von Hippel 1986); an innovation commons (Allen and Potts 2015); an open innovation network (Chesbrough 2003); or more classically a start-up firm, or a spin-out from an existing firm (Anton and Yao 1995, Shane 2001). The actual form that the organizational governance of innovation takes will depend upon the microstructure of transactions costs.

While the output of both the ‘science of choice’ and the ‘science of contract’ approaches are the same—new knowledge, or innovation—the former ‘choice’ approach focuses on *production costs*, while the latter ‘contract’ approach focuses on *transactions costs*. Thus our new approach to the innovation problem—the governance of innovation—follows the New Institutional approach developed by Williamson (1975, 1979, 1981, 1985) that operationalized Coase’s (1937, 1960) transactions costs in terms of uncertainty, asset specificity and opportunism. We modify these constructs to the particular contractual context of innovation by explaining how transactions costs are a much neglected dimension of the total costs of innovation (i.e. the production of discovery) that
arise from the need for groups of people to make highly idiosyncratic investments that generate quasi-rents only if others in the group make complementary investments. This exposes all parties to opportunism hazards. However, given the high levels of uncertainty affecting ex ante contracting and difficulty of using formal legal institutions, “private ordering efforts by the parties to re-align incentives and embed transactions in more protective governance structures have the purpose and effect of mitigating the contractual problems that would otherwise arise” (Williamson 2002: 438).

3 Innovating in groups

Innovation is the process by which valuable new ideas—whether technologies, products or processes—are originated and subsequently adopted into the economy. The standard innovation economic problem centres about the fixed (sunk) costs of creating each new idea—classically, these are the R&D expenditures that are irrecoverable in a perfectly competitive market (P=MC<AC, because FC>0).1 Defining innovation in this way consistently diagnoses market failure in the production of new ideas, revealing a perpetual problem of insufficient private investment—here the solution is to create exploitable monopoly power.

Instead, consider innovation from the Coasian perspective of contract (Coase 1937, Buchanan 1975) and governance (Williamson 1985) as a problem of economizing on transaction costs.2 This shows a somewhat different view of the economic problem underlying the production and consumption of new ideas. Innovation remains fundamentally an investment problem, but not that of incentivizing an optimal level of investment. Innovation now involves the problem of escaping the limitations of innovation autarky so as to exploit such benefits of exchange and specialization. But these exchanges, we will show, face various hazards, opening the possibility of different forms of institutional governance.

The basic economic innovation economic problem is now that innovation requires multilateral or bilateral investment in transaction-specific assets with uncertain value. The realization of this value is contingent on co-investment by others, and thus exposed to the hazards of opportunism (Williamson 1985).3 We now have a consistent representation of the innovation problem as a contracting and governance problem (rather than a market failure problem). Solutions to the innovation problem thus

---

1 A different approach is the ‘learning by doing’ literature (Arrow 1962b) that attributes productivity gains to cumulative experience, rather than up-front investment.
2 Economizing can refer to two distinct operations: economizing on production costs and on transactions costs. Standard market failure models of innovation economics focus entirely on production costs, where economizing is evaluated from a societal allocation perspective. But the New Institutional Economics approach to innovation advanced here focuses on economizing on transactions costs. Here economizing is the private ordering selection of efficient governance mechanisms.
3 However, as we will explain, this innovation process undergoes a ‘fundamental transformation’ ex ante and ex post market opportunity.
involve crafting effective institutional governance mechanisms to induce mutual investment and subsequent cooperation to realize value.

3.1 The problem of contract: bounded rationality, opportunism and asset specificity

In a world of certainty, contracts face few contractual hazards. Governing ‘certain’ transactions is relatively uninteresting because almost any governance structure will do (Williamson 1979: 253). But as we move away from blackboard economics—largely by adopting nontrivial uncertainty—contractual difficulties grow. Uncertainty is a fundamental problem because exchanging parties must \textit{ex ante} determine the impact of \textit{ex post} uncertain events. That is, both the parties and their contractual arrangement must be adaptable. We will return to the idea of uncertainty later – for the real problem of uncertainty arises only in combination with opportunism and asset specificity. What is important for our purposes is to assume a nontrivial level of uncertainty that necessitates adaptation to changing events, which requires the coordination of knowledge (Hayek 1945).

Thus even assuming a nontrivial level of uncertainty, perfectly rational individuals could write contracts outlining the entire ‘decision tree’ of contract outcomes. A full list of possible contingencies could be agreed upon in advance, surprising or unexpected changes would never arise, and thus contracting would largely become a non-issue. But of course writing such complicated contracts requires an extraordinary computational capacity. \textit{Homo sapiens}, however, do not possess such cognitive powers – we are “intendedly rational, but only limitedly so” (Simon 1957: xxiv).\footnote{Note that while ‘limited rationality’ describes cognitive capacities—that we cannot possibly know \textit{ex ante} the all future changes in the world—it is the other element of ‘intention’ which encourages the study of institutions to economise on these shortcomings.}

Incomplete contracts arise.\footnote{Specifically, bounded rationality is a semi-strong form of rationality between the strong form neoclassical ‘maximisation’ and weak evolutionary ‘organic rationality’}. But individuals could still theoretically trust and rely on their trading partners to fairly deal with any unexpected problems. Contractual difficulties would vanish as “gaps in long-term, incomplete contracts would be faultlessly filled in an adaptive, sequential way” (Williamson 1979: 241). Contractual deficiencies would be negotiated in good faith – updated and redrawn with ease (Earl and Potts 2011: 5).

But assuming “some individuals are opportunistic some of the time” which is “rarely transparent \textit{ex ante}” governance apparatus become necessary (Williamson 1985: 64). The presence of even some opportunistic individuals self-interest seeking with guile makes this negotiation process difficult (Williamson 1985: 47). Parties cannot be sure others will not act opportunistically in the face of contract adaptation. This gives us Table 1 below (from Williamson 1985: 67).

<table>
<thead>
<tr>
<th>Condition of Opportunism</th>
<th>Condition of bounded rationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Bliss</td>
</tr>
<tr>
<td>Admitted</td>
<td>General clause contracting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition of Opportunism</th>
<th>Condition of bounded rationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Bliss</td>
</tr>
<tr>
<td>Admitted</td>
<td>General clause contracting</td>
</tr>
</tbody>
</table>

\footnote{6}{Note that while ‘limited rationality’ describes cognitive capacities—that we cannot possibly know \textit{ex ante} the all future changes in the world—it is the other element of ‘intention’ which encourages the study of institutions to economise on these shortcomings.}
Bounded rationality and opportunism necessitates *ex ante* screening and *ex post* safeguards. But adding asset specificity adds further contractual difficulties. Transactions involving asset specific (or idiosyncratic) investments are prone to hazards because other trading partners are not easily arranged. In these scenarios (unlike neoclassical contracting) transactions are “neither faceless nor instantaneous” (Williamson 1985: 56) and the “identity of the parties has important cost-bearing consequences”. It is in the interest of both parties to continue the exchange relation (Williamson 1979: 240). The behavioural assumptions described above with ‘implied’ contracting models in Table 2 below (from Williamson 1985: 31).

<table>
<thead>
<tr>
<th>Behavioural Assumption</th>
<th>Bounded Rationality</th>
<th>Opportunism</th>
<th>Asset Specificity</th>
<th>Implied Contracting Process</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Planning (e.g. mechanism design)</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>Promise</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>Competition</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Governance (private ordering)</td>
</tr>
<tr>
<td>present in significant degree = +; presumed to be absent = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Implied contracting process by behavioural assumptions

The first three scenarios—of planning, promise and competition—are implied when one of these assumptions are left out. But with bounded rationality, opportunism, and asset specificity, we enter the complicated world of governance and private ordering. Perfect rationality (not assuming bounded rationality) implies *planning* – a clear association with the mechanism design literature (i.e. Hurwicz, 1973; Myerson 1979). Contract execution problems arise because an appropriate *ex ante* bargain may be made which takes into account all relevant contingencies. Assuming away opportunism, we enter the world of *promise*. Here, as problems arise in the execution of incomplete contracts each party will renew the contract under fairness. Contracts will make it efficiently through to completion through promise – “an agent is as good as his bond” (Williamson 1985: 31). Without asset specificity, we have *competition* (i.e. discrete market contracting), where parties to the contract may easily turn to other suppliers or buyers and write a new contract (there is no continuing interest for each of the parties to keep exchanging with the other). Contract disputes are sorted in court.
All three of the behavioural assumptions, however, makes planning, promise, and competition fall down.\(^6\) Governance, is much the result of the link between the level of asset specificity and uncertainty – as uncertainty over the future outcome of the transaction increases, it becomes “more imperative to devise a machinery to ‘work things out’” (Williamson 1979, p 254). But the particular organisation of the machinery will vary.\(^9\)

The types of governance mechanism for innovation is not limited to the firm-market duality highlighted by Coase (1937) and developed by Williamson (1975) to address the particular question of vertical integration.\(^10\) To the choice of *markets or hierarchies* as transactions cost minimizing forms of innovation governance we also add the institutions of *open networks* (von Hippel 1988, Pisano 1991, Hagedoorn 1993, Langlois and Robertson 1995, Powell et al 1996), *clubs* (Buchanan 1965) as collaborative joint ventures (Caloghirou et al 2003), and the *commons* (Ostrom 1990), which is the particular focus of this paper.

The governance of innovation is a more fundamental economic problem than the market failure of innovation because innovation is a problem of *private ordering* long before it ever manifests as a problem of public goods provision (i.e. a market failure). The specific ways in which idiosyncratic investment, asset specificity and opportunism manifest, as problems of private ordering, are all consequences of the significance of transactions costs incurred in seeking to organize coordinated investment under conditions of extreme uncertainty. The basic economics of innovation, from this perspective, consists of entrepreneurial actions to minimize *transaction costs* by selecting appropriate governance structures\(^11\) to coordinate these multilateral investments in creating new knowledge.

But what actually is a *transaction* in innovation? For Williamson (1985: 1): “A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins.” Thus transactions connect the modular stages of a production process separated by transfers within a task network (Baldwin 2008). The main difference between the production of a widget and the production of innovation—or the path from invention to

---

\(^6\) Planning fails because plans and contracts are necessarily incomplete. Promise does not work where individuals pursue self-interest with guile, opportunism. Competition is inefficient because economic rents are lost if parties have to begin contracting with others due to asset specificity.

\(^9\) One answer is to standardise the products (sacrificing features) and thus applying market governance. Alternatively, asset specificity could be maintained, but surrounded by an elaborate governance apparatus.

\(^10\) The main governance approach in the organizational economics of innovation has been to develop the Williamson make-or-buy problem in the context of *vertical integration* (Pisano 1991, Robertson and Langlois 1995), and more recently *open innovation* (Lazzarotti and Manzini 2009, Dahlander and Gans 2010). Evolutionary and Schumpeterian economists have countered this with the importance of innovation competencies in the knowledge-based theories of the firm (Penrose 1959, Nelson and Winter 1982, Marengo and Dosi 2005).

\(^11\) A governance structure refers to ‘the institutional matrix within which transactions are negotiated and executed’ (Williamson 1979: 239). Furthermore, ‘special governance structures supplant standard market-cum-classical contract exchange when transaction-specific values are great. Idiosyncratic commercial, labor and family relations are examples.’ (ibid: 244-5)
innovation—is that innovation involves the combination and coordination of activities and resources to produce new knowledge and also to discover the economic opportunity associated with that new knowledge. It is a fallacy of innovation economics that the innovation problem is solved when a new technology is discovered (Allen and Potts 2015). But that the true innovation problem—the discovery of market opportunities—occurs in the context of fundamental uncertainty (Knight 1921) is inescapable. We propose this suggests an innovation specific definition of a transaction cost\textsuperscript{12} as the cost of discovering and creating a new economic opportunity using some manner of contracting mechanism. What this means is that by specifying the innovation problem as a governance problem we are comparing it to an autarkic (or Robinson Crusoe-type) solution in which innovation is simply an allocation choice of investment, rather than one that inherently involves \textit{idiosyncratic contracting under extreme uncertainty}.

The \textit{feasible set} of modes of contracting in the economic organization of innovation will be constrained from above and below. Bounded rationality, distributed information and radical uncertainty over the prospect and value of discoveries imply that all contracting will be necessarily and often radically incomplete. But it will also seek to account for the unknown distributions associated with prospective costs and payoffs. This puts both an upper and a lower bound on the complexity of organizations that govern innovation, including markets and hierarchies. At the lower bound innovating organizations need to avoid being hopelessly naïve in creating unnecessary or unsustainable hazards for individual contributions. But at the same time they need to avoid becoming impossibly complex in anticipating all contingencies, resulting in excessive overhead and sacrificed agility.\textsuperscript{13} The institutional and organizational complexity can be allocated in firms or in markets, or in some complex combination (Clark et al 2008). This suggests that some kind of polycentric governance (Ostrom 1990, 2010) with multiple centres of decision-making, and effective monitoring, provision for exit and fluid external contracting is likely to be dynamically efficient in the governance of innovation, just as in the governance of local public goods.\textsuperscript{14} As explained below and elsewhere (Allen and Potts 2015), the institutions of the commons will often furnish efficient governance models to minimize transactions costs associated with private order resolutions of collective action problems (i.e. social dilemmas) involved in contributing and pooling resources for knowledge discovery.

\textsuperscript{12} The Coasean definition of a transaction cost is ‘the cost of using the price mechanism’, whereas two distinct meanings have subsequently developed (Allen 1999). In the neoclassical literature transaction costs refers to ‘the costs resulting from the transfer of property rights’, whereas in the New Institutional literature it is ‘the cost of establishing and maintaining property rights’.

\textsuperscript{13} These can be usefully arrayed on what Djankov et al (2003) call the institutional possibility frontier as a convex function on axes of the costs of disorder (decentralized chaos) and the costs of dictatorship (centralized control).

\textsuperscript{14} ‘By the mid-twentieth century, the dominant scholarly effort was to try to fit the world into simple models and to criticize institutional arrangements that did not fit.’ (Ostrom 2010: 642).
An innovation commons—the topic of section 5—in this sense, is a way to economize on bargaining in the face of uncertainty (Williams 1979: 247–51)—it is a negotiation structure that minimizes the hazards of opportunism in investment in idiosyncratic knowledge capital. Opportunism in innovation investment can refer to several things, including direct theft of ideas, but also exploitation due to weakened bargaining position after the fundamental transformation that accrues once innovation moves from autarky to production in a group.

Transaction cost economics (TCE) was developed precisely to study such governance problems. The logic behind TCE is deceptively simple—assuming boundedly rational agents, uncertainty over the future state of the world, and asset specific investments, contracts face *ex post* hazards. These hazards come from transaction costs in exchange. Oliver Williamson (1975, 1979, 1985) operationalized this framework through two main steps: (1) dimensionalising transaction costs and governance structures along several attributes; (2) matching these up in a discriminating way as to economise on the sum of production and transaction costs (i.e. the application of a discriminating alignment hypothesis). Thus “transaction costs are economized by assigning transactions (which differ in their attributes) to governance structures (the adaptive capacities and associated costs which differ) in a discriminating way” (Williamson 1985: 18). The result is a predictive theory of transaction costs and organisation.

The process by which transactions are aligned with governance structures so as to affect an economizing result is known as ‘private ordering’ (Williamson 2002). Characterising each side of the ‘private ordering’ equation provides the predictive character of TCE (Williamson 1991)—what specific governance structures will apply to different transactions. But to analyse this we must first outline the dimensions of transaction costs (section 3.2) and governance structures (section 3.3).

### 3.2 Transaction cost dimensions

Transaction costs received a ‘bad name’ in economics (following the brilliant work of Ronald Coase) partly because the concept was “frequently invoked in a tautological way, thereby to ‘explain’ any puzzling phenomenon whatsoever after the fact.” (Williamson 2007: 16). What was needed was a deeper understanding of the specific factors responsible for different transaction costs and governance structures. Oliver Williamson (1979) dimensionalised transaction costs along three dimensions:

---

15 Williamson (2002) distinguishes between economics as a science of choice and economics as a science of contract. As science of contract, it divides into private ordering (the New Institutional Economics of governance and mechanism design) and public ordering (Constitutional Economics). Note that the economics of the Commons is on the branch of private ordering, and therefore so is the ‘new innovation economics’ proposed here.

16 As a governance structure a commons is a *closed multi-lateral structure* (cf. bilateral open structure (relational contracting) or unified structure (firm)).

17 ‘Private ordering’ is the process by which transactions are aligned with governance structures to economise on transaction costs (Williamson 2002). Predicting this process first involves characterising each side of the ‘private ordering’ equation (Williamson 1991).
While the first is useful, it is the latter two that provide refutable implications for a TCE of innovation. We further argue that there is an added element of ‘entrepreneurial uncertainty’ necessary to understand the early stages in the innovation process. Thus the argument is made that the presence of entrepreneurial uncertainty—as contrasted but complimentary to the ‘state of the world’ and ‘behavioural uncertainty’ of Williamson—brings the need for a governance apparatus unique to the early stages of the innovation process.

The frequency of a transaction implies the continuity of the relationship. The general implication here is that the cost of specialised governance structures will be “easier to recover large transactions of a recurring kind” (Williamson 1985: 60). Asset specific and idiosyncratic investments (as described earlier) emerge when specific investments into an exchange relationship create an incentive for parties to continue the transaction. What begins as a large numbers competitive bidding game may become a bilateral supply. The former is largely free from contracting difficulties because new trading partners are easily arranged, while the latter has contractual asymmetry and has “pervasive contracting consequences” (Williamson 1985: 61).

Changing from competitive relationship to an asset specific relationship is what Williamson (1975) calls the fundamental transformation. While this accepts the conventional problem of ex ante bidding competition, it brings to relevant the ex post impact. The idea of the fundamental transformation is simple – a contract that begins in a regular competitive bidding war may later become asymmetrical and near monopolistic because the winning exchange makes idiosyncratic investments which are difficult to recover by a second round of bidding. The large numbers bidding game may continue for a second round only “where no such specialised investments are incurred, [and] the initial bidder realises no advantage over nonwinners” (Williamson 1985: 61). This contractual asymmetry arises because “economic values would be sacrificed if the ongoing supply relation were to be terminated” (Williamson 1985: 62). Idiosyncratic investments throughout the course of a contract often take the form of human capital (e.g. learning by doing) – this is especially poignant for our discussion of innovation below. We return to the concept of the fundamental transformation in section 4.2 below – where we argue that there is a fundamental transformation in innovation which occurs between the ex ante and ex post discovery of entrepreneurial market opportunities.

Williamson’s (1979) framework assumes that “uncertainty exists in some intermediate degree”. Although he does note some dynamics: with asset specificity, increasing the degree of uncertainty “makes it more imperative that the parties devise a machinery to ‘work things out’—since contractual
gaps will be larger and the occasions for sequential adaptations will increase in number and importance as the degree of uncertainty increases.” (1979: 254). Williamson’s uncertainty is behavioural uncertainty (due to opportunism) as well as state of the world uncertainty (about how changing events will impact on the execution of the contract.). The answer Williamson suggests is either hierarchy or market (with benefits and costs of each, as described earlier). The underlying principle of Williamson is that the higher the uncertainty, the more likely the transaction will face ex post hazards. But our concern in this paper is especially with the very early stages of the innovation process – before firms and markets. The problem here is not just uncertainty relating to contingencies (i.e. changes in the world that impact the completion of the contract) but also the more fundamental problem of entrepreneurial uncertainty itself (see section 4).

3.3 Governance structures and adaptation

The central problem of economics is adaptation to the changing circumstances of time and place (Hayek 1945). F A Hayek proposed that the price mechanism—and thus markets—were an efficient mechanism for communicating information, and therefore dealing with the economic problem. Similarly, Barnard (1938) argued that the role of internal organisation—such as the hierarchy within firms—was concerned with the adaptation to a fluctuating environment. These two scholars argued two sides of the same coin: the “marvel of the market” and the “market of internal organisation”.

The question becomes “wherein does one outperform the other?” (Williamson 1991). The answer Williamson gives to this is a dimensionalisation of governance on the basis of different types of adaptations. Hayek’s spontaneous adaptation—through prices, demand and supply—is autonomous adaptation. Bernard’s intentional adaption—through recourse to hierarchical governance mechanisms—is coordination adaptation. Markets are an effective governance mechanism when referring to autonomous adaptation (the conclusion Hayek drew). When small disturbances occur, individuals can change and reposition their contracts quickly and efficiently. Because actions are ‘tightly linked’ to incentives (Williamson 1988) this provides ‘high-powered incentive intensity’.

However, when bilateral dependency ensues, there is an opportunity to realise gains through hierarchy. Internal organisation helps to mitigate some of the contractual hazards of markets through coordination adaptation. But while hierarchies may help to reduce the incentive intensity of opportunism, this governance form has costs of its own—especially relating to the administrative bureaucracy costs of internal organisation. Between markets and hierarchies are hybrids. The hybrid mode “is characterized by semi-strong incentives, an intermediate degree of administration apparatus, displays semi-strong adaptations of both kinds, and works out a demi-legalistic contract law regime.” (Williamson 1991: 281).
Williamson (1991: 281) gives the following table to describe the different attributes of three governance structures—markets, hybrids, and hierarchies.

<table>
<thead>
<tr>
<th>Governance Structure</th>
<th>Market</th>
<th>Hybrid</th>
<th>Hierarchy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incentive Intensity</td>
<td>++</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Administrative Controls</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Adaptation (Autonomous)</td>
<td>++</td>
<td>+</td>
<td>0</td>
</tr>
<tr>
<td>Adaptation (Coordination)</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>

++ = strong; + = semi-strong; 0 = weak

Table 3: Governance structures and adaptability

4. **Entrepreneurial discovery under uncertainty as a fundamental transformation**

The ‘fundamental transformation’ described by Oliver Williamson (1979, 1985) is widely accepted within new institutional economics. A fundamental transformation often evolves throughout the execution of a contract as we move from a ‘large numbers competitive bidding game’ to a ‘small numbers bilateral supply’. As additional asset specific investments are made—whether they be capital-specific or human-specific investments—asymmetrical bargaining by opportunistic individuals has “pervasive contracting consequences” (1985: 61).

In this section we apply this concept of the fundamental transformation—and the contractual difficulties that emerge from it—to the ‘innovation problem’, which we define as the discovering market opportunities by coordinating dispersed Hayekian knowledge.

As described in section 3, there is theoretical need for innovation to occur in groups. We assume this contract outcome to be more efficient than innovation autarky, given the need for individuals come together to recombine dispersed, contextual and heterogeneous Hayekian knowledge. But with the formation of groups comes question of how contractual hazards and transaction costs and managed? The solution, of course, is through institutional governance structures. We now have a connection between ‘innovation transactions’ of dispersed knowledge, and the ability of governance structures of overcome ex post hazards.

The innovation fundamental transformation is different from Williamson’s because entrepreneurial discovery does not begin as a ‘competitive bidding process’ concerned with prices and quality.

---

18 Williamson’s proposed governance solutions to this problem come either through markets (and standardisation with the backdrop of the legal system) or through hierarchies (substitution of the legal system for internal control).
Entrepreneurial discovery, *ex ante* market opportunity discovery, is concerned with coordinating dispersed entrepreneurial knowledge. Drawing lessons from Williamson’s (1975, 1979, 1985) transaction cost economics (TCE) framework a fundamental transformation implies different economizing governance structures *ex ante* and *ex post* of entrepreneurial market opportunity discovery.

Williamson’s framework has three main attributes through which transactions are defined – the degree of uncertainty, frequency of transaction, and level of asset specificity (Williamson 1979). Different styled transactions are then matched to implied governance structures (largely defined by their ability to adapt to uncertainty in different ways). So as to “simplify the exposition” Williamson also assumes “uncertainty exists in some intermediate degree” (Williamson 1979: 246). This gives the following application of the ‘discriminatory alignment hypothesis’ (Williamson 1975: 79):

![Figure 3-2 Efficient Governance](image)

But the uncertainty Williamson describes as the backdrop to the table above is one particular type of uncertainty – it is uncertainty about how the future state of the world will impact on the possible completion of the contract. This uncertainty relates to how exogenous events will impact on the transaction (requiring adaptation) as well as the strategic disclosure or nondisclosure of information from the other party (opportunism). The question, then, is how the governance structures of markets and hierarchies economise on these costs.

But the innovation problem is solved in the context of a more fundamental form of uncertainty: entrepreneurial uncertainty. We propose that Williamson’s transaction dimensions must be modified to include a new dimension: entrepreneurial uncertainty. We make three further predictions regarding the presence of entrepreneurial uncertainty: (1) this uncertainty is highest *ex ante* the discovery of a market opportunity because of distributed Hayekian knowledge; (2) the shift from entrepreneurial uncertainty to that uncertainty which Williamson describes is a fundamental transformation; and (3)
this shift implies a different matching of governance institution (more specifically, an institution that will collapse as a market opportunity is revealed because of the change in the economising properties).

4.1 A new dimension: entrepreneurial uncertainty

Entrepreneurial uncertainty precedes all thinking about the other three dimensions described above. Williamson’s framework assumes that market opportunities exist, and contracts have an end goal (a ‘deliverable’ per se). Parties to an exchange understand what they are transacting for, and agree on the value. These contracts are impacted both by ‘state of the world’ uncertainty—which necessitates adaptation—and ‘behavioural uncertainty’—which is observed as opportunist behaviour in the context of idiosyncratic investments. But entrepreneurial uncertainty is fundamentally different. At the very beginning of the innovation process—prior to markets and firms and thus before the revelation of a market opportunity—entrepreneurs face uncertainty even over what the market opportunity looks like. Before a market opportunity is revealed (and thus entrepreneurial action is possible) there is a problem where the parties to the exchange (the potential entrepreneurs) have radical entrepreneurial uncertainty over whether or not an opportunity will be revealed from a given transaction, what its value will be if revealed, and whether the other party is fulfilling their end of the contract. These are unique problems that do not fit within the TCE framework.

One way to think about this is to separate thinking about innovation into two separate (yet sequential) problems. The first problem is the governance problem existing before a market opportunity is revealed (i.e. ex ante market opportunity). Here the entrepreneur must access (exchange) the dispersed and contextual knowledge within the minds of other entrepreneurs. Their aim is to acquire knowledge from others that will enable them to piece together a market opportunity. The second problem is also a governance problem, but of a different kind – existing after the opportunity is revealed through solving the preceding innovation problem (i.e. ex post market opportunity). We assume that the latter governance problem, ex post opportunity, fits nicely within Williamson’s TCE framework. Here the boundedly rational agent economises on the sum of production costs and transaction costs.

4.2 A fundamental transformation ex ante and ex post market opportunity

We propose that from the perspective of TCE, the contractual structure of the process of market opportunity discovery by potential entrepreneurs (ex ante market opportunity) compared to the discovery of a market opportunity (ex post market opportunity), represents what Oliver Williamson called the ‘fundamental transformation’. Entrepreneurial contracts begin with low or mixed levels of idiosyncratic investment (and thus with many other potential trading partners) as entrepreneurs coordinate and sharing dispersed contextual entrepreneurial knowledge, to a small numbers game of idiosyncratic investments where the continuity of the relationship is valued. Thus we propose that the joint discovery of a market opportunity indicates that a ‘bilateral dependency condition’ is obtained.
Such bilateral dependency, in the face of opportunism, creates the need for “value-preserving governance structures—to infuse order, thereby to mitigate conflict and to realize mutual gain…” (Williamson 2002: 176). This section first focuses on the nature of ‘entrepreneurial transactions’ *ex ante* and *ex post* market opportunity discovery, before moving onto one potential governance structure—the innovation commons (Allen and Potts 2015)—in the following section.

Our concern here is with the ‘innovation problem’ which is the process of discovering market opportunities. Therefore our discussion is centred at the very beginning of what is generally termed the innovation trajectory – before firms and markets. Potential entrepreneurs, who are searching for market opportunities, must interact and share distributed Hayekian knowledge with other agents. These interactions are contracts. And these contracts at the beginning of the innovation process involve idiosyncratic investments – not in physical capital, but in entrepreneurial human capital. As Williamson (1979: 240) describes:

“*Specialized training and learning-by-doing economies in production operations are illustrations [of human-capital investments]. Except when these investments are transferable at low cost, which is rare, the benefits of the set-up costs can be realized on so long as the relationship between the buyer and seller of the intermediate product is maintained.*”

In the context of innovation contractual asymmetries defining the fundamental transformation become apparent as: (a) as human-capital investments throughout the market opportunity discovery process would be “sacrificed if the ongoing supply relation were to be terminated” (Williamson 1985: 62); and (b) when a market opportunity is discovered and thus potential economic values are realisable. It is the combination of these two elements that forms the parallels between the discovery of a market opportunity and of Williamson’s fundamental transformation.

In the *ex ante* market opportunity stage as there is no measurable economic value to be seen. This implies opportunity costs of investments are difficult to measure and economise on. This is not to say that some of the human capital investments (e.g. learning by doing) are not accruing, yet it is by definition difficult to measure these in terms of opportunity costs. Williamson suggests that governance structures attempt to economise on the sum of transaction costs and production costs. We define *ex ante* market opportunity as a scenario where production costs are zero—the problem is entirely a question of transaction costs—which are significantly non zero)

When entrepreneurs move from sharing and exchanging information with others in efforts to discover an opportunity to the point when they discover an opportunity, there is a fundamental transformation in the characteristics of the transaction. Rather than transactions with very little visible economic value (the scenario before the discovery of a market opportunity), we move to a situation where the creation of a new bundle of property rights (the market opportunity) may hold significant value. The
transaction, then, is characterised as “neither faceless nor instantaneous” (Williamson 1985: 56). A host contractual difficulties associated with opportunism over the bargaining of economic value in that transaction emerge. A scenario of relatively faceless contracting is supplanted with a scenario “where the pairwise identity of the parties matters” (Williamson 1985: 62).

The idiosyncratic investments creating contracting difficulties need not be in physical plant or equipment. The entrepreneurial investments we refer to here are investments in human capital—largely of ‘learning by doing’—in the process of discovering a market opportunity. Two or more individuals coming together and attempting to discover a market opportunity effectively create a property right—in the sense of ‘the right to do something’, to act on the market opportunity—and contracting difficulties emerge because this investment is tied to the other individuals (see Allen 1999).

Human capital investments increase as the ex ante market opportunity contracting process plays out. That is, asset specific investments evolve as the contracts continue. But the contracting difficulties become perverse only when a market opportunity is discovered. This is true because market opportunities hold economic value which may be bargained over through opportunism. We propose that this change—as economic values enter the relationship through the discovery of a market opportunity—represents a fundamental transformation because the idiosyncratic investments in human capital “can be realised only so long as the relationship between the buyer and seller is maintained” (Williamson 1985: 62). This fundamental transformation emerges precisely because of the “nonstandardised nature of the transactions” (Williamson 1985: 75).

However, in the absence of opportunism contracting difficulties here would largely vanish: as a market opportunity with economic value is revealed, the parties would easily adapt and re-draw contracts so as to divide the future benefits. However, when at least some parties in a population are opportunistic some of the time, we have a bilateral monopoly where “both buyer and seller are strategically situated to bargain over the disposition of any incremental gain whenever a proposal to adapt is made by the other party” (Williamson 1985: 63). Thus while both parties may both jointly wish to fully realise the economic benefits of the market opportunity—by, for example, founding a new firm—they are also incentivised to bargain as much of the gain as they can each time the contract is ‘re-drawn’.

These opportunistic tendencies seem similar to the ones Williamson (1985) describes at length—especially false statements about the state of world. It seems for the case of innovation, the biggest threat is the asymmetrical information associated with discovery of a market opportunity.

This contractual distinction between ex ante and ex post discovery of market opportunities has interesting implications for the Schumpeterian innovation trajectory. For Schumpeter, the analysis
begins where the entrepreneur/firm exists as a temporary monopoly before more entrants create
rivalrous competition and finally we end up at oligopoly (as the technology is adopted and diffused).
Thus Schumpeter’s trajectory assumes the process by which the initial market opportunity (defined by
the presence of a firm) are created. But what we have revealed in this section is the necessity for a
further complex (yet temporary) governance structure before the revelation of the market opportunity.
Once the market opportunity is discovered, the transaction type undergoes a fundamental
transformation, and the conventional story of Williamson and Schumpeter begins – economising on
transaction costs through founding of an entrepreneurial firm (or market).

This fundamental transformation we have described here, following Williamson, suggests peculiar
contracting difficulties to be managed by temporary governance apparatus. Similar to Williamson’s
prediction that as the degree of uncertainty increases it becomes “more imperative that the parties
devise a machinery to “work things out”—since contractual gaps will be larger and the occasions for
sequential adaptions will increase in number and important as the degree of uncertainty increases”
(Williamson 1979: 254) we argue that the higher the level of entrepreneurial uncertainty, the more
likely the presence of a type of governance apparatus called the innovation commons (Allen and Potts
2015).

5. A temporary governance apparatus: the innovation commons

In this section we briefly introduce a new governance apparatus—the innovation commons (Allen and
Potts 2015)—as a temporary institution which economises on the transaction costs associated with
discovering market opportunities. When a market opportunity is discovered the innovation commons
undergo a fundamental transformation and collapse into other governance apparatus such as markets
and hierarchies. We further propose that the innovation commons are a private ordering based on
credible Williamson’s (1983) ‘credible commitments’ (e.g. hostages) model, but where the ‘hostages’
are physical or scientific information pooled together. These bilateral credible commitments are a type
of ‘contractual safeguard’ which make visible transaction specific investments in the ‘forward stage’
(Williamson 1985: 190).

Private ordering solutions to the innovation problem have been relatively neglected in innovation
economics. This is a similar situation to that which pertained in the study of the ‘tragedy of the
commons’ (in common pool resources) before Lin Ostrom (1990) explained how effective private
governance solutions work, and why they are generally superior to property rights or government
planning based solutions. This work has recently extended to the study of the knowledge commons
(Ostrom and Hess 2007, Frischmann et al 2014). From the perspective of the market failure mode of

19 Private ordering refers to governance solutions that concern ‘not the rules of the game, but the play of the
game’ (Williamson 2000).
analysis, any solution will always be in the form of a reallocation, which will require government coercion to shift incentives (i.e. changing the rules of the game) or to redistribute resources. Private ordering solutions have no part in this diagnostic schema.

But this is also a consequence of analysis of innovation from the perspective of the innovating firm (Schumpeter 1942, Penrose 1959, Nelson and Winter 1982, Pisano 1991, Teece et al 1997), which is to presume that the most efficient organizational governance structure (vertically integrated R&D) has already been chosen. In the standard models of innovation economics, there are hierarchically organized innovating firms, contracts for research, and markets for ideas (Katz and Shapiro 1985, Aghion and Tirole 1994, Gans and Stern 2003). But there is little role for private orderings in this analytical scheme (two broad exceptions are the work on user innovation, e.g. von Hippel 1986, 2007; and on private collectives, von Hippel and von Krogh 2003, 2006; Gachter et al 2010).

A major reason for this neglect of private orderings is that innovation studies tend to begin when firms have already formed, because this provides a natural target for study as well as better data. But innovation actually begins prior to this institutional selection, in the ‘pre-firm state’ (Goorha and Potts 2015), when groups of agents are still engaged in refining institutions and rules about the prospect of an idea or technology in order to discover an entrepreneurial opportunity. We call this privately ordered space, which is pre-firm and pre-market because of extreme uncertainty, but yet still requires economic organization because of the value of coordinated idiosyncratic investments, the ‘innovation commons’ (Allen and Potts 2015).

In an innovation commons “entrepreneurs pool innovation resources (i.e. inputs into the innovation process) under defined access and governance rules” (Allen and Potts 2015: 1). Thus, the innovation commons are an emergent institution “where agents cooperate to pool information in order to discover entrepreneurial opportunities” (Allen and Potts 2015: 4). An innovation commons, we argue, is an efficient governance model for very early stage economic organization of discovery and development of an opportunity because of its hybrid adaptive capacity, governed by credible commitments and hostages. The unique nestedness of rules in some innovation commons (see Allen 2015) appears to allow adaptation of both the ‘autonomous’ and ‘coordinated’ kind.

The goal of such a commons is for market opportunities to be revealed through the coordination of heterogeneous contextual Hayekian knowledge. But only once the opportunity is revealed do firms and markets and subsequently industries emerge. From the outside, the innovation commons can appear to be composed of club-like (Buchanan 1965) or peer-group collaborative structures (Williamson 1975: ch 3), seemingly coordinated by the altruistic or cooperative behaviour of the participants (Bowles and Gintis 2011). But we do not depend upon cooperative agents, but rather on well-designed governance institutions for collective action that incentivize group-level cooperation, as outlined in Ostrom’s (1990, 2005) eight rules for governing the commons.
In Allen and Potts (2015) we presented the innovation commons—with examples including hackerspaces and the beginning of the 3DP printing industry—as a dual commons. That is, there are two resources being pooled in an innovation commons: ‘technical (or scientific) knowledge’ (including the physical resources) that describe a new idea or technology; and ‘entrepreneurial knowledge’ about market opportunities. While space constraints here restrict our ability to further explore this hypothesis, we may draw parallels between the physical resources in an innovation commons—for example, pooled 3D printers in a hackerspace or co-working space—and the ‘hostage’ and ‘credible commitment’ theories of Williamson. Thus we propose that the ‘innovation problem’ hazards described earlier in this paper can be managed by using credible commitments (e.g. hostages, information disclosure mechanisms, specialized dispute settlement, etc). These credible commitments entail self-enforcing agreements on behalf of the innovation commons participants which effectively bind them to the constitution of the particular innovation commons. These “hostages can have both ex ante (screening) and ex post (bonding) effects” (Williamson 1983: 521). Such hostages may bring about mutually beneficial cooperation in the early stages of the innovation process.

We also hypothesised in Allen and Potts (2015) that the innovation commons would be a temporary phase before the beginning of the traditional Schumpeterian innovation trajectory. We suggested that “While the innovation commons are born of fundamental uncertainty about innovation opportunities, addressing this problem successfully will collapse the functional rationale for the commons” because “uncertainty is what engenders their creation; and the resolution of that same uncertainty instigates their collapse” (Allen and Potts:11). In this paper we suggested that a fundamental transformation occurs in the governance of innovation as we move from ex ante to ex post market discovery, which each require different governance apparatus. In the context of an innovation commons, this fundamental transformation occurs as the commons collapses and we enter the institutions of markets, firms and states.

6. Concluding remarks

Since Schumpeter (1942) and Arrow (1962a) innovation economics been almost entirely preoccupied with a ‘choice-theoretic’ approach. This ‘lens of choice’ approach diagnoses a market failure in innovation through suboptimal private investment, and remedies that failure through innovation policy. Our approach to innovation economics in this paper, however, is of economic organisation, contracting, and transaction cost economics. Our ‘new innovation economics’ focuses on the ‘lens of contract’ rather than the ‘lens of choice’ and provides new analytical basis for studying the early stages of the innovation process.

Through application of Williamson’s (1975, 1979, 1985) transaction cost economics framework we show the basic economic problem of early stage innovation is one of multilateral investment in
**transaction specific** assets with **uncertain economic value**. Plainly, in this framework innovation becomes a problem of economic organisation of how to coordinate the discovery of market opportunities. The serious contractual hazards associated with this coordination necessitate institutional governance through private ordering. Innovation, then, is no longer focused on sub-optimal private investment ameliorated through state intervention, but rather on how private ordering governance structures economise on the transaction costs of innovation exchange.

Explicating the dimensions of *ex ante* and *ex post* entrepreneurial market opportunity discovery revealed an analogy between Williamson’s ‘fundamental transformation’ and the innovation process. A fundamental transformation emerges as the economic value of a market opportunity becomes clear, and as the economic value becomes open to asymmetric bargaining and opportunism. This distinction is only clear once entrepreneurial uncertainty over the discovery of market opportunities is recognised. We propose that *ex ante* market opportunity, the sum of transaction costs and production costs are economised through the innovation commons, while *ex post* market opportunity, we move to other governance forms.

![Figure 2: The new innovation problem](image)

Our analysis sets the path for understanding alternative organizational forms in innovation economics (i.e. private orderings). In this paper we briefly introduce once such path: the innovation commons (Allen and Potts 2015). This particular form of temporary economic organisation exists *ex ante* the discovery of a market opportunity. The innovation commons economise on both ‘autonomous’ and ‘coordination’ types of adaptation. An innovation commons may use a unique ‘nestedness’ of rules which (see Allen 2015) and credible commitments (e.g. hostages) to overcome free rider problems associated with under-contributing.
The new innovation economics provides the foundation for a greater understanding of innovation economics and organisation. We have placed the importance of both institutions—and thus the entrepreneurial process—back into the heart of innovation economics. Further, new research on the governance and transaction costs of innovation may better inform our application of innovation policy.

**Literature Cited**


