

Technology and social rules and norms in neo-Schumpeterian economics and in original institutional economics

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Abstract:

The foundation for both the neo-Schumpeterian and original institutional economics school of thought is the emphasis on evolutionary processes in economies. The relationship between technology and the social rules and norms that coordinate the behavior of people provides the focus for their respective conceptualizations of such processes. However, the seemingly familial relation of their analytical frameworks is tempered by how they conceptualize social rules and norms. We discuss the differences between neo-Schumpeterian and original institutional economics. These differences are a result of each approach's conceptualizations of social rules and norms, in particular when it comes to evolutionary processes and innovation dynamics.

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Evolutionary approaches to economic issues address the complexity of an economic system more immediately than equilibrium-based analytical frameworks. The shared focus in evolutionary analytical frameworks emphasizes change and novelty that emerge endogenously in the system under consideration. Still, evolutionary economics is not monolithic. While a focus on endogenously emerging novelty provides an overarching theme, the complexity of the economic system leaves significant room for integrating different variables and for operationalizing variables in different manners. Thus, evolutionary analytical frameworks may differ. Moreover, the vocabulary employed within different analytical frameworks can be the same while specific terms may be defined differently. Emphases in analyses and evaluations of analytical results can differ notably, referring back to the writings of Marx, Veblen, Schumpeter, and von Hayek as distinct key influences that are at times combined with biological analytical approaches of evolutionary processes (for early overviews and examples, see Hodgson, 1993; England, 1994; Magnusson, 1994; Witt, 2003b). Lately, we also find evolutionary mechanisms more immediately embedded in analyses of economic complexity (Beinhocker, 2006).



In this paper, we will look specifically at evolutionary approaches that integrate social rules and norms into their analytical frameworks; as routines and social technology, or as institutions, and the manner in which they integrate these with technology and technological change. In particular, we will focus on the foundations of both neo-Schumpeterian analyses from its inception (Nelson and Winter, 1982) and assertively claiming the evolutionary economics label, (e.g., Nelson et al., 2018; and Nelson, 2020) and original institutionalist analysis following Veblen and Ayres, Mitchell, and Commons, (see Hodgson, 1993) in order to contrast the dynamics of change that result in them.

The neo-Schumpeterian and the original institutionalist analytical frameworks share commonalities in their thinking about economic issues. These commonalities follow rather directly from the shared emphasis on endogenous change; in particular where technology impacts the social rules and norms they respectively define (Hodgson, 2007; Dominguez Lacasa, 2019). This commonality notwithstanding, the methods in which social rules and norms are introduced and integrated into analyses, and the scope of their definitions, show a more limited focus in neo-Schumpeterian economics versus a broader one in original institutional economics. The view on economic activity, economic issues, and change that are respectively formulated can show notable divergences. In many ways, we may think of the neo-Schumpeterian analytical structures as being more concerned with observing specific aspects of a given system in order to enhance its performance (as measured in innovativeness and growth), compared to a focus on a more analytical understanding of the socio-economic system in general, in the original institutional economics (OIE).

Neo-Schumpeterian theory focuses on firms – or networks of firms, in its dominant strand (Evangelista, 2018) – as the locus of innovation, and it considers the structure of relations between agents mainly through its impact on firm performance and innovation processes. Innovations, and the changes they have brought, are submitted for decentralized approval in market environments. The focus on firms derives from the recognition that structural changes, while manifesting at the industry (meso) level of an economy, are driven by decisions taken in firms. The structural changes in an economy matter because an economy's macro-level performance is shaped by them. The 'normative principle' of neo-Schumpeterian economics is the future development potential of an economy; its analyses is aimed at removing constraints that may limit this potential (Hanusch and Pyka, 2007a).

Original institutional economics focuses on societal structures and their dynamics of change, or the absence thereof, in relation to the state and dynamics of change in technologies. It utilizes the ceremonial-instrumental dichotomy as a valuation principle to structure its considerations and analyses (e.g., Hodgson, 2004), opening a broader field than the functionality of structures for achieving business or innovation objectives. Broadly speaking, ceremonial structures support existing power structures in groups for the sake of reinforcing these structures, while instrumental structures enable broader participation and openness for novelties that benefit a population at large (for more details, see section 2 below). We surmise that the overarching objective here would be to maintain, strengthen, or enable instrumental structures in a society in order to support progressive conditions for its population (e.g. Adkisson, 2010). However, while technological change is generally recognized as a main factor for achieving this end, the institutional embeddedness of human activity means that the two do not automatically cause or follow each other. Change can manifest in a way that further strengthens existing ceremonial (power) structures. Markets are not the default choice for

achieving objectives. For an evaluation of innovation, a blanket assumption of its beneficence cannot be maintained.

In sections 1 and 2, we will briefly define and discuss the concepts of both technology and the rules of social interactions. Section 3 introduces the outlines of an evolutionary process, and how it can be applied to structure considerations of technological and institutional change. Section 4 discusses the mutual influence technological and institutional change have on each other, and on each other's dynamics of change. In all sections, as appropriate, a contrast will be drawn between neo-Schumpeterian and original institutional economics. Section 5 discusses how the outcome of dynamics of change can be assessed within the respective frameworks, and section 6 summarizes and concludes the paper.

1. Technology

The concept of technology serves to describe the application of our knowledge about the natural environment and its regularities and laws. Technology, among other things, can help to ease our interactions with our environments – in order to better control the risks we face from that environment – or to more easily engage with that environment in order to satisfy individual or collective needs and wants. We consider technology to more specifically stand for problem-solving abilities, in the realm of applications of natural laws and relations. In this, we follow Lawson (2009, pp. 649-650) who describes “technology [as a ...] part of a particular process [...] in which the intrinsic causal powers of material artifacts are harnessed in order to extend human capabilities”. The application of technological knowledge is embodied in a combination of tools and skills (e.g. Schumpeter, 1934; Ayres, 1978; Metcalfe, 1995; Dosi and Grazzi, 2010, Mayhew, 2010) which are employed to achieve specific ends, and the more knowledge we can employ in such a manner in wide-spread utilization, the broader our capabilities for manipulating our environment become. We further enhance our technological knowledge through the different aspects of activities in its application (Malerba, 1992). Autonomous learning and experimentation, Veblen's (1914) workmanship, are crucial to the process of technological change as well, to enhance our understanding to manipulate our environment for achieving specific ends (Mokyr, 2002). Furthermore, technology is modular: we combine smaller components into larger problem-solving apparatuses (Mokyr, 1992; Beinhocker, 2006).

Technological change represents a change in problem-solving capacities. Depending on the change, our capabilities may expand into newly opened space. Technological change partly follows the application of human capacity to identify and find solutions to problems that did not have a solution before and to issues that were redefined as problems following a change in an understanding of our environments; technological change can also help find different solutions to issues already addressed (Witt, 2003a; Metcalfe, 2010).

Given the modularity of technology, in dynamics of technological change, the existing foundation provides the means for an expansion of technological capability (Mayhew, 2010). The more extended this foundation is, the more options for new combinations exist within this technology system (on technology systems and paradigms, see Dosi, 1982). We see a cumulative process unfold in a path-dependent pattern as technology's modular nature and the need for compatibility with existing problem-solving structures limit the possible changes. As activities provide the foundation for learning processes, a loss of some opportunities for

further learning eliminates some possible paths for development and change (Mokyr, 1992; see also Matsuyama, 1992; Schwardt, 2013).

While the understanding of technology may be broadly shared, the role it plays in the analytical structure differs between NSE and OIE. As the social rules and norms of groups are integrated, considerations around technology, the role and function it plays, the evaluation of its impact, as well as the dynamics of change, differ. The ultimate systemic objectives for neo-Schumpeterian authors are structural change, economic growth and enhanced value-added in economies (Hanusch and Pyka, 2007a). An understanding of further aspects of technology is accordingly emphasized in this branch of the literature. In particular, aspects like cumulateness, tacitness and appropriability (Dosi, 1990) – traits that influence transmissibility and learning – as well as conditions that support the flow of technological knowledge between agents, provide a focus. Hindrances and impediments can then be removed and “constraints limiting the scope of *economic* development” (Hanusch and Pyka, 2007b, p. 6, emphasis added) can be reduced. Technology immediately serves the objectives of firms, and it impacts the larger population when products relying on or connected to certain technologies remain present in markets. In OIE, it is the impact on the institutional environment that is of interest, and the role technological knowledge plays in ongoing human problem-solving activities to accomplish the objectives of a group of people. To that end, emphases may be more on structures that permit the privatization of aspects of the collective social knowledge fund technology (Bush, 1983) for individual profit, by means of “sabotaging” (see Veblen, 1954, p. 32) economic activity under pecuniary considerations. In NES, these two aspects would more likely be addressed as part of a structure to incentivize private entrepreneurship, and as decisions that are subject to some market evaluation and discipline.

Technology may be conceptualized in general terms and in isolation, but its application depends on the way people utilize it. The concrete ability and willingness to employ certain problem-solving mechanisms, as well as the direction of technological development, are molded by the social rules and norms of a group. We will take up this aspect in sections 4 and 5, after considering the role and conceptualization of the social environment of agents from the different perspectives we discuss in the following sections.

2. Social technology and institutions

The integration of causal powers, or the utilization of our understanding of natural laws and relations to solve problems, lay the groundwork for our technological capability. Our capacity depends on how far we explore the potential that our capability offers. All purposive problem-solving structures are facets of human knowledge, but the foundation in natural laws and relations differentiates technology from problem-solving structures in the social realm. Together, these shape the larger domain of human problem-solving capabilities. The relevant differences between NSE and OIE reside in the conceptualization of the social environment and its integration into the respective analytical frameworks. Neo-Schumpeterian economics favors a narrower view over the wider conceptualization put forward by the OIE. Both agree that the realized technological capability of groups is shaped by the social rules and norms in place in a group. They differ in what the relevant groups are; or their interests differ and so the groups that are considered differ, as well.

2.1. Routines and Social Technology in Neo-Schumpeterian Economics

The integration of direct interaction structures of agents into analyses in neo-Schumpeterian economics follows considerations around the functioning of firms (following Nelson and Winter, 1982). The focus on firms as the locus for innovation and questions of innovation and growth provide a narrow foundation in which social rules and norms are introduced, considered, and utilized. Their 'routines', later social technology, serve as a 'collection of procedures' to enable the utilization of physical technology in specific environments and for specific purposes in predictable ways. The author who has written on this area most extensively amongst neo-Schumpeterians – Nelson – later adds that these are "structures that define or mold the way *economic* agents interact to get things done" (Nelson, 2005, p. 153, emphasis added) in ways that keep transactions costs low.

Technological change is driven by the activity of profit-seeking firms. Changes in social technology result from attempts to improve the effectiveness of the utilization of the physical technology employed; or, more specifically, that support expectations of improvements in firms' positions, assessed in production, productivity, or profitability (Nelson, 2005, p. 203). Such productivity-enhancing and generally profit-inducing change provides a key focus area for companies, as innovation competition is generally assumed to be pursued over price competition by firms (Hanusch and Pyka, 2007a).

A second focus area where relations between agents matter is the transfer of technological knowledge. As Hanusch and Pyka (2007a) outline, innovation processes increasingly are coordinated within networks of firms. How such networks can be structured and supported, therefore, becomes of interest in the larger pursuit of innovativeness, structural dynamics, and economic growth. Still, the focus is on specific aspects of relations between agents, namely, those that have been identified as relevant for immediate economic activity and innovation, or, structures that "shape the generation of new technology and govern [change]" (Dosi, 1990, p. 339). For the overall economic structure and structure of economic activity, the question to consider is, "what are the conditions that make the evolutionary process rapid and sustained?" (Nelson, 2005, p. 198). In other words, how can firms – individually or in networks – be supported and incentivized to continue pursuing technological change?

2.2 Institutions in original institutional economics

In the original institutional literature, institutions are conceptualized as guiding the interactions of people as "socially prescribed patterns of correlated behavior" (Bush, 1987, p. 1076) and, as such, reflect Veblen's "correlated patterns of thought", based on learned habits and what he called instincts (Cordes, 2005). Collectively shared social rules and norms can bring stability of expectations and predictability in interactions (Elsner, 2012). An institutional framework enables interactions and coordinated activity in directly interdependent situations, as "collective action in restraint, liberation and expansion of individual action" (Commons, 1934, p. 74). Institutions structure interactions in a way that brings about outcomes which fulfill certain expectations. Furthermore, institutions are linked by values, which motivate people's actions (Bush, 1987); patterns of behavior that are superficially identical may be assessed differently under different motivations of the acting agents.

Institutions are not static. There is a mutual influence between behavior of individuals and the institutional framework of a group, where, in an ongoing process, social structure emerges

from human interactions and so is potentially transformed in those interactions as well. Institutions are continuously reconstituted in the interactions of people, as they emerge from these micro-level interactions in an ongoing process of “reconstitutive downward causation” (Hodgson, 2003), leading to the formulation of a “transformational model of social activity [... where...] conditions of actions become the result of actions in a complex and recursive manner” (Lawson, 2009, p. 650). The emergent institutional structure guides the behavior of people because they are socialized into it through their social environment. A reaffirmation of existing institutional structure results from behavior compatible with learned patterns within that structure (Hodgson, 2006). In the ongoing process of human activity, learning and discovery, experimentation and curiosity can introduce changes to how things are approached, and hence to behavior and institutions.

Beyond changes in what people do, ongoing processes of institutional change can be further conceptualized by use of the concepts of instrumentalism and ceremonialism (e.g. Waller, 1982; Bush, 1983). As social rules and norms are interwoven with the values motivating people’s actions, institutional change is also constituted by a change in the underlying motivations and values of people. The ceremonial-instrumental dichotomy has at times been interpreted to be sharp. Integrating motivations and values into our understanding of institutions has permitted a structured move beyond the sharp distinction and recognize that both ceremonial and instrumental attributes may be, and typically are, found in institutions (Bush, 1987). This more nuanced formulation of institutions has in turn helped avoid a path some institutional authors have taken where technological change in institutionalism enabled a sort of progressivism (Dugger and Sherman, 1997).

Ceremonial and instrumental value systems have distinct logics, as John Fagg Foster develops, as ongoing processes of learning in instrumental structures versus the rationalization of pre-determined outcomes in ceremonial ones (Tool, 2000; also, Bush, 1983, 1987). Ceremonial components drive systems towards stagnation, and relative and eventually absolute decline (Veblen, 1914, 1934; Ayres, 1951; Bush, 1987). They are informed by arguments centered on justifying an existing status quo and individuals’ position in the concurrent social hierarchy. They may be past-bound initially, but may then be increasingly focusing on a rationalization of the present in a form of (new) elitism (Dugger, 1995). Ceremonial actions resulting from these institutional influences are geared towards individual (resource) control, or the potential for it; status and power, ultimately, and proxies for these, as well as the signals attached to them. Ceremonial institutions serve related purposes, in the maintenance of an existing hierarchy, and its supporting structures (Ayres, 1978). They provide neither space nor scope for the development of individuals’ potential, but rather support the maintenance of an existing hierarchy, and its concurrent boundaries, and possibly even enhance structural restrictions to individuals and groups. Under this view, how a society changes, and the technology employed, depends on the relative strengths with which ceremonial and instrumental factors impact societal relations.

3. Evolution

For approaching the processes involved in changes of technology and social rules and norms, we can start with a formulation of a generic evolutionary framework for their analyses. Evolutionary systems show characteristics we can identify, independently of the substrate of

their processes, such as path dependency and true uncertainty (e.g. Beinhocker, 2006). Change within such systems happens based on processes of selection of endogenously evolving variations. How the selection environment is set up, or where variation emerges, naturally or socio-economically, for instance, is not crucial and so we can identify different examples for evolutionary systems beyond the biological one (Metcalfe, 1995; Beinhocker, 2006; also compare Dopfer and Potts, 2008).

If we approach an evolutionary process as 'variation – selection – retention and replication' (V-S-R), then, the dynamic that underlies the generation of variation is not instrumental for the process itself; although for understanding, influencing, or even shaping at least parts of the process, this will matter. For this kind of evolutionary process, we require a number of variations in problem-solving approaches for specific problems – whether biological, cultural, or other – that compete so that their relative adaptation to the relevant environment can be assessed, directly, or indirectly. Better adaptation will then show through an increased presence of the relevant problem-solving components over time.

The relevant parts of an environment in an evolutionary process may not be apparent to an observer. Furthermore, as the composition of variations changes, the environment within which the competition and selection processes occur changes as well. A measure of success, sustaining a problem-solving approach for a time, is only ever relative to the relevant environment. For a process to continue, an ongoing introduction of novelty into the system that sees its parts evolve is required, whether through mutation in biological systems, or experimentation and learning in socio-economic systems.

We can approach technological structures as examples of such evolutionary systems, and for some of the conceptualizations of social rules and norms, those as well, and consider changes in both areas of problem-solving capacity as subject to evolutionary pressure in the selection environment where they play out. The modularity of technologies allows us to consider its component parts as the subject of selection; understanding that an existing structure will impose limits on the changes that are viable. There is no optimal outcome, only viable ones, and ones that may work better than what is currently available. NSE treats its social technology in much the same way. Behavior on a larger scale is the combination of numerous detailed behaviors. Those that do not work for the purpose pursued may be set aside. What is considered to work is evaluated through the lens of what decision-makers in firms deem successful. Some institutionalists (e.g. Hodgson and Knudsen, 2006) argue the same principle can be applied to the original institutionalist formulations, in that the unit of selection in an institutional environment is the individual behavior reflecting the behavioral rule that guides it.

In contrast, Witt (2003b) argues that the environment in which social rules and norms change is not reasonably simplified in the V-S-R structure of Darwinian evolution. Rather, he proposes a concept of cultural continuance instead. Witt's argument focuses on the fact that the scope for institutional variation is large, in an environment where selection pressure is low, irrelevant, or non-existent. Hence, in the reconstitutive downward causation of the institutional environment, a drift can happen, where numerous small changes can eventually combine to manifest a changed institutional environment. This introduces aspects of a changing environment that a narrow V-S-R structure cannot capture.

In NSE, the evolutionary processes are assumed to be Darwinian, in the V-S-R structure. In OIE, there appears to be an argument for additional processes of change to unfold, in Witt's cultural continuance structure.

4. The relation of technology and social rules and norms

Technology and institutions represent two aspects of human problem-solving capacity (e.g. Nelson, 2003; Lawson, 2009; Latsis, 2010). They are complementary parts of human activity (Nelson, 2003; Beinhocker, 2006; Latsis, 2010). They may be conceptualized individually but they have to be considered jointly once human activity is addressed (Lower, 1987; Brinkmann, 1997; Robert and Yoguel, 2016; Perry, 2020). Technological capability shapes possibilities for activity, outlines requirements for effective interactions and for organizing groups of people. All of this impacts the ways people relate and interact as well as the technological capacity actually displayed. To utilize a technology, particularly to use it effectively, requires that the user's behavior be suitable for and meet at least a minimum of requirements to the problem-solving approach in question. The application of technology relies on an organization of activity and interactions through rules and norms guiding interactions, its effective utilization on compatible patterns of behavior, so that the level and structure of technology can influence group behavior and organization. Social rules and norms are then influenced by the technology in use in societies. This has been a long-standing component of analyses in different frameworks considering or integrating the socio-economic role of technology and technological change (e.g. Lower, 1987; Nelson, 1994; Metcalfe, 1995; Dugger and Sherman, 1997; Rosenberg, 2000; Witt, 2003a; Latsis, 2010). The impact and embeddedness of such influence differs in different frameworks, though. An influence of social rules and norms on technology, and its change, is integrated entirely differently in NES and OIE, on the other hand. Furthermore, the differences in the respective conceptualizations of social rules and norms that shape neo-Schumpeterian and OIE analytical structures not only reflect the focus and interest in the respective school of thought, they also have a fundamental impact on the processes of change that can be considered in a structured manner.

4.1. The relation of technology and social rules and norms in neo-Schumpeterian economics

The focus and interest in neo-Schumpeterian economics is the functioning of firms, their innovation performance, and, finally, the growth of an economy as the fundamental criterion for its evaluation (Hanusch and Pyka, 2007a; Nelson, 2007). The inclusion of social rules and norms as routines or, later, as social technology (Nelson, 2005), reflects that the potential that physical technology may offer can depend on people working together in its utilization. They enter as firm-specific structures of rules and norms. Internally, firms organized suitably can maintain their presence in markets. Firms that are not suitably organized go out of business, or they reorganize. For their external relations, networks of firms are relatively more or less innovative, and potentially successful, depending on how they can relate to relevant others.

A wider social structure, an institutional environment embedding lower-level activities, is recognized. Nelson (2005, p. 154) writes, “[b]ehind the scenes are broad social and cultural values, norms, beliefs and expectations”. However, these do not feature in the analyses: “they are definitely behind the scenes in our formulation” (ibid.). The wider framework and structure are referred to verbally at times (e.g., Nelson and Winter, 1982, ch. 11), but they are not integrated further into results or analyses, where the profit-driven firm in a market arena remains the focus. Firms seek change and improvement in an “exogenously determined environment” (Nelson, 2005, p. 96). The wider capitalist environment is accepted and taken as

given in the neo-Schumpeterian approach. The ultimate selection process is focused on end-user choice among alternative options, through the choices people make in markets between the results of different internal selection processes and choices in firms.

A neo-Schumpeterian approach emphasizes the role of firms in the system for experimenting with the introduction of, and as the locus of the spread of, technology. Within the given capitalist structure, these firms are then assumed to be disciplined by market outcomes, so that selection among firms as sets of routines and technology applied operates on their profitability. In contrast to the OIE, Veblen's (1954) distinction that business focuses on making money, not on producing (useful) things, is neglected, and these two different aspects of firms' activities appear to be equated, rather.

The approach to innovation dynamics reflects a specific supposition concerning the problems people seek to address, how they can most effectively address them, and the incentivizing structure that promises to bring people to undergoing efforts of discovering novelty in an environment characterized by true uncertainty. Experimentation is undertaken for an improvement of a firm's position. Where social rules and norms are concerned, they focus on the aspects of coordinating behaviors that are relevant for production. An impact on those social rules and norms – on the internal routines – is undertaken as firms attempt to make technology work as effectively as possible. Social technology evolves following technology and learning about the functioning of technology and possible novelties where technological change is concerned.

For the influence of social rules and norms on changes in technology, a structured integration has not been forthcoming. The selection environment of markets and the logic of business in market operations are taken as given, reflecting an analytical interest in capitalist systems and their reward structures, a point that is also reflected in the embrace of growth and future development potential as the ultimate objectives to support. As Rosenberg (2000) proposes, even in research facilities where people working there may be intrinsically motivated to explore and discover, someone has to decide what gets funded, and such decisions will be undertaken with an eye toward opening future revenue options. While that may signal a recognition of broader motivations and ambitions in people, the analytical focus is on how to put these in service to market outcomes.

Hanusch and Pyka (2007a) emphasize that individuals, firms, and the public sector are coevolving in changing economies. Their changes, though, are driven by attempts to make firms more innovative. A focus in studies follows, centering on the conditions for and consequences of overcoming or removing constraints that limit the scope of economic development, as structural change and growth. Economic development, here, is focused on as a process which reflects that firms in a territory, or an economy, have successfully improved their competitive position and, thereby, may have enabled an expansion of officially recorded economic activity, structural change, and possibly enhanced value-added in production. Metcalfe (1995) likewise stresses that polity, law, and economy are inseparable when considering designing, implementing, and enforcing the rules of the game. Still their objective is to enhance the performance of the firms that are constituents to those rules. He also posits that laws adjust following changes that have been implemented in practice, so that the view of technology as leading changes can be understood to be underlying his analysis as well.

4.2. The relation of technology and institutions in original institutional economics

Technological capability, and utilized capacity, sets the frame for what people may be able to pursue and achieve. It has long been understood that available physical problem-solving concepts have an impact the structure of organization of people (e.g. Veblen, 1954). Problem-solving potential in the specific shape of a particular technology makes it so that certain demands on individual action are realized. In a potential impact on the broader institutional environment, these demands may eventually lay the foundation for behavior patterns acquired in a certain setting to be transferred to other settings and environments. Put differently, behavior patterns can eventually influence us and be reflected beyond the initial arena of their development or emergence (e.g. Elsner and Schwardt, 2014).

However, technology shapes – or at least impacts – how we see and how we make sense of our environment (e.g. ‘brain as machine’ supplemented by ‘brain as computer’). It also impacts the specific risk environment that we encounter, at the very least in relative terms, and how we face it (e.g. risk emanating from the natural environment can be controlled better in parts of the world, and threats to the stability of people’s livelihoods there tend to be risks emanating from socio-economic structures). Technology may then impact the institutional framework of a group in ways other than attempts to improve the result of organized activity, by undermining traditional narratives, by changing roles to be filled and identities formed based on such roles, or by requiring different relational emphases to be utilized effectively, amongst others.

But the reverse direction of causality plays a role in the OIE as well. The influence of institutions on technology and technological change runs through the frame that institutions set for people’s behavior, the social hierarchy that they reaffirm, the power structures they define and related habits of thought they foster, the decision structures they uphold, but also through people’s utilization of their technological problem-solving capabilities in pursuit of the objectives they hold, and the values that shape these objectives. Directing attention and interest, institutions shape where and how to perceive situations as problematic, where and how we consider improvements which may be possible. They also provide a framework for how to address issues and to assess where and how changes in problem-solving capacities are deemed desirable, and where existing interests and power structures, conventional wisdom, or ceremonially embedded thought patterns can shape a course of action. The conceptualization of problems itself is shaped by the institutional framework – its worldview and mental models, and the values that it entails. Solutions to problems identified or prioritized therein are sought within this framework and its hierarchies.

Where authors solely focus on institutional change that is motivated by untapped technological potential that agents recognize and try to exploit by adapting, or designing, institutions accordingly, they leave out the views and perceptions of potential and what it permits, as well as the ability to take influence and implement changes, are themselves shaped by the institutional structure in place. Further, the explicit inclusion of people’s values into the conceptualization of an institutional environment means that what people in a society are taught to seek, and what they are taught as acceptable ways of achieving their objectives impacts use of and the attempted changes made to technology. Where we find evolving technology in market environments as the evolutionary process in NES, we find co-evolving technology and institutions in OIE.

5. Evaluation of innovation dynamics

In NSE and OIE, the relation between social rules and norms and technology embeds innovation dynamics differently. Direction, as well as evaluation of changes in problem-solving capacity, are likewise embedded, conceptualized, and understood differently. In brief, neo-Schumpeterian formulations appear to be willing to accept markets as bottom-up decentralized problem-solving structures and the arenas for the final arbitration of innovation attempts. OIE formulations are not accepting this as the necessarily desirable general case, leaving room to examine market outcomes and changes more generally – including technological innovation.

The neo-Schumpeterian analytical structure rests on an acceptance of markets fulfilling specific roles. The private individual as consumer decision-maker is the sovereign decision-maker to wield authority in an uncertain evolutionary environment. The plethora of decisions taken in the economic sphere offer information about collectively desirable resource allocation, and changes to resource allocation. Markets can aggregate the individual wills thus expressed into a collective decision faster than any other potential approach would. The market arena is also preferred as the decision-making arena for resource allocation, as purchasing decisions are seen as a true signal of preferences. Competition between companies to realize profit will be judged by the potential end-users of their products, and so, disciplined by the need to find customers to generate revenue and realize a profit, companies are kept on a path where their decisions inadvertently benefit end users, as signaled by these end users' decisions. Technological change is introduced by firms in their attempts to strengthen their market positions, the acceptability of their attempts is mediated by consumer choices. Thus, successful innovation represents aggregate choice. This foundation is reflected in the direction of analyses towards supporting and increasing innovativeness in the system, and the focus on growth as a success criterion for economic dynamics.

In the OIE, on the individual level, the institutional influence provides the framework for behavior and for value formation, and the degree to which different motivations come to bear on behavior. Individuals, in turn, shape groups and emerging group dynamics, for instance concerning openness to novelty and progressive change versus a consolidation of existing interests. How any new knowledge is utilized can only be assessed with a view on institutional structures, and the criteria for that assessment are not universally fixed (on the locus of value, see Tool, 2000). While individual agency is not to be discounted, the group level and its emergent institutions provide the frame for the socialization of individuals.

The institutional framework provides an ideological anchor for agents and the framing for decision-making and allocation of decision structures. It carries the institutionalized power structure of groups (Dugger, 1980). Such a power structure reflects, structures, and justifies the group's hierarchy. It also sets up positions and appropriate behaviors, thinking about related issues, and imbues positions within the hierarchy – independently of specific people involved in them – with power over others. Habits of thought acquired against their background, values acquired in the socialization in the environment they define, and power structure and problem perception they enable – these all set the stage for considerations about technology and the potential directions for its change.

From this relation between problem-solving approaches in the institutional and problem-solving potential in the technological spheres, change can take different forms. Technology utilization is embedded into an institutional structure and so can be utilized to further various

ends. Change may then be introduced with an eye on the potential for furthering existing patterns of control and dominance, and not on progress and emancipation (e.g. Hayden, 1984; Bush, 1986, 1987; Brinkmann, 1997; Dugger and Sherman, 1997; Latsis, 2010), a potential captured by Bush (1983, 1987) as ceremonially encapsulated versus instrumentally warranted. If encapsulated within and in support of the structures in place at the time of its introduction, new knowledge only contributes to maintaining, and potentially deepening, the ceremonial components of a status quo. Regarding market outcomes, to point to two exemplary aspects, a 'one-dollar-one-vote' environment is not the arena in which, generally, collective decisions that benefit the community at large occur. Relatedly, Swaney (1986) argues to combine Bush's concept with a dimension depicting the ecological sustainability of our evolutionary path, offering a four-sector categorization in which occasions are (more or less) instrumental or ceremonial and (more or less) sustainable. The short-term orientation of business in markets (e.g. Veblen, 1954; Lazonick, 2014) lends itself to neglecting long-term impacts of decisions taken, whether internally in the firm, or externally by customers. The sustainability of for-profit operations may then be questioned.

Therefore, in an OIE framework, we cannot assume that technological change would be synonymous with progress, as an advancement of the capacity to develop human potential. Institutions shape what is selected. In other words: in terms of problem-solving, whose problems are prioritized and which are ignored, and how solutions are sought and which ones are pursued (or even allowed) depends on the institutional framework, as does the choice of more specific selection criteria for new technologies and the arena where they are applied (Waller, 1987; Bush, 1986, 1987; Dugger and Sherman, 1997; Beinhocker, 2006; Latsis, 2010; Smith, 2010). Relying on markets shifts decision-making power according to purchasing power. Potential for progressive, or instrumental, change may be derailed before ever even manifesting (Brinkmann and Brinkmann, 2002). As Swaney (1989) also reminds us, the instrumentality of changes, or their evaluation as such, also depends on the perspective of the observer because the line drawn concerning whom to include in the consideration may change the result to how much of a ceremonial impact change may have had.

The acceptance of the market environment and the focus of analyses on changes in it have offered insights into the empirical reality of innovation processes and the structures that can support them and strengthen them. Trusting market environments to identify socio-economically relevant problems and offer ways for addressing them leaves us in a situation where we trust "the nastiest motives of nasty people for the ultimate benefit of society" (origin unknown). On the other hand, acknowledging and integrating power structures and ideology into the analytical structure and the ability and will to use them permits us to critically address market-centered narratives and to develop more nuanced and informed – or at least explicit – ways to come to a position regarding the desirability (potential or observed) of outcomes and dynamics.

6. Discussion

We have considered technology and social rules and norms, the relationship between these two elements, and the dynamics of their changes that emerge in neo-Schumpeterian economics and original institutional economics. The former seeks to better understand innovation processes in capitalist economies and the latter seeks to better understand socio-

economic systems. It is only by assuming that market outcomes, supported by innovation policies, represent a best possible problem-solving approach that these would align. In the analytical structure of OIE, such an assumption is not justified.

NSE posits economic growth as the overall objective, arguing that structural change at the meso-level of an economy is instrumental to this end. In its analytical structure, it embeds itself in a space of economic theory that accepts the sovereignty of individual agents as final arbiter regarding firms' decisions through their consumption choices. OIE draws attention to ceremonial structures in societies, and thereby opens a path to moving to a more instrumental framework, and to furthering more participatory outcomes for broader human development. These differences are reflected and embodied in different conceptualizations of social rules and norms, as routines or social technology, or institutions. Their conceptualizations of technology largely overlap.

In neo-Schumpeterian economics, the objective formulated is ongoing innovation as the necessary condition for the overarching goals, economic growth and development potential. The capitalist environment and firms as carriers of innovation delineate a specific set of incentives and rewards to consider where innovation dynamics are involved. The function of social technology enables the organization of people in a way that allows an effective utilization of technology, specifically with a view on the application of technology in production processes under business control. With a specific system being given, and a specific subset of agents and motives therein emphasized, innovation analyses are set onto a specific path. The ways to improve systems' functioning and agents' performance, as evaluated using the above criteria, is likewise tightly constrained. If critical approaches to economic structures develop a framework to engage with economic issues in an open-ended manner, beyond the mere rejection of an equilibrium-based methodology, then NES is not a critical, or heterodox, school of thought. Numerous critiques of customer choice as final arbiter – ranging from unequal purchasing power distribution and, therefore, unequal voice to the ability to stimulate and shape demand by producers to wasteful resource allocation for wealth and power signals to complex systems characteristics, such as emergence and aggregation fallacies – are set aside. So, too, are considerations of an incentive structure in market environments which rewards individual behavior that is detrimental to collective well-being – from power exercised, to the collectivization of private cost, to profitability considerations trumping serviceability, and beyond.

While consumer choice provides the direction for technologies, markets themselves are not addressed in further detail. The selection environment for the agents pursuing innovation is taken as a given, and not as a further part of assessments of dynamics. The fact that markets themselves are sets of rules and norms, and hence shaped by the polity itself, is not broadly discussed. Insofar as selection environments in socio-economic systems consist of rules and norms formulated by the people in these systems, this exclusion leaves a noticeable gap, particularly once policy considerations are formulated.

If we were to integrate more explicit considerations addressing the selection environment to which firms are exposed, the primacy of sovereignty in the customer's role can be amended, as the role of political agent would allow an impact on the rules and norms structuring market activity. It would likewise allow more considered approaches to whether a market environment is in fact the suitable arena to entrust innovation outcomes for a given problem structure. If we permit agents to be more than production factors, consumers, entrepreneurs,

and investors, we can consider complementing or competing approaches to technological change in more nuance and detail.

In OIE we see an evolutionary system take shape, where collective problem solving capacities change over time, subject to various influence dynamics. Individual interests and aggregate group or class interests are embedded in an ideological framework that justifies and shapes, but also reflects, values and behavioral rules and norms. Our mental models of the world are shaped by the institutional framework in which we are socialized (e.g. Witt, 2003a). Within this system, technology and technological changes – as well as institutions and changes in institutions – are interdependent. They provide a critical component in the selection environment for each other's evolutionary process, and they jointly shape the direction of changes in the system as they impact problem-solving needs, problem-solving desires, problem-solving abilities, and the problem-solving focus of agents. What we perceive as problematic is not only shaped by how technology lets us interact with the world, but also by how we interpret occurrences that follow. That is, our understanding of our environment shapes how we engage with it, and how we attempt to manipulate and control it.

Markets are embedded in the institutions that shape the socio-economic environment of agents. Firms operating in such markets as profit-seeking entities face a general set of constraints. As Veblen (1954), amongst others, lays out, under such conditions, firms' activities and the interests of the public at large will overlap incidentally. A society's formulation of the specifics of the environment in which firms can operate may shift how much of an overlap we observe, but the ceremonial components behind firms' decisions will never completely be overcome in a for-profit structure. To focus on firms as drivers of change will then not likely lead to improvements under an objective assessment criterion, especially once environmental carrying capacity and sustainability of activities are integrated into considerations. It is because of the institutional embeddedness of technological change that technological change may end up reinforcing retrogressive – or ceremonial – tendencies and patterns, instead of breaking them up. Enhanced knowledge does not necessarily translate into social progress.

Taking the capitalist for-profit environment as a given, NSE approaches remove aspects that are key components in the formulation of OIE. By implicitly adopting the Austrian-evolutionary view on market outcomes, this difference is further exacerbated, reducing the focus to market environments limits the available perspectives. If we accept market outcomes in some general measure as good, desirable, or at minimum the least damaging, then these limitations will shape our problem-solving approaches in a profound manner. In contrast, in the OIE formulation, who decides allocations, who controls knowledge, who can restrict use and usage patterns are all integrated as hurdles to the system's innovativeness. This also places related decisions in the hands of a much smaller group than the consuming public. This group includes the controlling interests in real-life firms, whose interests as capitalists, or absentee owners, may be to prioritize their cashflow hurdles rather than than hurdles to system innovativeness. Leaving innovation in the vehicles for the creation of such cashflows may then produce a contradiction between desired outcomes and the suitability of the preferred tools to foster these outcomes, especially where that innovativeness focuses on problems other than those addressed through gadgetry.

Still, NES aspects, such as considerations about the nature of knowledge and its transmissibility, can be integrated with other analytical frameworks. The empirical work around innovation dynamics and processes in firms and in networks of firms can inform

studies and policies more broadly, as these studies are not necessarily applicable in market environments only.

The complementary and even family resemblances between NES and OIE appear to be rather superficial and limited to a broadly shared concept of technology and the recognition that the system is endogenously changing. Still, not even the conceptualizations of the evolutionary processes underlying such change are necessarily the same.

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