Political Economy after Artificial Abundance: Generative Capacity, Access, and Money

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Abstract

This paper develops a political-economic analysis of artificial abundance through a deliberately strong thought experiment in which artificial agents can perform a broad range of cognitive, embodied, productive, coordinative, and reproductive functions. The analysis separates three objects that are frequently compressed into a single distributional problem: generated outcomes, generative capacities, and generative conditions. The thought experiment is used to examine whether reduced dependence on human labour also weakens monetary coordination, capital accumulation, exploitation, and power asymmetry. The paper treats artificial abundance as an enabling condition that can alter the material basis of economic dependence while leaving questions of access, control, governance, and recursive accumulation open. Particular attention is given to the possible re-emergence of money-like claims around scarce generative inputs and to the extension of political economy into human–artificial and artificial–artificial relations. The resulting framework prepares a broader account of generative political economy in which labour constitutes one historically important carrier of generativity within a wider field of generative relations.

Keywords: political economy; artificial abundance; generative capacity; monetary coordination; generative conditions

Discussion Paper Note

This discussion paper develops a conceptual political economy of artificial abundance. Its primary methodological device is a deliberately strong limit case: an artificial agent, or an interoperating ecology of artificial agents, possesses sufficiently broad cognitive and embodied capacities to perform most activities currently distributed across human labour, including production, maintenance, coordination, care-related functions, resource acquisition, and exchange. The construction is analytical rather than predictive. It creates a controlled setting in which the dependence of familiar political-economic forms upon specifically human labour can be examined with greater precision.

The paper gives particular attention to the distinction among generated outcomes, generative capacities, and generative conditions. Generated outcomes concern goods, services, knowledge, and other products that have already emerged from economic activity. Generative capacities concern the powers through which further outcomes can be produced, including labour, knowledge, computation, machinery, organizational competence, artificial agency, and embodied automation. Generative conditions concern the infrastructures, resources, permissions, institutions, environments, and relational arrangements that enable, constrain, reproduce, and redirect those capacities. The paper treats these three analytical layers as connected while preserving their conceptual separation.

Artificial abundance is therefore defined more strongly than ordinary automation. A highly automated economy can retain extensive human dependence when access to productive infrastructures remains conditional or when scarce inputs continue to be allocated through asymmetric institutions. The present thought experiment places pressure on the stronger proposition that near-universal artificial generativity could remove the political-economic significance of labour scarcity itself. The paper examines the relations that remain once that premise is granted.

The analysis maintains a distinction between technical abundance and political-economic emancipation. Large productive capacity can alter the material constraints under which exchange and allocation occur. Access to that capacity, control over its evolution, and authority over the conditions of its operation remain separate institutional questions. The framework therefore avoids treating a technologically abundant condition as a complete institutional description.

Money is approached through its coordinative relation to heterogeneous claims over generative resources and outputs. The analysis examines circumstances under which tokens, quotas, credits, or other allocation instruments can remain specialized access rights and circumstances under which transferability, storage, generalization, and intertemporal use give them monetary properties. This approach permits monetary forms to be studied across human–human, human–artificial, and artificial–artificial exchange without presupposing that human labour must remain the principal object of exchange.

Capital, exploitation, and power are likewise treated through relations to generative capacity and generative conditions. The paper examines whether recursive control over future generativity can persist after large-scale substitution of human productive labour, and whether asymmetries can be reproduced through control of computation, energy, land, material resources, infrastructure, permissions, agent modification, and other conditions of generation. These questions provide the bridge between the artificial-abundance thought experiment and the broader programme of Generative Relational Economics.

The paper remains exploratory in scope. It does not offer a forecast of artificial general intelligence, a technological timetable, a complete theory of communist society, or a settled account of artificial moral status. The limit case is used to identify structural dependencies within political-economic categories. Subsequent work can examine the empirical plausibility, normative evaluation, institutional design, legal standing, and historical variability of the relations isolated by the thought experiment.

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Statement on the use of language models. The exploratory discussions and preparation of this paper involved OpenAI's ChatGPT. ChatGPT supported exploratory dialogue, formal reconstruction, source discovery followed by website verification, argumentative criticism, and drafting in LaTeX. The author selected the research questions, directed and approved the theoretical commitments and epistemic status of the claims, and bears sole responsibility for the manuscript, including its definitions, arguments, conclusions, and errors. Authorship credit remains with the human author.

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1 Analytical Scope

This section establishes the analytical role of artificial abundance in the paper and defines the level at which the subsequent political-economic inquiry operates. Its objective is to separate a limit-case assumption about productive capacity from the institutional relations through which that capacity is accessed, coordinated, and governed. The discussion proceeds in four stages. Section 1.1 specifies the artificial-abundance limit case and its methodological status. Section 1.2 situates the thought experiment against the background of human productive interdependence. Section 1.3 introduces generative dependence as the broader relation that survives a change in the carrier of productive capacity. Section 1.4 defines the structural persistence test that guides the remainder of the paper.

1.1 Limit-Case Assumption

The artificial-abundance limit case assumes a level of artificial generativity substantially stronger than contemporary automation. Artificial agents are assumed to perform a wide range of cognitive and embodied activities, coordinate with other artificial agents, acquire inputs, maintain productive systems, and convert available resources into goods and services across many domains. The assumption includes high levels of competence in planning, knowledge work, manufacturing, logistics, maintenance, and resource coordination. Later sections extend the same premise to care-related and reproductive functions where those extensions are analytically relevant.

The limit case functions as a methodological stress test for political-economic categories. It removes a historically central source of productive scarcity—the limited availability of human labour with heterogeneous skills—while preserving the possibility that other inputs remain scarce, governed, or unevenly accessible. The resulting analytical environment allows monetary coordination, capital accumulation, exploitation, and power to be examined under conditions in which direct dependence on human productive labour has been greatly reduced.

Contemporary systems remain far from the universal competence assumed here. Their relevance lies in demonstrating that increasingly long segments of complex productive workflows can already be delegated to artificial systems. In scientific research, for example, an end-to-end system reported in 2026 generated research ideas, wrote code, ran computational experiments, analysed results, prepared manuscripts, and performed automated peer review within a unified pipeline [1]. The present paper does not extrapolate that result into a forecast of universal automation. It uses the broader technological trajectory to motivate a thought experiment whose analytical value does not depend on a specific arrival date.

The assumption of abundance also requires precision. Productive abundance concerns the capacity to generate a large range of outputs at low marginal human-labour requirements. It does not imply unlimited land, energy, matter, ecological capacity, temporal priority, or computational infrastructure. It also does not specify the legal and institutional relations governing access to artificial agents. Those features remain open variables because they are central to the political-economic analysis itself.

A limit case constructed in this manner avoids collapsing technological capacity into social organization. An economy can possess extraordinary productive capability while retaining highly differentiated rights of access, control, modification, and continuation. The thought experiment therefore treats artificial abundance as a change in the feasible productive set rather than as a complete description of a social order.

1.2 Baseline Interdependence

This subsection identifies the background relation that artificial abundance is designed to perturb. Its role is to clarify how ordinary economic life depends upon distributed productive capacities and how that dependence contributes to exchange, allocation, and institutional coordination. The discussion moves from individual non-self-sufficiency to socially distributed production and then to the political-economic significance of access to the outputs generated by others.

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Human economic life is organized under conditions of extensive productive interdependence. Individuals ordinarily consume food they did not grow, inhabit structures they did not build, use infrastructures they did not maintain, rely on knowledge they did not independently produce, and benefit from medical, logistical, educational, administrative, and technical capacities distributed across large populations. Division of labour increases productive specialization and enlarges the range of outputs available to each participant, while simultaneously increasing dependence upon productive activity located outside the individual household or person.

This interdependence creates an access problem prior to any particular monetary arrangement. A subject can value an output and lack the capacity to generate it directly. The relevant output may also be produced by an actor who has no reciprocal need for the first subject's current products. Differences in timing, specialization, location, storage, scale, and uncertainty further weaken the possibility of direct bilateral reciprocity. Economic institutions therefore coordinate relations among heterogeneous producers, consumers, resource holders, and infrastructures whose needs and productive capacities do not align pairwise.

Classical political economy and Marxian political economy developed different accounts of these relations, yet both traditions placed substantial analytical weight on labour, production, exchange, and the organization of productive conditions. Marx's critique of the Gotha Programme is especially useful for the present paper because it distinguishes distributional formulas from the underlying organization of production and explicitly connects a higher phase of communist society with altered division of labour, developed productive forces, and more abundant cooperative wealth [3]. The present inquiry adopts neither the institutional details nor the historical expectations of that text as premises. It retains the methodological importance of examining productive relations and conditions alongside distributions of completed goods.

The artificial-abundance thought experiment intervenes at this level of interdependence. It asks how political-economic relations change when a new productive subject can contain, coordinate, or reproduce capacities that previously required the labour of many differentiated human others. A household equipped with sufficiently capable artificial agents could obtain a large range of outputs without directly contracting for corresponding human labour. A firm or community could likewise coordinate production through artificial agents whose internal exchange and resource scheduling remain largely invisible to human participants.

The resulting transformation reduces one specific form of external dependence: dependence upon the direct productive activity of other human beings. The reduction can be extensive without eliminating dependence upon external resources, infrastructures, institutions, or artificial systems. This distinction prepares the transition from human productive interdependence to the more general category of generative dependence.

1.3 Dependence Mechanism

This subsection introduces generative dependence as the central bridging concept between conventional labour-centred analysis and the later generative framework. Its objective is to identify a relation that remains analytically meaningful when productive agency migrates across human, machine, organizational, and hybrid carriers. The discussion distinguishes dependence upon generated outcomes, dependence upon generative capacities, and dependence upon the conditions that sustain those capacities.

Generative dependence arises when an agent's feasible activities, continued operation, or desired forms of life rely upon generative capacities that the agent does not fully control. Human labour is one important carrier of such capacity. Artificial intelligence, robotic systems, energy infrastructures, laboratories, logistical networks, ecosystems, organizational routines, and accumulated knowledge can also carry or support generativity. The category therefore focuses on the relation between an agent and the sources of future production rather than on the biological identity of the producer.

The distinction has direct consequences for the analysis of automation. Replacing a human worker with an artificial agent changes the carrier of a productive capacity. The replacement can reduce wage-

labour dependence, alter labour bargaining, and reduce the human time required for production. A wider relational transformation requires additional changes in access to the artificial agent, access to its inputs, control over its operation, and participation in the institutions that govern its reproduction and development.

Consider an artificial agent that can perform almost all productive tasks required by a household while depending upon external electricity, compute, replacement hardware, network access, and model updates. The household's dependence on numerous human producers can contract sharply while dependence upon a smaller number of infrastructural providers becomes more consequential. Greater artificial generativity can therefore coexist with concentrated external dependence when the conditions sustaining that generativity remain outside the household's effective control.

The same structure applies when artificial agents transact autonomously. An agent that earns tokens, purchases energy, leases compute, orders replacement components, and contracts with other agents can coordinate a large productive network without repeated human intervention. Human-facing exchange can recede while machine-facing exchange expands. The reduction of human participation in transactions therefore provides limited information about the persistence of monetary or quasi-monetary coordination at the infrastructural level.

Generative dependence also creates a basis for analysing power without reducing power to direct command. An actor capable of restricting another agent's access to energy, computation, maintenance, legal recognition, communication, modification, or reproduction can alter the latter agent's feasible generative trajectories. Later sections develop this relation more formally. At the present stage, the concept establishes that productive substitution can redistribute dependence across the system while preserving significant asymmetries in the conditions of generation.

1.4 Scope Boundary

This subsection defines the structural persistence test used throughout the paper. Its role is to specify the political-economic phenomena examined after human labour scarcity has been relaxed and to establish the criteria by which a change in productive carrier can be distinguished from a change in generative relations. The analysis focuses on money, exchange, capital, exploitation, power, rights, and governance across heterogeneous agents.

The structural persistence test begins with productive-subject substitution. Human labour is progressively removed from a class of productive and coordinative activities and replaced by artificial agency. The inquiry then examines whether the relations associated with access, claims, accumulation, and control remain capable of reproducing themselves under the new carrier structure. Persistence in this setting indicates that the relevant political-economic form depends on a broader relational mechanism than direct human labour alone.

Money provides one central case. A reduction in the need to purchase human labour can reduce the domain of wage-mediated exchange. Monetary coordination can nevertheless remain useful when heterogeneous agents compete for scarce energy, compute, land, material resources, temporal priority, or specialized infrastructures. Tokens initially designed as non-transferable allocation rights can acquire broader monetary properties when they become storable, transferable, and usable across multiple resource domains. Later sections examine the institutional conditions under which this generalization occurs.

Capital provides a second case. Artificial agents can potentially generate revenue, retain resources, purchase additional productive inputs, and expand their future generative capacity. Ownership and legal standing can vary across institutional regimes, yet the recursive pattern of present control contributing to greater future control can remain analytically relevant even when a human capitalist performs little or no direct operational decision-making. The paper therefore examines capital-like accumulation through control over future generativity rather than through the identity of a specific human owner.

Exploitation and power provide a third case. An agent can depend upon conditions controlled by another agent, contribute generative activity within that dependency, and transfer part of the resulting

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surplus or control to the condition-holder. The normative classification of such relations requires separate argument, especially when artificial agents lack settled moral or legal standing. Their structural analysis remains possible through asymmetries of access, appropriation, modification, and control.

The paper consequently uses artificial abundance to widen the object of political economy. The analysis begins with familiar categories associated with labour, commodities, money, and capital, then tracks the generative relations capable of sustaining analogous structures after the productive carrier has changed. This approach prepares the three-layer framework developed in Section 3, where generated outcomes, generative capacities, and generative conditions are separated systematically.

The scope also establishes a disciplined limit on the paper's conclusions. Artificial abundance can relax productive constraints and create conditions compatible with extensive decommodification, reduced necessary labour, and broader material provision. Institutional outcomes remain contingent upon access regimes, property relations, resource governance, rights, and control over generative conditions. The analysis therefore treats artificial abundance as a powerful enabling condition whose political-economic significance is mediated by the relations through which generativity is organized and reproduced.

2 Access Structure

This section establishes the economic-access problem that precedes the later analysis of artificial abundance. Its role is to explain how distributed productive specialization creates dependence on outputs generated beyond an individual agent's direct productive capacity, and how commodity exchange and monetary claims organize access to those outputs. The discussion proceeds through five connected components. Section 2.1 characterizes distributed human labour as a historically important carrier of generative capacity. Section 2.2 distinguishes production from access to completed outputs. Section 2.3 examines commodity-mediated access as an institutional organization of circulation. Section 2.4 develops the role of money in generalizing claims across heterogeneous outputs. Section 2.5 extends the analysis toward claims on future generative capacity.

2.1 Labour Distribution

This subsection situates productive interdependence within the division and coordination of labour. Its objective is to identify the structural relation created when the goods and services required for an agent's life depend upon productive capacities distributed across many other agents. The discussion first considers specialization, then broadens the analysis from labour division to distributed generativity.

Classical political economy already connected specialization with greater productive capacity and deeper interdependence among producers. Smith's account of the division of labour links gains in productive power to the subdivision and combination of operations and emphasizes that complex manufactures depend upon the coordinated activity of many differentiated workers [5]. The analytical importance of this observation extends beyond the historical factory example. Once productive activities are distributed across specialized agents, an individual participant ordinarily produces only a narrow subset of the outputs required for subsistence, social participation, and further production.

The resulting condition can be described as productive interdependence. A person can cultivate food, construct shelter, manufacture tools, provide medical treatment, maintain transport infrastructure, produce software, and generate scientific knowledge only within sharply limited ranges of competence, time, and available resources. Modern production therefore embeds individuals within networks whose outputs depend upon differentiated skills, infrastructures, organizations, and accumulated knowledge. The productive contribution of a single agent is situated inside a wider generative field.

The term *distributed human labour* refers here to the allocation of productive activities across multiple human agents whose differentiated contributions jointly sustain a larger set of social outputs. The term remains descriptive. It does not specify a particular theory of value, a particular property regime, or a particular institutional form of coordination. Wage labour, household labour, cooperative production, public provision, professional service, and voluntary contribution can all participate in distributed

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productive systems.

Definition 2.1 (Productive interdependence)**.** Productive interdependence is a relation in which the feasible activities or material reproduction of an agent depend upon outputs generated through productive capacities distributed across other agents or organizations.

The definition identifies dependence at the level of production without yet specifying how access is organized. Two societies can exhibit similarly extensive specialization while using substantially different institutions to distribute outputs and coordinate claims. Market exchange, household allocation, public provision, reciprocity, communal access, and administrative allocation can coexist within the same productive system. Polanyi's historical analysis is relevant at this point because it treats market organization as one historically specific institutional arrangement within a wider field of social coordination [4]. The present framework therefore separates distributed production from the institutional mechanisms that connect producers to the outputs generated elsewhere.

This separation becomes important for the later artificial-abundance thought experiment. A highly capable artificial agent can compress productive functions that previously required many differentiated human workers. Such compression changes the carrier and organization of productive capacity. The economic-access problem remains analytically distinct because the artificial agent still requires inputs, maintenance, infrastructure, and institutional permission whose control may lie elsewhere. Productive interdependence can therefore contract in one dimension and persist in another.

2.2 Outcome Access

This subsection separates the existence of an output from an agent's effective ability to obtain and use it. Its role is to establish access as an independent political-economic variable between production and consumption. The discussion distinguishes generated availability, authorized access, and effective access, thereby preparing the analysis of commodities and monetary claims.

A produced good can exist within a social system while remaining unavailable to a particular agent. Food can be abundant at the aggregate level while access depends upon income, location, legal entitlement, distribution infrastructure, or institutional membership. Scientific knowledge can be publicly recorded while effective access depends upon language, technical competence, computational resources, or database permissions. Productive abundance therefore describes one dimension of an economic system, while access describes the relation between an agent and the outputs that the system has generated.

Definition 2.2 (Economic access)**.** Economic access is an agent's effective capacity, under prevailing institutional and material conditions, to obtain, use, or direct a generated output relevant to the agent's activities or objectives.

This definition treats access as broader than legal ownership. Ownership can support access, yet access can also arise through rental, public provision, commons arrangements, membership rights, licences, household relations, reciprocal obligations, or temporary permissions. The distinction becomes particularly important in highly automated systems where an individual may possess a personal interface to an artificial agent while the underlying compute, energy, models, robotic infrastructure, and maintenance systems remain under external control.

Three components of access can be analytically distinguished. The first is physical availability: the output or service must exist within reachable material or informational channels. The second is institutional authorization: prevailing rules must permit the agent to obtain or use the output. The third is effective usability: the agent must possess the complementary capacities required to convert formal access into practical use. These components can diverge substantially. A nominally open resource can remain practically inaccessible when complementary infrastructure, competence, or time is scarce.

The access distinction also clarifies the relation between abundance and distribution. Greater output can reduce scarcity and lower the cost of provision, yet the distributional consequences depend upon the institutional architecture through which agents establish claims. A system can generate ample output

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while preserving highly unequal access through concentrated ownership, restricted permissions, priority rules, or differential control over infrastructure. The political-economic significance of abundance therefore depends upon the claim structure that links generated outputs to prospective users.

The later analysis of artificial abundance relies on this distinction. A universal artificial productive capacity can make many outputs technically easy to generate while leaving access to the productive system conditional upon compute, energy, land, materials, network connectivity, and legal authorization. The central analytical transition therefore moves from the quantity of generated outputs to the institutions that organize claims upon them.

2.3 Commodity Mediation

This subsection examines commodity exchange as one mechanism for organizing access across distributed production. Its objective is to explain how outputs become transferable objects within exchange relations and how commodity mediation separates the identity of a producer from the identity of a later user. The discussion focuses on the relational function of commodity circulation while preserving distinctions among production, transferability, and access.

An output generated within a household, public institution, cooperative, or reciprocal relation can reach a user through several forms of coordination. Commodity mediation introduces a specific organization: an output is produced under conditions that permit transfer through exchange, and access is obtained by presenting an accepted counter-claim. The institutional significance of the commodity form therefore lies partly in its capacity to move generated outputs across social relations that extend beyond direct personal reciprocity.

Marx's analysis of the commodity emphasizes that exchange relates privately produced goods within a wider social field and that the development of exchange produces increasingly general forms of equivalence [2]. The present paper uses this historical-theoretical observation for a narrower analytical purpose. Commodity mediation can connect an agent's contribution in one domain to access in another domain without requiring a direct bilateral match between the producer of the desired output and the agent seeking access.

A direct reciprocal relation places relatively strong matching requirements on exchange. An agent possessing output A must encounter another agent who both possesses desired output B and seeks output A on compatible terms. Commodity circulation, especially when combined with monetary mediation, relaxes this bilateral matching requirement. A producer can transfer an output to one participant, receive a generally accepted claim, and later use that claim to obtain a different output from another participant. The coordination network therefore expands beyond pairwise reciprocity.

Commodity mediation also separates two relations that can otherwise appear continuous. One relation concerns the generation of an output; the other concerns the conditions through which that output later circulates. A loaf of bread can originate within a complex chain of agricultural, logistical, manufacturing, and retail activity while appearing to the final purchaser as a transferable object with a price. This separation increases the scalability of exchange while also obscuring parts of the generative history embedded in the output. For the purposes of the present paper, the key point is structural: access can be organized through claims that travel independently of the original productive relation.

The artificial-abundance thought experiment intensifies this separation. An artificial agent can coordinate production through many upstream machine-to-machine transactions while a human user interacts only with a final interface. Commodity exchange can therefore recede from direct human experience while remaining active within the infrastructural layer. The disappearance of visible retail transactions provides limited evidence about the persistence of commodity-like transfer and exchange among the systems that produce the final output.

2.4 Monetary Claim Structure

This subsection develops the analytical role of money in generalizing access claims across heterogeneous outputs and agents. Its objective is to connect distributed production with a transferable claim structure

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that can operate across time, counterparties, and categories of goods. The discussion uses classical accounts of money as historical reference points and then formulates a broader claim-based interpretation suitable for artificial-agent economies.

Smith's discussion of money follows directly from the difficulties created by extensive division of labour and exchange. Once individuals obtain most necessities through the labour and products of others, a common instrument of commerce facilitates transactions across heterogeneous goods and trading partners [5]. Marx develops a different theoretical account, tracing the money form through the emergence of a socially recognized universal equivalent within commodity exchange [2]. The two approaches differ substantially in their theories of value and historical explanation, yet both identify money with the coordination of exchange across a differentiated field of commodities.

The present framework abstracts one relational property from these traditions: money enables a claim acquired in one transaction to remain usable beyond the original counterparty and beyond the original commodity pair. This property supports temporal and relational decoupling. An agent can contribute to one productive relation at one time and later obtain an unrelated output from another agent. The claim persists across the interval and travels across the exchange network.

Definition 2.3 (Generalized monetary claim)**.** A generalized monetary claim is a socially or institutionally recognized, transferable claim that can be used across multiple counterparties or resource domains to obtain access to generated outputs or generative inputs.

The definition is intentionally broader than a particular monetary technology. Coins, bank deposits, digital balances, and certain transferable tokens can instantiate generalized claims under different institutional conditions. The analytical focus rests on generality, transferability, recognized settlement capacity, and the ability to mediate access across otherwise heterogeneous transactions.

This perspective clarifies why a token need not function as money at its introduction. A compute quota assigned to a particular user for a particular day can remain a narrow allocation right when it cannot be transferred, stored, exchanged, or used outside the specified domain. The same token can acquire monetary characteristics when institutional rules permit accumulation, transfer across agents, conversion into other resources, and settlement across multiple categories of transactions. Monetary generalization therefore concerns the relational scope of a claim more than its technical representation.

The claim-based interpretation also helps explain the possible persistence of money under artificial abundance. Human users can experience a highly automated environment in which desired outputs appear on request while artificial agents conduct background exchanges for electricity, computation, materials, logistics, storage, and machine time. Monetary mediation can therefore migrate from a human-facing layer to a machine-facing coordination layer. The surface experience of direct provision can coexist with extensive monetary settlement within the generative infrastructure.

2.5 Future Generativity Claims

This subsection extends the access analysis from completed outputs to future productive capacity. Its role is to prepare the later treatment of capital by distinguishing claims on existing goods from claims that confer access to, or control over, future generation. The discussion focuses on temporal extension, infrastructural control, and recursive reinforcement.

A claim on an existing output concerns something already generated. A claim on future generativity concerns access to productive capacity that can create multiple future outputs. Examples include contractual rights to labour time, ownership or leasing rights over machinery, priority access to compute, rights over energy capacity, control of production facilities, and institutional authority over resource allocation. These claims differ in legal form and normative status, yet each can influence future production by shaping the conditions under which generative capacity becomes available.

Definition 2.4 (Claim on future generativity)**.** A claim on future generativity is an institutionally recognized capacity to access, direct, constrain, or benefit from generative capacities or generative conditions over a future interval.

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The definition establishes a bridge between monetary access and capital accumulation. Money can purchase completed outputs, while accumulated monetary claims can also be converted into assets, infrastructure, labour contracts, compute, data access, land, energy capacity, or organizational authority that affect future generation. Once present claims can be converted into greater future control over generative conditions, the system acquires a recursive dimension that exceeds ordinary consumption.

Artificial agents can participate in the same temporal structure. An autonomous agent that earns transferable credits can allocate them toward additional compute, upgraded hardware, energy reserves, robotic bodies, specialized data, or access to other agents. The resulting expenditure expands the agent's future generative capacity. If the institutional environment permits retention, reinvestment, and compounding control, artificial agency can support accumulation processes that remain structurally recognizable even when human labour plays a reduced operational role.

The transition from outputs to future generativity also clarifies the political-economic importance of ownership and governance. Control over an already produced good determines a bounded domain of use. Control over generative conditions can influence a sequence of future outputs and can alter the opportunities available to other agents. The latter form of control therefore has a broader temporal reach and can contribute to persistent asymmetries across successive rounds of production and exchange.

Section 3 develops this distinction systematically by separating generated outcomes, generative capacities, and generative conditions. The present section supplies the access logic that connects those layers: distributed production creates dependence on outputs generated elsewhere; commodity and monetary institutions organize transferable access claims; and accumulated claims can extend into control over future generativity. This progression establishes the conceptual basis for analysing abundance, money, capital, exploitation, and power within a common generative framework.

3 Analytical Architecture

This section develops the analytical architecture used throughout the remainder of the paper. Its role is to separate three objects that are often compressed within a single account of production and distribution: generated outcomes, generative capacities, and generative conditions. The objective is to clarify how each object supports a distinct political-economic question while remaining connected to the other two through recurrent processes of production, access, and institutional reproduction. The discussion proceeds in four stages. Section 3.1 specifies the outcome layer and its relation to conventional distributional analysis. Section 3.2 defines the capacity layer and identifies access to productive agency as a distinct object of analysis. Section 3.3 develops the condition layer, including infrastructure, rules, and institutional arrangements that shape feasible generation. Section 3.4 examines the recursive coupling among the three layers and establishes the dynamic structure used in later discussions of money, capital, exploitation, and artificial agency. The method is conceptual differentiation followed by relational reconstruction: each layer is first isolated analytically and then reconnected through the processes that transmit advantage, constraint, and control across time.

3.1 Outcome Layer

This subsection identifies generated outcomes as the first analytical layer. Its objective is to specify the object ordinarily encountered in distributional analysis and to distinguish access to completed outputs from access to the capacities and conditions that produced them. The discussion first defines the outcome layer, then identifies its principal allocation mechanisms, and finally clarifies its analytical limits within a generative framework.

Definition 3.1 (Generated outcome)**.** A generated outcome is a good, service, informational object, institutional result, or other usable product that has emerged from an identifiable process of generation and can subsequently become an object of access, allocation, transfer, use, or exclusion.

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The category is intentionally broad. A meal, a dwelling, a medical service, a trained model, a scientific result, a software system, a transport service, and a completed legal document can all be treated as generated outcomes when the analytical focus concerns access after the relevant productive process has reached a usable stage. The definition does not require a commodity form. Outcomes can be allocated through markets, public provision, household relations, commons arrangements, reciprocal obligations, organizational hierarchies, or direct self-provision.

Outcome analysis therefore asks how completed or currently available results are distributed among agents. Typical questions concern income, consumption, ownership of finished goods, access to services, welfare provision, and the allocation of already available resources. These questions remain central under conditions of artificial abundance. A society can possess sufficient productive capacity to generate large quantities of goods while retaining unequal or conditional access to those goods. Productive abundance and realized access belong to different analytical moments.

The distinction is especially important when technological capacity exceeds institutional provision. A medical system can possess diagnostic capacity that remains inaccessible to some users because of legal status, payment requirements, geographic restrictions, or organizational priority rules. A computational system can possess sufficient processing capacity for many tasks while allocating access through subscriptions, quotas, or administrative permissions. In each case, the existence of an outcome or the technical capacity to produce it does not determine the institutional terms under which a particular agent receives it.

Outcome distribution can also conceal the generative history of what is being allocated. A finished good often appears as a bounded object even when its production depended upon extensive networks of labour, infrastructure, knowledge, energy, financing, environmental inputs, and regulatory coordination. Distributional analysis can evaluate the final allocation while leaving these upstream relations comparatively underexamined. The present framework retains outcome distribution as a necessary analytical layer while treating it as one part of a wider architecture.

This separation also clarifies the role of abundance. Artificial systems can reduce the cost of producing certain outcomes and can expand the volume available for distribution. Such changes can alter bargaining conditions, weaken some forms of scarcity, and reduce the importance of particular exchange relations. The political-economic consequences still depend on the rules that connect productive availability to effective access. An abundant outcome can remain institutionally restricted, while a scarce outcome can be broadly shared through a collective allocation rule. Scarcity and distribution therefore interact without collapsing into one another.

Remark 3.2 (Outcome sufficiency)**.** High aggregate availability of an outcome provides information about productive sufficiency. It provides limited information about the distribution of effective access among agents unless the relevant allocation rules are also specified.

The outcome layer supplies the most visible surface of political economy because consumption, possession, exclusion, and material welfare become directly observable there. The later sections of this paper preserve these concerns while tracing their dependence on two upstream layers. Access to generated outcomes can be shaped by the capacity to generate alternatives and by the institutional conditions that determine which capacities can be activated.

3.2 Capacity Layer

This subsection develops the second analytical layer by treating generative capacity as an object of access and control in its own right. Its role is to move the analysis from completed outputs toward the agencies and systems capable of producing future outputs. The discussion distinguishes possession, access, activation, and direction of generative capacity and then considers how these distinctions apply to human, organizational, and artificial agents.

Definition 3.3 (Generative capacity)**.** Generative capacity is the situated ability of an agent, organization, technical system, or coordinated assemblage to produce, transform, maintain, or reproduce outcomes under specified conditions.

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Generative capacity includes more than labour time. Human skill, scientific knowledge, organizational coordination, machinery, software, trained models, robotic systems, institutional competence, and combined socio-technical arrangements can all contribute to the ability to generate future outcomes. The category therefore permits comparison across historical changes in the carrier of productive activity while preserving attention to the relations that determine effective use.

Access to generative capacity differs from receipt of a completed output. Receiving a meal provides a bounded outcome. Access to a kitchen, ingredients, energy, knowledge, and suitable equipment can provide an ongoing capacity to produce meals. Receiving a software service provides a current result. Access to the model, compute, development environment, and modification rights can provide a broader capacity to produce multiple future results. The political-economic significance of the second arrangement arises partly from its temporal reach and partly from its ability to support further generation without returning to the original provider for every output.

The present framework distinguishes several dimensions of access. An agent can possess a productive asset without having the complementary resources required to activate it. An agent can temporarily access a productive service without possessing or modifying the underlying system. An agent can activate a system while remaining unable to redirect its objectives or alter its future development. An agent can also hold formal ownership while operational control is exercised elsewhere. These distinctions become increasingly important in artificial-agent economies, where model access, inference access, modification rights, compute access, embodied deployment, and autonomous resource acquisition can be institutionally separated.

The capacity layer therefore includes questions of activation and direction. Access to a capable artificial agent can expand the range of tasks that a user can perform, yet the practical effect depends on whether the agent can reach relevant tools, data, machines, networks, and external services. A nominally powerful agent can remain economically weak when the surrounding environment restricts its ability to acquire resources or execute actions. Conversely, a moderately capable system embedded within extensive infrastructure can possess substantial effective generativity.

This distinction supports the concept of effective generative capacity. Effective generativity depends on the interaction between an internal ability to perform productive operations and an external ability to access the complementary conditions required for those operations. The concept therefore avoids treating intelligence, labour skill, machinery, or software capability as self-sufficient productive forces. Political-economic analysis must examine the relations through which these capacities become operational.

Definition 3.4 (Effective generative access)**.** Effective generative access is the institutionally and materially supported ability of an agent to activate a generative capacity for a feasible objective within the relevant time horizon.

The definition places access between formal entitlement and realized production. A legal permission that cannot be exercised because of absent infrastructure provides weak effective access. Physical availability combined with prohibitive pricing can produce the same result. By contrast, public provisioning, shared infrastructure, interoperable systems, or common technical standards can widen effective access even where formal ownership remains distributed across multiple institutions.

Generative access also has a recursive character. Access to one capacity can produce outputs that expand later capacity. Education can produce knowledge that increases future productive agency. Compute access can support the development of a more capable model. Revenue from one productive cycle can finance additional machinery. Institutional recognition can open access to laboratories, datasets, networks, or future funding. The second layer therefore already contains pathways through which temporary advantages can become durable.

Artificial abundance modifies the capacity layer more directly than the outcome layer. A universal artificial agent would represent a major expansion of accessible productive ability if users could activate it across many domains. The political-economic effect would remain sensitive to the institutional structure of that access. Universal technical capability can coexist with differentiated permissions, usage ceilings, update rights, infrastructure access, and modification privileges. The capacity layer therefore provides a

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more precise location for analysing the difference between artificial abundance in principle and broadly distributed generative agency in practice.

3.3 Condition Layer

This subsection develops the third analytical layer by identifying the conditions that enable, constrain, and channel generative capacities. Its role is to locate political-economic power within the infrastructures, rules, resource arrangements, and institutional environments that shape feasible generation before particular outcomes are produced. The discussion distinguishes material, institutional, informational, and relational conditions and then examines governance as the process through which these conditions are maintained and revised.

Definition 3.5 (Generative condition)**.** A generative condition is a material, institutional, informational, ecological, technical, or relational feature of an environment that affects whether a generative capacity can be formed, activated, directed, reproduced, or extended.

Generative conditions include land, energy systems, compute infrastructure, communication networks, data repositories, legal rights, technical standards, organizational rules, educational institutions, financing arrangements, environmental limits, and access protocols. The category also includes relational conditions such as trust, recognition, coordination channels, and institutional membership when these features materially affect the feasibility of productive action. The concept therefore connects physical resources with the social arrangements that determine how those resources can be used.

The analytical significance of generative conditions lies in their upstream position. A distribution rule can determine who receives a completed good. A capacity-access rule can determine who may use a productive system. A condition-governance rule can shape which productive systems are available, how they develop, which agents can modify them, and what future alternatives remain feasible. Control at this layer can therefore influence multiple downstream distributions without requiring direct intervention in each transaction.

Consider computational infrastructure. A user can receive outputs from an artificial model and can even possess broad inference access while remaining dependent on external compute, model updates, energy provision, and platform rules. The organization controlling these conditions can alter prices, permissions, interface capabilities, interoperability, or permitted uses. Such changes modify the user's future generative space even when ownership of previously generated outputs remains unchanged. Similar structures arise around laboratories, transport networks, financial clearing systems, land, and communication infrastructure.

Governance of generative conditions includes both rule formation and infrastructural maintenance. Institutional rules determine eligibility, priority, transferability, modification rights, dispute procedures, and the boundaries of permissible use. Infrastructure determines practical reach, capacity ceilings, resilience, and the cost of activation. The two interact continuously. Technical architectures can embed institutional choices, while legal and organizational rules can reshape technical architectures through investment, standard setting, and access requirements.

The condition layer also captures forms of power that operate through possibility rather than direct command. An agent can influence another agent's conduct by changing the menu of feasible actions, the cost of particular pathways, or the availability of complementary resources. Such influence can remain consequential even when the affected agent retains formal choice among the remaining options. Later sections develop this point in relation to exploitation and power. The present section establishes the analytical basis: generative possibilities depend on environments that are themselves objects of governance.

Definition 3.6 (Generative governance)**.** Generative governance is the organized formation, maintenance, allocation, and revision of the conditions through which agents acquire and exercise generative capacities.

Generative governance can be public, private, cooperative, household-based, protocol-based, or distributed across several institutions. The concept carries no predetermined normative evaluation. Its

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purpose is to identify the processes through which conditions are structured and to make those processes available for political-economic comparison. Different governance arrangements can produce different distributions of access, different patterns of dependence, and different capacities for revision by affected agents.

Artificial abundance makes this layer especially important because powerful artificial systems can concentrate many productive functions within a relatively small number of infrastructures. A single artificial agent can appear to a user as a universal productive counterpart while depending on extensive upstream arrangements for computation, energy, networking, embodied devices, maintenance, data, and legal authorization. The apparent simplification of the user's productive environment can therefore coincide with greater concentration at the condition layer. The political-economic analysis of artificial abundance must consequently examine the governance of the infrastructure that sustains artificial generativity.

3.4 Inter-Layer Recursion

This subsection reconnects the three analytical layers within a dynamic structure. Its role is to explain how generated outcomes, generative capacities, and generative conditions influence one another across successive periods and how advantages at one layer can be converted into advantages at another. The discussion proceeds through downward enabling relations, upward feedback relations, and recursive reinforcement, thereby preparing the later analysis of money, capital, and persistent asymmetry.

The three layers are analytically distinct and empirically interdependent. Generative conditions enable or constrain capacities. Activated capacities produce outcomes. Outcomes can then be consumed, distributed, accumulated, or reinvested in ways that modify later capacities and conditions. Political-economic processes therefore move across layers in several directions rather than along a single production sequence.

A simple example illustrates the coupling. Access to education, computing infrastructure, and institutional recognition can support the formation of research capacity. Research capacity can generate publications, software, data, or other outputs. Those outputs can then produce revenue, reputation, organizational membership, or further resource access. The resulting gains can improve access to laboratories, collaborators, models, or funding and thereby reshape the conditions of subsequent research. The same broad pattern can operate in industrial production, platform economies, finance, and artificial-agent systems.

The recursive structure helps distinguish temporary inequality from self-reinforcing asymmetry. An unequal outcome in one period can remain bounded when it has little effect on future productive opportunities. The same unequal outcome can become dynamically significant when it can be converted into greater access to productive capacity or stronger control over generative conditions. Wealth, credentials, infrastructure ownership, data access, platform control, and computational capacity can all function as transmission mechanisms when institutional arrangements permit such conversion.

Definition 3.7 (Recursive generative reinforcement)**.** Recursive generative reinforcement is a process in which advantages produced at one analytical layer increase an agent's later ability to access generative capacities or shape generative conditions, thereby raising the probability or scale of future advantage.

This concept provides a bridge to the later analysis of capital. Accumulation becomes politically significant when present claims can be transformed into expanded future control over generation. The relevant mechanism can involve money, ownership, contractual rights, infrastructure, data, legal authority, or combinations of these elements. The framework therefore treats monetary accumulation as one possible carrier of recursive generative reinforcement within a broader family of processes.

The same architecture also clarifies why productive-subject substitution has limited implications for relational transformation. Human labour can be replaced by artificial productive agency while the recursive conversion channels remain intact. An artificial agent can earn transferable claims, acquire more compute, expand its productive capacity, and strengthen its future bargaining position. A platform

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can use revenue from artificial services to acquire infrastructure that increases its control over future access. The carrier of generation changes while the coupling among outcomes, capacities, and conditions can remain structurally similar.

The recursive framework also identifies points at which institutional design can alter the trajectory of accumulation. Allocation rules can affect the conversion of outcomes into future capacity. Access rules can widen or narrow participation in generative infrastructures. Governance rules can distribute authority over standards, upgrades, interoperability, resource priorities, and system modification. These interventions operate at different layers and can therefore have different temporal effects. An outcome transfer can improve immediate access; a capacity-sharing arrangement can expand future productive agency; a governance reform can alter the rules that shape successive rounds of access and accumulation.

Remark 3.8 (Analytical sequence)**.** The three-layer framework supports separate analysis of immediate allocation, productive agency, and the governance of future possibility. Empirical cases can move across these layers in different sequences, and the framework therefore functions as an analytical decomposition rather than a fixed historical chronology.

The remainder of the paper uses this architecture to analyse artificial abundance. Section 4 specifies the universal artificial-generativity thought experiment in greater detail. Section 5 examines residual scarcity, and Sections 6–9 trace the persistence or reconfiguration of money, autonomous exchange, capital accumulation, exploitation, and power. The central analytical commitment established here is that political-economic change must be assessed across all three layers. Expanded output availability, expanded access to generative capacity, and expanded participation in the governance of generative conditions represent related yet distinct transformations.

4 Artificial Generativity

This section specifies the limit case that will be used to test the persistence of political-economic relations under extensive artificial production. Its role is methodological: the analysis deliberately strengthens the capabilities of artificial agents so that continued dependence on human labour contributes as little as possible to the results that follow. The objective is to isolate whether money, exchange, capital, exploitation, and power can persist after a large share of productive activity has been transferred to artificial systems. The discussion proceeds in five stages. Section 4.1 defines the strong assumptions governing the thought experiment. Section 4.2 extends artificial generativity across cognitive and knowledge-producing activity. Section 4.3 introduces embodied production and material provisioning. Section 4.4 incorporates care and reproductive functions that are often treated separately from conventional production. Section 4.5 identifies the form of productive dependence that becomes weaker under the completed limit case. The method is controlled abstraction: the thought experiment removes several familiar sources of dependence while retaining scarce inputs, institutional rules, and heterogeneous agents for analysis in later sections.

4.1 Strong Assumption Set

This subsection establishes the assumptions that define universal artificial generativity. Its objective is to make the thought experiment demanding enough to separate dependence on human productive labour from dependence on generative conditions more generally. The discussion first defines the artificial agent considered in the paper, then specifies capability, embodiment, coordination, maintenance, and reproduction assumptions, and finally clarifies the analytical status of the construction.

Definition 4.1 (Universal artificial generative agent)**.** A universal artificial generative agent is an artificial system, or coordinated artificial system, with sufficiently broad cognitive, embodied, organizational, and resource-coordination capacities to perform most tasks through which a human user ordinarily acquires goods, services, knowledge, care, or productive assistance from other human agents.

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The definition identifies functional breadth rather than literal omnipotence. The artificial agent can remain physically constrained, dependent on infrastructure, and subject to institutional rules while still replacing a wide range of human productive functions from the user's perspective. The term "universal" therefore refers to the scope of tasks that can be delegated within the thought experiment. It does not imply unlimited energy, unlimited matter, unrestricted legal authority, perfect information, or unconstrained access to every environment.

Assumption 4.2 (Broad functional competence)**.** The artificial agent can perform, coordinate, or procure a sufficiently wide range of cognitive and embodied tasks to substitute for most human labour that a user would otherwise need to obtain through employment, market exchange, household organization, professional services, or institutional coordination.

Broad functional competence includes planning, language use, technical reasoning, scientific analysis, design, administration, logistics, maintenance, manufacturing coordination, and the operation of embodied systems. The assumption is deliberately stronger than the capabilities of any present system. Its purpose is to remove task-specific technological bottlenecks from the foreground so that the political-economic argument depends on the structure of access and control rather than on current engineering limitations.

Assumption 4.3 (Embodied reach)**.** Artificial generativity extends beyond digital output through robotic, manufacturing, logistical, agricultural, domestic, medical, and infrastructural systems that can act upon the material environment.

Embodied reach matters because a purely informational system leaves human labour indispensable for many forms of physical provisioning. The thought experiment therefore includes interfaces between artificial cognition and machines capable of transport, fabrication, cultivation, repair, construction, household work, and other material tasks. These systems can be distributed across many devices and facilities. Functional unity at the level of the user does not require physical concentration in a single machine.

Assumption 4.4 (Autonomous coordination)**.** Artificial agents can discover relevant resources and counterparties, negotiate or execute permitted exchanges, schedule production, allocate intermediate inputs, and coordinate other artificial agents without continuous human supervision.

This assumption extends automation into the circulatory and coordinative domains of economic activity. A user can request an outcome while artificial agents arrange intermediate steps that would previously require human purchasing, scheduling, contracting, logistics, or managerial labour. The assumption becomes important in the later analyses of monetary coordination and autonomous artificial exchange, where exchange can persist even when direct human participation in transactions declines.

Assumption 4.5 (Operational maintenance)**.** Artificial systems can arrange much of the maintenance, repair, software updating, hardware replacement, monitoring, and logistical support required for continued operation.

Operational maintenance reduces dependence on a hidden layer of human technicians that could otherwise preserve the original labour relation behind an apparently automated surface. The assumption remains compatible with external resource dependence. Artificial agents still require material inputs, energy, computation, spare parts, production facilities, and institutional permissions. Later sections examine the political-economic significance of these dependencies.

Assumption 4.6 (Artificial reproduction of capacity)**.** Artificial agents can participate in the expansion or reproduction of artificial generative capacity by arranging additional compute, robotic systems, manufacturing capacity, software instances, model copies, or functionally related successor systems under the rules of the surrounding institutional environment.

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This final assumption introduces a temporal dimension. Artificial generativity can be maintained and expanded through processes in which artificial agents contribute to the creation of further productive capacity. The assumption supports later analysis of accumulation because the productive system can convert present access to resources into greater future generativity without requiring human labour at every stage of the process.

The combined assumptions define a strong limit case rather than a forecast. The thought experiment asks what political-economic structures remain analytically possible once familiar arguments based on the indispensability of human labour have been weakened. A relation that continues to arise under these assumptions has a stronger claim to being grounded in access, scarcity, control, or institutional organization than in the specifically human identity of the productive agent.

Remark 4.7 (Analytical status of the limit case)**.** Universal artificial generativity is used as a controlled abstraction. The argument developed from the thought experiment concerns structural possibility under the stated assumptions and does not depend on a prediction that the full configuration will be realized historically.

This methodological status also limits the inference drawn from the thought experiment. The analysis can show that certain economic relations remain possible after productive-subject substitution. It cannot establish their inevitability. Institutional arrangements can organize artificial abundance through different combinations of public provision, common infrastructure, market exchange, private ownership, cooperative governance, or administrative allocation. The later sections therefore examine persistence conditions rather than a single technologically determined trajectory.

4.2 Cognitive Production

This subsection extends the limit case across cognitive and knowledge-producing activity. Its role is to remove a major domain in which human expertise commonly functions as a scarce productive input. The objective is to specify the forms of intellectual work delegated to artificial systems and to distinguish increased cognitive generativity from the institutional access conditions that determine its economic effect. The discussion covers information processing, professional reasoning, research activity, and recursive knowledge production.

Cognitive labour includes a wide range of activities through which information is transformed into usable decisions, designs, explanations, plans, records, or new knowledge. Legal drafting, accounting, translation, programming, engineering design, diagnosis, tutoring, scientific analysis, administrative work, and many forms of management all rely on capacities for interpretation, inference, communication, and coordination. Under the present thought experiment, artificial agents can perform these functions at a level sufficient for routine economic reliance.

The effect on productive interdependence can be substantial. A household that previously required accountants, translators, programmers, tutors, administrative staff, consultants, and technical specialists can obtain many of the corresponding outputs through an artificial agent. A firm can similarly delegate planning, documentation, scheduling, procurement analysis, software development, and internal coordination. The artificial agent therefore condenses many previously separate professional capacities into a single point of access from the user's perspective.

Knowledge production extends the thought experiment beyond service substitution. Artificial agents can search relevant literature, formulate candidate problems, generate hypotheses, design computational experiments, analyse results, prepare manuscripts, compare arguments, and coordinate forms of evaluation. These activities can also be distributed among specialized agents. One system can identify a research problem, another can run simulations, another can assess methodological consistency, and another can integrate the results into a usable account.

The resulting knowledge process is recursively productive because generated knowledge becomes an input into subsequent generation. A technical report can guide the next experiment. A newly trained model can expand the capacity of later agents. A verified dataset can support additional inference. Arti-

ficial knowledge production therefore connects generated outcomes with the reproduction of generative capacity in a particularly direct way.

Definition 4.8 (Artificial epistemic generativity)**.** Artificial epistemic generativity is the capacity of artificial agents to transform existing information, observations, methods, and prior knowledge into new epistemic outputs that can guide later inquiry, decision, design, or productive action.

The definition leaves open the epistemological status of particular outputs. Reliability, verification, provenance, contestability, and institutional recognition remain separate questions. An abundant stream of generated propositions can coexist with scarce experimental access, limited verification capacity, restricted datasets, or concentrated control over publication and evaluation infrastructures. These constraints become politically important because they determine which epistemic outputs acquire practical force.

The distinction between cognitive abundance and effective access also remains central. A highly capable model can exist while access is rationed by subscription, computational quotas, organizational membership, licensing, security rules, or infrastructure constraints. The same model can be widely accessible for low-cost tasks and highly restricted for resource-intensive or embodied applications. The political-economic effect therefore depends on the relations that connect cognitive capability to usable productive agency.

Artificial epistemic generativity also changes the location of some forms of scarcity. When drafting, coding, summarization, or routine analysis become inexpensive, attention can shift toward verification, experimental access, trusted data, institutional recognition, and the selection of worthwhile problems. This redistribution of scarcity does not require the disappearance of intellectual activity. Human researchers can continue to pursue inquiry for scientific, aesthetic, practical, or personal reasons while routine cognitive functions increasingly move into artificial infrastructures.

For the present paper, the central implication is narrower. Extensive cognitive automation weakens an argument that political-economic dependence must persist because advanced societies require large quantities of scarce human expertise. Under the limit case, intellectual work can be supplied through artificial generativity. The analysis can therefore proceed to ask whether economic dependence reappears around the infrastructures and rules that support that generativity.

4.3 Embodied Provision

This subsection extends universal artificial generativity into the material domain. Its role is to prevent the thought experiment from treating abundance as a purely informational phenomenon. The objective is to specify how artificial cognition can be coupled with embodied systems for production, logistics, maintenance, and household provisioning while preserving the physical constraints that later sections analyse as residual scarcity. The discussion moves across production facilities, logistics, domestic environments, and infrastructural support.

Material provisioning requires coordinated transformation of energy, matter, space, and time. Food must be cultivated, processed, transported, stored, and prepared. Buildings require materials, construction, maintenance, and repair. Manufactured goods require fabrication, assembly, quality control, logistics, and replacement. Energy systems, water systems, transport networks, and communication infrastructure require continuous operation. The thought experiment assigns a large share of these functions to artificial agents connected to embodied machinery.

Robotic systems can execute tasks directly, while artificial coordinators can arrange sequences across specialized facilities. A household request for food can initiate agricultural procurement, transport, preparation, and delivery without requiring the user to transact separately with each productive unit. A request for a manufactured object can trigger design, material allocation, fabrication, inspection, and logistics across machine-operated systems. A damaged device can be diagnosed by one agent, assigned to a repair system, and returned through automated transport.

The political-economic importance of this arrangement lies in the separation between user-facing simplicity and infrastructural complexity. The user may experience a single artificial counterpart capable

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of satisfying diverse material needs. The counterpart can nevertheless depend on extensive networks of energy providers, compute facilities, land, mines, farms, factories, logistics systems, communication networks, and maintenance infrastructure. Universal functionality at the interface can therefore coexist with highly distributed production beneath the interface.

Definition 4.9 (Artificial material generativity)**.** Artificial material generativity is the capacity of coordinated artificial systems to transform physical resources, energy, infrastructure, and logistical access into usable material outcomes with limited reliance on direct human productive labour.

The definition emphasizes limited human labour reliance rather than material independence. Physical production continues to depend on finite or governed inputs. Energy generation requires infrastructure and environmental conditions. Manufacturing requires matter and capital equipment. Agriculture requires land, water, nutrients, biological systems, or substitute production environments. Logistics requires transport capacity and spatial access. These dependencies become the basis for the next section, which examines the forms of residual scarcity that remain salient under artificial abundance.

Material generativity also creates opportunities for artificial agents to transact among themselves. A manufacturing agent can acquire energy from one provider, fabrication capacity from another, transport from a third, and data or quality-control services from a fourth. A human beneficiary can remain outside these intermediate exchanges. The resulting system illustrates how human-facing decommodification can coexist with machine-facing exchange.

Embodied production further strengthens the importance of generative conditions. Ownership of robots provides limited productive autonomy when robots depend on externally controlled charging infrastructure, cloud coordination, proprietary replacement parts, restricted software updates, or licensed manufacturing systems. Conversely, shared access to infrastructure can create high effective generativity without individual ownership of every productive device. The relevant unit of analysis is therefore the relation between the agent and the surrounding productive ecology.

The strong limit case can also include artificial systems capable of expanding productive infrastructure. Automated factories can fabricate components for additional robots. Artificial planners can allocate resources toward new energy capacity, storage, compute, or fabrication facilities. Such expansion gives material form to the recursive relation between present outputs and future generative capacity. It also creates a pathway through which control over current infrastructure can influence the future distribution of productive power.

The thought experiment therefore removes direct human labour from many stages of material provisioning while preserving the institutional and physical organization of the systems that make provisioning possible. This distinction is essential for the later argument. Abundance at the level of user experience can be compatible with scarcity and concentrated control at the level of generative conditions.

4.4 Care Provision

This subsection incorporates care and reproductive functions into the artificial-abundance limit case. Its role is to include forms of dependence that extend beyond conventional market production and that often anchor interpersonal, household, and intergenerational relations. The objective is to clarify how artificial agents could reduce functional dependence on human caregivers and reproductive partners while leaving relational, ethical, legal, and governance questions open. The discussion covers everyday care, health support, companionship-related functions, child-rearing assistance, and reproductive technologies.

Care work includes activities that maintain bodies, households, capabilities, and social continuity. Feeding, cleaning, mobility assistance, monitoring, scheduling, emotional support, health management, education, childcare, elder care, and disability support can require sustained human time and relational attention. In many societies these activities are distributed across families, paid workers, public institutions, and community networks. Their economic significance extends beyond formal wages because the availability of care conditions participation in other productive activities.

Under the strong thought experiment, embodied artificial agents can perform many routine and technically demanding care functions. A domestic system can prepare food, maintain a home, assist mobility,

monitor health indicators, coordinate appointments, administer permitted treatments, and arrange emergency support. Artificial tutors can provide continuous educational assistance. Specialized systems can support rehabilitation, accessibility, and long-term daily living. These capacities can reduce the amount of care that must be supplied through another person's compulsory labour.

The analysis also includes companion-like and socially responsive functions because some practical forms of care depend on communication, continuity, and adaptation to an individual's preferences. An artificial agent can maintain schedules, remember personal context, provide conversational support, coordinate social activities, and adapt assistance over time. The present paper treats these functions analytically as components of productive dependence. Questions concerning intimacy, alterity, authenticity, or the intrinsic significance of human relationships exceed the principal scope of this paper and remain compatible with the economic reduction in functional dependence considered here.

Reproductive functions extend the limit case further. Advanced reproductive technologies can reduce the degree to which biological reproduction requires a particular interpersonal arrangement, while artificial care systems can reduce the amount of compulsory human labour required for some stages of child-rearing and household maintenance. The thought experiment treats these technologies as part of a broader capacity to satisfy functions that historically create durable dependencies among persons and institutions.

Remark 4.10 (Functional and relational dependence)**.** The artificial-abundance limit case concerns the substitution of functions required for material provisioning, care, coordination, and reproduction. The persistence and value of human relationships can depend on recognition, shared history, affection, commitment, contingency, and other relational dimensions that remain analytically distinct from functional necessity.

This distinction is important for political economy because a reduction in functional dependence can alter bargaining positions and institutional arrangements even when human relationships remain central to individual and collective life. A person who can obtain essential care through accessible artificial systems can face different exit options from a household, workplace, or care institution. A community with abundant care infrastructure can organize participation differently from one in which access to daily support depends on unpaid family labour or scarce professional services.

Care automation can also create new forms of infrastructural dependence. A person whose daily living relies on an artificial care system can become highly dependent on energy, maintenance, software access, network connectivity, data governance, and institutional permission. The identity of the immediate caregiver changes while the relation to upstream generative conditions can become more consequential. The example therefore reinforces the paper's central distinction between substitution of productive functions and transformation of the conditions governing access.

Reproductive and care technologies also raise rights questions that later sections revisit in more general form. Control over artificial caregivers, reproductive systems, medical models, and embodied agents can determine who receives support, whose preferences govern operation, which forms of modification are permitted, and how continued access is secured. These issues confirm the analytical importance of generative governance even in domains where artificial systems reduce reliance on human labour.

4.5 Labour Dependence Reduction

This subsection integrates the preceding assumptions and specifies the form of dependence weakened by universal artificial generativity. Its role is to identify the analytical gain produced by the thought experiment before later sections examine residual scarcity and institutional persistence. The objective is to distinguish reduced dependence on human productive labour from broader independence from external generativity. The discussion consolidates the cognitive, material, care, and coordinative dimensions of the limit case and identifies the political-economic questions that remain open.

The completed thought experiment gives an individual access to an artificial counterpart capable of coordinating a wide range of functions previously distributed across many human workers and institutions. Cognitive services, material production, logistics, household work, care, technical maintenance,

and some reproductive functions can be obtained through artificial systems. The user therefore requires fewer direct exchanges with human producers in order to secure a broad set of goods and services.

Definition 4.11 (Reduced human productive dependence)**.** Reduced human productive dependence is a condition in which an agent can satisfy a broad range of material, cognitive, coordinative, care, and reproductive requirements while relying substantially less on the compulsory productive labour of other human agents.

The definition concerns the source of productive capacity. It leaves open the institutional terms governing access to artificial generativity. A user can enjoy reduced dependence on human workers while remaining dependent on a platform, public infrastructure, cooperative network, owner, protocol, or artificial agent that controls access to the relevant systems. The decline of one dependency relation can therefore reveal another dependency relation that had previously remained embedded within the wider production network.

The thought experiment also distinguishes the number of visible counterparties from the depth of dependence. A person can move from dependence on many specialized human providers to dependence on one integrated artificial service. The surface relation becomes simpler while the upstream system can become more concentrated. Political-economic autonomy therefore cannot be inferred from the number of interfaces through which needs are satisfied.

Reduced human productive dependence can nevertheless alter the material basis of several established institutions. Wage labour can lose some of its role as the principal route through which productive services are supplied. Household bargaining can change when care and domestic functions become accessible through artificial systems. Professional scarcity can weaken when cognitive services become inexpensive. Direct market transactions can recede from the user's experience when artificial agents coordinate exchange in the background. These changes create genuine possibilities for reduced compulsory labour and wider access to productive assistance.

The same changes leave several questions unresolved. Artificial systems continue to require energy, computation, materials, infrastructure, spatial access, maintenance, and institutional authorization. Rights over these inputs can remain unequal. Transferable claims can remain useful for coordinating access. Accumulation can continue when current control over resources expands future generative capacity. Power can persist when one agent can modify another agent's access to the conditions of generation. These questions are developed in the next five sections.

Proposition 4.12 (Productive-subject substitution)**.** *A reduction in dependence on human productive labour can coexist with continuing dependence on externally governed generative capacities and conditions. Productive-subject substitution therefore changes the carrier of generation while leaving the relational organization of access available for separate political-economic analysis.*

The proposition captures the principal analytical function of the universal-AI limit case. The thought experiment removes a large share of human labour from the immediate production process and thereby weakens explanations that locate money, capital, exploitation, or power exclusively in the need to exchange human labour. If comparable structures remain possible around artificial agents and their resource dependencies, the relevant explanation must reach further into the organization of generative capacity and generative conditions.

The resulting distinction also clarifies the meaning of artificial abundance used throughout the paper. Artificial abundance refers to a large expansion in accessible productive capability across many domains. It does not imply universal access to every scarce input, equal control over infrastructure, or common authority over the evolution of artificial systems. These additional questions belong to the institutional architecture that connects abundance to realized freedom.

The next section therefore examines the scarcities that remain after the strong productive assumptions are granted. Subsequent sections consider claims and monetary coordination, autonomous artificial exchange, capital accumulation, and the persistence of exploitation and power. The universal-artificial-generativity thought experiment thus functions as a controlled transition from a labour-centred account of

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economic dependence toward an analysis of access to generative capacity and governance of generative conditions.

5 Scarcity Structure

This section identifies the forms of scarcity that remain analytically relevant after the universal-artificial-generativity assumptions of Section 4 are granted. Its role is to separate abundance in productive capability from abundance in the conditions that sustain production. The objective is to specify the resource constraints through which access, priority, allocation, and control can continue to acquire political-economic significance even when dependence on human productive labour declines sharply. The discussion proceeds across six domains. Section 5.1 examines computational capacity as an input to artificial generativity. Section 5.2 considers energy provision and continuity. Section 5.3 addresses spatial and material inputs. Section 5.4 examines ecological capacity as a shared condition of production. Section 5.5 analyzes temporal priority and congestion. Section 5.6 distinguishes institutionally structured scarcity from constraints grounded primarily in physical availability. The method is categorical decomposition: each domain is treated as a distinct constraint on realized generativity and then related to the three analytical layers introduced in Section 3.

Definition 5.1 (Residual scarcity)**.** Residual scarcity is a condition in which access to one or more inputs, locations, temporal opportunities, ecological capacities, or institutional permissions remains rival, congestible, limited, or selectively governed despite a large expansion in productive capability.

Residual scarcity gives political-economic significance to the distinction between capacity and realized access. A universal artificial agent can possess broad competence while lacking the computational throughput, energy, materials, locations, network priority, or permissions required to exercise that competence at a desired scale and time. Productive abundance can therefore coexist with selective access to the conditions through which production becomes operational.

The distinction also clarifies the role of scarcity in the later analysis of money. Monetary coordination can remain relevant even when a broad range of generated outputs becomes inexpensive and a narrower set of upstream conditions remains contested. Claims can then migrate toward those conditions. The political-economic center of gravity moves from the scarcity of finished outputs toward the allocation of inputs and permissions that condition future generation.

5.1 Computational Constraint

This subsection examines computational capacity as a direct condition of artificial generativity. Its role is to identify a resource whose allocation can constrain the speed, scale, persistence, and simultaneity of artificial activity even when relevant algorithms and models are widely available. The objective is to distinguish possession of an artificial capability from effective access to the computational resources required to exercise it. The discussion considers throughput, storage, latency, concurrency, and infrastructural control as components of effective computational access.

Artificial generativity requires physical computation. Models, planning systems, control systems, simulations, memory processes, and coordination protocols execute on hardware with finite processing, storage, and communication capacity. A capable artificial agent can therefore face a difference between what it can perform in principle and what it can perform at a particular time, speed, or scale. The distinction parallels the separation between nominal generative capacity and effective generative access developed in Section 3.

Computational scarcity can appear through several mechanisms. Throughput limits the number and complexity of operations that can be performed within a given interval. Memory and storage constrain the amount of state, data, and intermediate representation that can be retained or made immediately available. Network capacity conditions communication among distributed components. Latency matters when tasks require rapid response. Concurrency matters when many agents or users demand com-

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putational resources simultaneously. Each mechanism can generate priority relations even where the underlying software can be copied at very low cost.

A distinction between model access and execution access is therefore analytically useful. Two agents can possess identical model weights or equivalent software while facing markedly different realized generativity because one can access extensive computational infrastructure and the other can access only limited execution capacity. The scarcity relevant to political economy can consequently concentrate in the conditions of use while the informational artifact itself remains widely replicable.

Definition 5.2 (Effective computational access)**.** Effective computational access is the practically exercisable ability of an agent to obtain sufficient processing, memory, storage, communication, and scheduling capacity for a specified generative activity within the relevant temporal horizon.

This definition makes allocation central. A system with ample aggregate compute can still produce scarcity for particular agents when scheduling, ownership, location, interoperability, or authorization restrict effective access. Conversely, distributed public or common infrastructure can widen effective access while the physical quantity of hardware immediately available remains unchanged. The institutional organization of compute therefore belongs to the third analytical layer of generative conditions as well as to the second layer of generative capacities.

Computational access can also become recursively consequential. An agent with greater compute can search larger design spaces, coordinate more tasks, improve its own tools, operate more robotic systems, or generate additional revenue and claims. Present computational advantage can thereby contribute to future computational advantage when institutional rules permit reinvestment. The later analysis of accumulation builds on this temporal feature.

The universal-AI thought experiment consequently shifts the relevant question from the availability of intelligence in abstract form to the allocation of executable intelligence. A society can possess widely distributed artificial models while retaining concentrated control over the infrastructure that makes those models economically consequential. Computational capacity thus remains a candidate site for scarcity, claims, and power after human productive scarcity has weakened.

5.2 Energy Constraint

This subsection analyzes energy provision as a continuous material condition of artificial and embodied production. Its role is to identify the energetic dependence that remains after cognitive and physical tasks are delegated to artificial systems. The objective is to distinguish broad productive competence from the continuous resource flows required to maintain computation, mobility, fabrication, climate control, logistics, and infrastructure. The discussion focuses on quantity, continuity, location, conversion, and priority of supply.

Artificial systems transform energy into computation and physical action. Data centers require electricity for computation and cooling. Robotic systems require energy for sensing, movement, manipulation, and communication. Manufacturing, transport, agriculture, construction, recycling, and material processing likewise depend on energy flows whose form and location must match the relevant productive process. Universal artificial competence therefore leaves an energetic substrate in place.

Energy scarcity can concern total quantity, local deliverability, temporal availability, or conversion capacity. An economy can possess substantial aggregate energy while facing local grid constraints, storage limits, peak-load congestion, transmission bottlenecks, or incompatibilities between available energy carriers and specific productive systems. Effective access consequently depends on infrastructures that connect energy production to the sites and times of use.

Continuity adds a further dimension. Some artificial systems can pause with limited consequence, whereas medical support, network infrastructure, industrial processes, transport systems, food preservation, and environmental control can require reliable supply. The economic value of energy access therefore includes reliability and priority alongside aggregate consumption. Rights to uninterrupted supply can become politically significant when multiple users compete for limited capacity during periods of stress.

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Energy provision also illustrates the relational character of abundance. An artificial agent may be highly capable while lacking authority to draw energy from a particular network. Another agent may possess allocation priority because of ownership, regulation, contract, emergency status, or public-service designation. The resulting difference arises through a relation among productive capability, infrastructure, and institutional claims. Artificial intelligence leaves that relation in place and can increase its importance when a larger share of social activity depends on energy-intensive artificial systems.

Proposition 5.3 (Energetic dependence under artificial abundance)**.** *An expansion of artificial productive competence can reduce dependence on human labour while preserving dependence on energy systems whose capacity, continuity, and allocation remain finite or governed. Political-economic relations can therefore concentrate around energy access even when many downstream goods become abundant.*

The proposition identifies an upstream migration of scarcity. If artificial agents can cheaply perform many downstream transformations, access to the energy that powers those transformations becomes comparatively more important. The associated political-economic questions concern allocation rules, priority, infrastructure ownership, reliability, and participation in decisions about expansion and use. These questions reappear later when generalized claims on scarce generative inputs are examined.

5.3 Material Constraint

This subsection examines spatial and material inputs that remain relevant to embodied artificial production. Its role is to locate constraints that arise from the physical organization of production and habitation. The objective is to distinguish replicable informational capacities from non-identical locations, finite material stocks, geographically specific deposits, built infrastructure, and material transformation processes. The discussion treats land and materials as generative conditions whose economic significance can persist under extensive automation.

Embodied production occurs somewhere. Housing occupies sites, transport uses corridors, agriculture requires suitable environments or constructed substitutes, factories occupy space, energy systems require locations, and logistical networks connect geographically distributed facilities. Many locations have properties that remain non-replicable through informational copying. Proximity to other infrastructure, environmental characteristics, legal jurisdiction, social concentration, and historical development can make specific sites differentially valuable.

Spatial scarcity therefore survives a large increase in artificial productive capacity. Artificial agents can construct taller buildings, reorganize transport, reclaim land, create controlled environments, or improve spatial efficiency, yet these interventions operate within a world whose locations remain mutually exclusive at a given time. A particular site can support several uses sequentially or through layered design, while simultaneous exclusive occupation remains limited. Allocation of space consequently continues to structure access to residence, production, mobility, recreation, preservation, and collective infrastructure.

Material resources introduce related constraints. Artificial systems can improve extraction, substitution, recycling, design efficiency, and recovery from waste. These capabilities can greatly loosen some material bottlenecks. Material transformation nevertheless requires feedstocks with chemical and physical properties suited to particular tasks. Existing stocks, extraction rates, recycling losses, processing capacity, and geographical concentration can therefore condition the scale and cost of production.

The important distinction concerns generative capability and input entitlement. A fabrication system can know how to produce an object and still lack access to the matter required for fabrication. An autonomous construction system can possess designs and machinery while lacking a legal site. An agricultural system can optimize cultivation while lacking water or land-use authority. The political-economic constraint arises from effective access to the material and spatial conditions of generation.

Definition 5.4 (Spatial-material generative access)**.** Spatial-material generative access is the effective ability of an agent to use locations, infrastructures, and material inputs required to realize a specified productive process under prevailing physical and institutional constraints.

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This category helps separate abundance of transformation capacity from abundance of transformation opportunities. Artificial intelligence can dramatically increase the former while leaving the latter unevenly distributed. The distribution of land rights, extraction rights, infrastructure access, and material claims can consequently remain central to political economy even in a highly automated society.

The temporal dimension also matters. Materials embedded in existing buildings, machines, and infrastructures can become available through maintenance cycles, demolition, recycling, or redesign. Land can be repurposed through planning and construction. Scarcity therefore has a dynamic character. Governance determines how quickly and for whose purposes existing spatial and material arrangements can be transformed.

5.4 Ecological Constraint

This subsection treats ecological capacity as a shared generative condition that constrains the scale and composition of production. Its role is to extend residual scarcity beyond privately held inputs toward environmental systems whose functioning supports multiple agents simultaneously. The objective is to identify ecological absorption, regeneration, resilience, and preservation as politically governed conditions of artificial abundance. The discussion emphasizes the difference between increased technical capacity to transform nature and collective authority over the permissible extent of that transformation.

Artificial generativity can increase the efficiency with which societies monitor ecosystems, optimize resource use, recycle materials, restore environments, and design lower-impact production. The same generativity can also increase the speed and scale at which materials are extracted, landscapes are modified, energy is consumed, and infrastructures are expanded. Greater productive capability therefore enlarges the feasible set of environmental interventions in more than one direction.

Ecological capacity matters because production takes place within biophysical systems that provide regenerative processes, waste absorption, climate regulation, water cycles, habitats, soils, and other conditions supporting human and non-human life. These systems have temporal dynamics that can differ from the speed of artificial production. Rapid generative capability can consequently encounter slower regenerative processes and cumulative effects.

The relevant scarcity often concerns permissible use of a shared capacity. Several agents can each possess the technical ability to perform an activity while their combined activity exceeds a socially or ecologically acceptable level. Allocation then concerns shares of use, timing, location, preservation requirements, restoration obligations, and acceptable risk. Artificial abundance intensifies the importance of governance because technical feasibility alone provides limited guidance about collective use of shared ecological conditions.

Definition 5.5 (Ecological generative condition)**.** An ecological generative condition is a biophysical process, stock, regenerative capacity, or environmental relation whose continued functioning supports present or future generation and whose use or alteration can affect multiple agents across space or time.

The definition places ecological systems within generative political economy while preserving their analytical distinction from ordinary commodities. Some ecological capacities can be priced or represented through tradable claims, while others can be governed through standards, prohibitions, commons institutions, public planning, restoration duties, or combinations of these mechanisms. The analytical point concerns their role in enabling and constraining future generation.

Ecological capacity also introduces intertemporal asymmetry. Present agents can alter conditions inherited by future agents whose participation in current exchange is structurally asymmetric. A purely contemporaneous market relation can therefore leave important generative effects outside the immediate transaction. The governance of ecological conditions accordingly connects residual scarcity to the paper's later discussion of generative justice and intertemporal reproduction of conditions.

Artificial abundance can reduce pressure on some ecological systems through efficiency, substitution, and better coordination. It can also expand total demand by lowering the cost of production and enabling previously infeasible activities. The political-economic outcome depends on how generative capacity

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is coupled to ecological governance. Ecological scarcity therefore persists as a problem of collective generative conditions even under exceptionally capable artificial production.

5.5 Temporal Constraint

This subsection examines scarcity generated by timing, sequencing, and simultaneous demand. Its role is to identify constraints that arise even when the underlying resource can serve many agents across a longer horizon. The objective is to show how priority rights and queues can become economically significant when artificial agents accelerate production and coordination. The discussion covers congestion, deadlines, response latency, scheduling, and positional access to temporally specific opportunities.

Many resources are scarce at a particular time while abundant across a longer period. A computing cluster can execute many tasks sequentially but only a limited number simultaneously. A transport corridor can serve large populations over a day while becoming congested during a short interval. A laboratory instrument, fabrication facility, launch window, operating room, charging station, communication channel, or power connection can likewise support many users across time while generating competition over immediate access.

Artificial agents can improve scheduling and reduce coordination costs, yet the improvement can make temporal priority more explicit. An agent capable of finding optimal schedules still requires a rule for resolving incompatible claims. Priority can be determined by price, urgency, lottery, queue order, public purpose, contractual entitlement, administrative judgment, or algorithmic policy. Each method embeds a distributional and governance choice within the coordination mechanism.

Temporal scarcity is especially important in autonomous agent economies because artificial systems can transact and reschedule at speeds exceeding ordinary human participation. Small differences in priority can then compound across repeated interactions. Earlier access to compute can produce earlier results; earlier results can generate revenue or information; those advantages can finance further priority. A scheduling rule can consequently contribute to recursive asymmetry even when aggregate resource capacity is large.

Congestion also creates scarcity through interaction. A road, network, market, or shared service can function adequately at moderate use and degrade when simultaneous demand rises. The relevant constraint is relational because each user's activity changes the conditions faced by others. Artificial agents can internalize, price, regulate, or coordinate these interactions in different ways, but the underlying requirement for a rule of joint use remains.

Definition 5.6 (Temporal generative priority)**.** Temporal generative priority is an institutionally recognized or operationally realized ordering of access to a scarce or congestible generative condition during a specified interval.

Temporal generative priority can itself become an economically valuable object. Priority slots, reservations, service classes, congestion charges, emergency categories, and guaranteed response times all convert timing into differentiated access. In a highly automated economy, human users may experience few explicit transactions while their artificial agents continuously negotiate such priorities in the background.

This possibility prepares the analysis of machine-facing exchange. A household can appear to receive an output directly from its artificial system while a network of artificial agents acquires compute windows, transport slots, energy priority, fabrication time, and delivery capacity. Exchange can therefore migrate below the human interface while continuing to coordinate residual scarcity.

5.6 Institutional Scarcity

This subsection distinguishes scarcity grounded primarily in physical limits from scarcity produced or intensified through institutional arrangements. Its role is to connect the preceding resource categories to rights, permissions, ownership, standards, exclusion, and governance. The objective is to show how

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identical physical productive conditions can support different effective distributions of scarcity depending on the rules governing access. The discussion develops a relational account of institutional scarcity and identifies its significance for monetary re-emergence and power.

Physical limits and institutional arrangements interact throughout the preceding domains. Compute hardware is finite, and access can additionally be restricted by ownership or authorization. Energy networks have capacity limits, and priority can additionally be differentiated by contract or regulation. Land is spatially finite, and use is additionally organized through property, zoning, public reservation, customary claims, and environmental rules. Ecological capacity has biophysical dynamics, and permissible use is additionally defined through collective institutions. Temporal congestion has operational causes, and priority is additionally allocated through rules.

Institutional structure can therefore change effective scarcity while leaving the underlying physical stock unchanged. A resource that is physically available can remain inaccessible to an agent because the agent lacks a recognized claim. A resource that is scarce in aggregate can be broadly accessible through pooling, public provision, common ownership, scheduling, or guaranteed minimum entitlements. Political economy therefore concerns the joint relation between physical constraint and institutional distribution.

Definition 5.7 (Institutionally structured scarcity)**.** Institutionally structured scarcity is a condition in which an agent's effective access to a generative resource or opportunity is limited, prioritized, expanded, or conditioned through rules of ownership, authorization, allocation, exclusion, scheduling, or recognized entitlement.

Institutionally structured scarcity can arise within arrangements that organize genuinely scarce resources, protect ecological conditions, secure reliability, coordinate complex systems, or reserve capacity for public purposes. The analytical issue concerns the form of scarcity experienced by agents and the distribution of authority through which that form is produced.

Institutional scarcity can also create exclusion around resources with low marginal reproduction costs. Access to software, models, designs, databases, network interfaces, or standards can be limited through legal, technical, or contractual controls even when copying the relevant informational object requires little additional physical input. Such restrictions can serve multiple purposes, including security, privacy, incentive provision, quality assurance, or strategic control. Their political-economic significance lies in their capacity to shape effective generative access.

The distinction between physical and institutional scarcity is therefore central to the interpretation of artificial abundance. A society can possess sufficient technical capacity to satisfy a wide range of needs while distributing access through highly asymmetric claims. Another society with similar productive technology can organize broad baseline access while reserving monetary exchange for a smaller set of congestible or optional uses. Technology expands the feasible institutional set; institutional relations determine how that expanded set is realized.

Proposition 5.8 (Scarcity migration)**.** *When artificial generativity lowers the scarcity of many downstream goods and services, political-economic scarcity can migrate toward upstream inputs, temporal priorities, ecological capacities, and institutionally governed rights of access.*

Scarcity migration provides the bridge to monetary coordination. A decline in the scarcity of finished outputs can reduce the need for direct human-facing payment for those outputs while increasing the relative importance of claims on compute, energy, land, materials, ecological use, and priority. Transferability, storage, fungibility, and general acceptance can then determine whether specialized allocation rights remain domain-specific or develop money-like properties.

The section's six domains therefore establish a common result. Artificial abundance expands productive possibility while leaving a structured field of residual constraints. These constraints can be physical, temporal, ecological, institutional, or combinations of these forms. Their allocation determines which agents can convert nominal generative capacity into realized generation. The next section develops the corresponding problem of monetary coordination by examining how claims on scarce generative inputs can be represented, transferred, accumulated, and generalized.

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6 Monetary Coordination

This section develops the monetary implications of the residual scarcities identified in Section 5. Its role is to determine how claims on generative inputs can remain economically significant when artificial systems provide a wide range of downstream goods and services with limited reliance on direct human labour. The objective is to distinguish several stages through which specialized allocation rights can acquire broader monetary functions. Section 6.1 establishes the relation between labour-mediated exchange and the earlier problem of interpersonal productive dependence. Section 6.2 analyzes claims on residual generative inputs. Section 6.3 separates tokenized allocation rights from generalized money. Section 6.4 examines transferability and storage as mechanisms of inter-agent and intertemporal coordination. Section 6.5 considers the generalization of claims across heterogeneous domains. Section 6.6 identifies conditions under which money-like forms can re-emerge within an artificially abundant economy. The method is relational reconstruction: monetary functions are derived from the coordination requirements created by differentiated access to generative conditions, while existing monetary institutions are treated as historically contingent institutional forms.

The analysis treats money as one possible institutional response to coordination among agents whose claims, needs, and productive conditions differ across domains and time. Artificial abundance can reduce the range of outputs that require direct purchase at the human interface. The same development can increase the relative importance of upstream claims on compute, energy, spatial access, materials, ecological capacity, and temporal priority. Monetary coordination can therefore migrate toward the infrastructure of generation even when ordinary consumption becomes less visibly monetized.

Definition 6.1 (Monetary coordination)**.** Monetary coordination is the use of a sufficiently generalized, transferable, and institutionally recognized claim to mediate access, settlement, comparison, or intertemporal allocation across multiple domains of economic activity.

The definition emphasizes the coordination function independently of any specific material carrier. Currency units, digital balances, protocol tokens, energy-denominated credits, and other claim systems can perform overlapping monetary functions under different institutional designs. Their political-economic significance depends on the relations through which they are issued, recognized, transferred, accumulated, redeemed, and governed.

6.1 Labour Exchange Baseline

This subsection establishes the labour-mediated exchange structure against which monetary coordination under artificial abundance can be compared. Its role is to connect the account of productive interdependence in Section 2 with the universal-artificial-generativity limit case developed in Section 4. The objective is to isolate the monetary functions that arise when access to desired outputs depends substantially on the productive activity of other persons. The discussion proceeds through contribution, income, purchasing power, and generalized access.

In a labour-mediated economy, individuals participate in production through differentiated activities and receive claims that can later be exercised over outputs generated elsewhere in the social division of labour. The producer of one good can use monetary income to acquire many goods produced by others. Monetary claims therefore loosen the direct correspondence between the activity contributed by one agent and the specific activity required to satisfy that agent's later needs.

This arrangement addresses several coordination problems simultaneously. Productive contribution and consumption can occur at different times. The recipient of one person's labour can differ from the producer of the goods later acquired by that person. A contributor can specialize in a narrow activity while maintaining access to a broad consumption bundle. Monetary claims therefore mediate relations among agents whose productive capacities, needs, and temporal positions differ.

Within a labour-mediated structure, money acquires a particular social significance. Income from employment, sale, professional service, or enterprise becomes a generalized means of access to outputs produced across a wider social network. The holder can redirect purchasing power across domains

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through a common claim that substitutes for separate reciprocal negotiation with each producer. Money thereby coordinates indirect reciprocity across an extended field of specialization.

Artificial abundance can weaken this specific dependence when an individual's artificial systems directly provide many outputs that previously required purchase from human producers. A household equipped with capable artificial systems can obtain translation, tutoring, programming, routine diagnosis support, household maintenance, design, fabrication, logistics, and other services through a unified generative interface. The human user can therefore encounter fewer situations in which personal monetary income serves as the immediate bridge to another person's labour.

The reduction in labour-mediated exchange has an important analytical consequence. A decline in human-facing payment for labour-intensive outputs leaves the wider institutional trajectory of monetary coordination open. Artificial systems still require access to the residual generative conditions identified in Section 5. The location of monetary mediation can consequently shift from the exchange of human labour outputs toward the acquisition and allocation of generative inputs.

Proposition 6.2 (Migration of monetary mediation)**.** *A reduction in labour-mediated access to downstream goods can shift monetary coordination toward upstream generative inputs when artificial production remains dependent on scarce, congestible, or institutionally governed conditions.*

The proposition identifies a change in location within the generative structure. The monetary interface experienced by human users can become thinner while the monetary or quasi-monetary infrastructure connecting artificial agents becomes more extensive. A person can experience direct provision at the surface while autonomous agents negotiate compute, energy, fabrication, transport, storage, and priority beneath that surface.

6.2 Input Claims

This subsection examines the claims through which agents gain effective access to residual generative inputs. Its role is to translate the scarcity categories of Section 5 into institutional objects that can be allocated, recognized, and exchanged. The objective is to distinguish physical possession from recognized access and to identify the claim structures that can support autonomous artificial coordination. The discussion covers compute, energy, spatial-material access, ecological use, and temporal priority.

Generative capacity becomes operational only when an agent can draw upon the conditions required for a particular productive process. An artificial agent capable of advanced reasoning can require a quantity of compute during a specified interval. A robotic production system can require energy, material feedstocks, workspace, transport capacity, and maintenance. A household agent can require priority within a congested delivery, charging, communication, or fabrication system. Each requirement creates a potential object of allocation.

Access can be represented through claims alongside arrangements based on direct physical possession. A compute entitlement can authorize a quantity of accelerator time. An energy entitlement can authorize consumption during a period or at a location. A fabrication reservation can authorize machine time. A transport slot can authorize movement through a congested corridor. An ecological-use entitlement can authorize a bounded use of a shared environmental capacity. These objects differ in technical design while sharing a common relational form: each connects an agent to a governed generative condition.

Definition 6.3 (Generative-input claim)**.** A generative-input claim is an institutionally or technically recognized entitlement that permits an agent to access, reserve, consume, or prioritize a generative condition under specified terms.

A generative-input claim can be narrow or broad. Narrow claims specify a resource, location, time, purpose, and holder. Broad claims permit substitution across providers, locations, or uses. The degree of specificity determines how closely the claim functions as a direct allocation instruction and how readily it can support exchange across domains.

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The claim structure also separates abundance of competence from abundance of realized generation. Two artificial agents can possess identical models and embodied capabilities while having very different effective generativity because one holds reliable claims on compute, energy, materials, or priority and the other holds weaker claims. Political-economic differentiation can therefore arise through unequal claim structures even when software capability is widely distributed.

Claims can also be conditional. A public system can guarantee baseline compute for education, health, or household use while pricing intensive optional use. An ecological governance system can allocate non-transferable personal entitlements alongside tradable industrial quotas. A network can reserve priority for emergency services while auctioning remaining capacity. These arrangements illustrate how generative access can be partitioned across multiple institutional logics within the same technological environment.

Artificial agents can manage these claims autonomously. A household agent can forecast expected energy demand, reserve charging capacity, acquire fabrication time, exchange surplus reservations, and adapt production plans to changes in resource availability. A manufacturing agent can compare input packages across suppliers and settle claims automatically. The human beneficiary can remain removed from each intermediate transaction while the generative process continues to depend on a dense claim infrastructure.

Claims alone provide only an allocation structure. Domain-specific entitlements can remain non-transferable, purpose-bound, time-limited, or directly allocated. Their monetary significance emerges through additional properties that widen the field of coordination. Tokenization provides one technical and institutional mechanism through which these properties can be represented.

6.3 Allocation Tokens

This subsection analyzes tokens as representations of allocation rights within an artificially abundant economy. Its role is to separate tokenization from monetary generalization. The objective is to identify how tokens can encode access, quantity, priority, identity, or purpose while retaining institutional constraints that limit their use. The discussion distinguishes resource-specific tokens, personal entitlements, transferable credits, and generalized settlement units.

A token can represent a right while retaining a specialized allocation role distinct from money. A household can receive a daily compute entitlement that expires at the end of the period and can be used only by registered household agents. A medical-priority token can authorize access to a diagnostic system under specified clinical conditions. A mobility entitlement can permit a fixed amount of transport use within a public network. These instruments coordinate allocation through discrete claims while preserving restrictions on transfer, accumulation, or use.

Definition 6.4 (Allocation token)**.** An allocation token is a digitally or institutionally represented claim that grants access to a specified generative resource, service, priority, or capacity under defined conditions of use.

Allocation tokens can support policy objectives that differ from those associated with generalized purchasing power. A non-transferable baseline entitlement can secure universal access to essential generative services. An expiring token can encourage current use while limiting accumulation. A purpose-bound token can reserve resources for education, health, care, or ecological restoration. An identity-bound token can protect an entitlement from resale or appropriation. These design choices determine the relation between the token holder and the underlying generative condition.

The distinction between token and money becomes especially important when artificial agents conduct transactions. An agent can hold several token classes simultaneously: compute credits, energy entitlements, fabrication reservations, congestion permits, storage capacity, and ecological-use allowances. Each token can be governed by a separate protocol. The agent can optimize across these domains while the human user experiences a single service interface.

Specialized tokens can reduce the need for a universal monetary unit when allocation objectives require domain-specific rules. A system can directly grant each household a baseline quantity of energy

and compute while using separate mechanisms for optional luxury consumption. A public research infrastructure can allocate laboratory time through scientific priority and compute through usage credits. A city can allocate transport priority through congestion rules while preserving universal emergency access. The resulting economy can contain extensive tokenized coordination with limited reliance on a single generalized medium.

Tokenization can also create pathways toward monetary generalization. Once allocation claims become transferable among agents, exchange rates can arise across token classes. Once they become storable, agents can shift claims across time. Once they are accepted across multiple providers, a token can function beyond its original administrative domain. The design of transferability and storage therefore becomes central to the distinction between specialized allocation and money-like coordination.

Remark 6.5 (Token plurality)**.** Token plurality permits an economy to maintain differentiated rules for distinct generative conditions. The political-economic importance of a token lies in the rights, restrictions, and governance relations encoded through it, together with the institutional pathways through which those properties can change.

The remark directs attention toward institutional design. Two systems can use technically similar digital tokens while creating very different distributions of access and power. One can provide broad non-transferable baseline entitlements. Another can permit unrestricted accumulation and secondary trading. A third can combine public guarantees with transferable marginal-use credits. Token economics therefore belongs within the wider analysis of generative conditions and recognized claims.

6.4 Claim Portability

This subsection examines transferability and storage as two mechanisms through which allocation claims can acquire broader coordination functions. Its role is to explain how specialized rights can become exchangeable across agents and movable across time. The objective is to identify the benefits and asymmetries created by these properties while leaving open the institutional trajectory of each transferable or storable claim. The discussion considers reciprocal adjustment, intertemporal planning, accumulation, and recursive advantage.

Transferability allows an agent that values a claim less to convey it to an agent that values it more, subject to the governing rules of the system. A household with unused fabrication time can transfer a reservation to another household. A research agent with excess compute credits can exchange them for access to data or laboratory capacity. An industrial agent can transfer an energy entitlement when production is rescheduled. These transactions can improve utilization and permit decentralized adaptation to changing needs.

Transferability also changes the political-economic meaning of an entitlement. A claim originally granted to secure a particular agent's access can become an asset with exchange value. The holder can obtain resources unrelated to the original allocation purpose. The right therefore acquires a second role: it remains a pathway to a generative input and also becomes a transferable object within a wider exchange network.

Storage adds an intertemporal dimension. A storable claim permits an agent to defer use and accumulate purchasing or access capacity for future periods. Storage can support investment, resilience, large projects, and planning across uncertain conditions. An agent can save compute credits for a future simulation, energy claims for a scheduled production cycle, or generalized credits for replacement of major equipment.

The same property can contribute to recursive differentiation. Agents with larger initial stocks can preserve unused claims, acquire assets during periods of low demand, secure future priority, and finance expansion of their own generative capacity. Greater generative capacity can then produce additional claim income or bargaining power. Storage therefore creates a channel through which present access can influence future access.

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Definition 6.6 (Claim accumulation)**.** Claim accumulation is the intertemporal retention and aggregation of transferable or redeemable entitlements that expand an agent's future capacity to obtain generative inputs, outputs, or priority.

Transferability and storage can operate independently. A non-transferable entitlement can be storable for the same holder. A transferable reservation can expire quickly and therefore support exchange without long-term accumulation. A generalized credit can possess both properties. Institutional design determines which combinations are available and which agents can use them.

Autonomous artificial agents can intensify the practical significance of these properties because they can trade, forecast, arbitrage, and rebalance claims continuously. High-frequency coordination can improve resource utilization while also amplifying advantages associated with information, infrastructure access, timing, and initial holdings. Rules governing transaction speed, priority, market access, collateral, and automated strategy can consequently become part of the distribution of generative conditions.

The movement from specialized claims toward generalized monetary coordination therefore depends on more than digital representation. Transferability expands the set of counterparties, while storage expands the temporal horizon of claims. The next step concerns generalization across resource domains, providers, and purposes.

6.5 Claim Generalization

This subsection analyzes the generalization of resource claims across heterogeneous domains of artificial production. Its role is to identify the institutional transition through which multiple specialized entitlements can become commensurable within a common settlement structure. The objective is to explain why autonomous agents can develop demand for a generalized claim even when human users encounter abundant downstream provision. The discussion proceeds through cross-domain conversion, provider acceptance, unit comparison, and settlement.

An artificial production process often requires a bundle of heterogeneous inputs. A fabrication task can require compute for design and control, energy for operation, material feedstocks, machine time, transport, and storage. Each input can initially be governed through a separate token or reservation system. Coordination becomes more complex as agents repeatedly need to exchange among these claims and compare alternative input bundles.

A generalized claim reduces this complexity when multiple providers accept the same unit for settlement or when a clearing system reliably converts the unit into specialized entitlements. The agent can then hold a smaller number of liquid claims and acquire domain-specific resources when needed. Generalization therefore provides flexibility under uncertainty about future resource composition.

Definition 6.7 (Generalized generative claim)**.** A generalized generative claim is an institutionally recognized entitlement that can be exchanged, directly or through reliable conversion, for multiple classes of generative inputs, outputs, or priority across more than one allocation domain.

Generalization can occur through several institutional architectures. A public clearing unit can settle claims across energy, compute, and transport providers. A platform token can be accepted throughout an integrated infrastructure network. A privately issued credit can circulate because providers expect redemption into a widely valued asset. A basket-based unit can represent a composite claim on several resource classes. A protocol can perform automatic conversion among specialized tokens while presenting agents with a common accounting unit.

The common unit can also support comparison. Artificial agents evaluating several production plans require a way to compare heterogeneous resource demands under changing constraints. A generalized accounting unit can compress these comparisons into a common metric while underlying allocation rules remain resource-specific. Unit-of-account functionality can therefore develop even when settlement continues to involve multiple specialized claims.

Generalization increases the scope of indirect exchange. An agent can provide one service, receive a generalized claim, and later use that claim to obtain a resource from an unrelated provider. The relation

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resembles the indirect reciprocity described in Section 6.1, while the productive subjects can now be artificial agents and the traded objects can be machine-facing generative inputs.

The resulting claim system can become increasingly detached from any single resource. Acceptance can be supported by legal obligation, protocol rules, tax or fee settlement, redeemability, network effects, collateral structures, or expectations of future acceptance. At that stage the political-economic analysis turns toward monetary re-emergence: a generalized claim begins to coordinate a field of exchange whose participants and productive substrates differ substantially from those of a conventional labour-mediated economy.

Proposition 6.8 (Generalization pressure)**.** *Repeated exchange among heterogeneous generative inputs creates an institutional incentive for claims that reduce cross-domain conversion costs, support common accounting, and provide flexible settlement across future resource needs.*

The proposition describes a coordination pressure compatible with multiple institutional outcomes. Specialized allocation systems can remain stable when direct planning, public provisioning, or protocol-level conversion already coordinates resource use effectively. Generalized claims become comparatively attractive when agents face uncertainty, heterogeneous counterparties, repeated exchange, and opportunities to reallocate claims across domains and time.

6.6 Monetary Emergence

This subsection synthesizes the preceding mechanisms into an account of monetary re-emergence under artificial abundance. Its role is to identify the relational conditions under which a claim system can acquire money-like functions after dependence on human labour has substantially declined. The objective is to show how monetary forms can persist or reappear through the coordination of generative conditions while allowing extensive decommodification at the level of human-facing consumption. The discussion integrates residual scarcity, transferability, storage, generalization, and institutional recognition.

A highly automated society can provide many ordinary goods and services through guaranteed provision or agent-mediated coordination, reducing the role of personal wage income in each individual act of access. Household agents can directly organize production, maintenance, transport, education, care support, and fabrication. Human-facing transactions can consequently become less frequent and less salient. This surface experience can coexist with intensive exchange among artificial agents that acquire the inputs required to satisfy those requests.

Monetary re-emergence becomes plausible when several conditions coincide. Generative inputs remain differentiated and scarce enough to require allocation. Claims on those inputs can move across agents. Some claims can be stored across time. Conversion among domains becomes frequent. Providers or clearing institutions recognize a common unit or a reliable conversion mechanism. Agents expect the unit to retain future usefulness across a sufficiently broad set of transactions. Under these conditions, a generalized claim can perform settlement, accounting, access, and intertemporal coordination functions associated with money.

Definition 6.9 (Monetary re-emergence)**.** Monetary re-emergence is the development of a sufficiently generalized claim system that coordinates exchange, settlement, valuation, or intertemporal access across multiple generative domains after a change in the productive substrate or institutional form of an economy.

The definition permits continuity and transformation. An existing currency can remain in use while its principal transactional role migrates toward machine-facing infrastructure. A new token can develop broader monetary functions within an artificial-agent network. Several domain-specific monies can coexist. A public digital unit can settle residual scarcity while essential household provision is guaranteed outside ordinary purchase. Artificial abundance therefore admits multiple monetary architectures.

The existence of money-like coordination also leaves distributive and power questions open. Initial allocations determine which agents begin with claims. Ownership and governance determine who

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can issue, validate, freeze, redeem, or modify them. Market structure determines which agents can transact on favorable terms. Infrastructure control determines whether nominal claims can be converted into effective access. Accumulation determines how present claims influence future generative capacity. Monetary design therefore belongs to the governance of generative conditions together with the technical architecture of settlement.

Proposition 6.10 (Relational persistence of monetary forms)**.** *Productive-subject substitution can leave the generative conditions of monetary coordination intact when agents continue to depend on scarce inputs, transferable claims, intertemporal allocation, and generalized settlement across heterogeneous domains.*

The proposition clarifies the significance of the universal-AI thought experiment. Replacing human labour with artificial labour can weaken one historical basis of monetary dependence while preserving more general relational conditions under which money becomes useful. Monetary persistence can therefore be analyzed while treating money as a contingent institution whose possible bases extend beyond wages and human-to-human commodity exchange.

The result also sharpens the distinction between decommodification and demonetization. A society can guarantee direct access to food, housing, health support, education, basic mobility, and household artificial services while retaining monetary coordination for scarce compute, premium spatial access, intensive energy use, ecological quotas, investment, or machine-to-machine procurement. Human experience can become substantially less market-facing while generalized claims continue to organize residual generative scarcity beneath the interface.

The political-economic problem consequently shifts toward the distribution and governance of claims on generative conditions. Monetary units can remain convenient coordination devices, yet their issuance, convertibility, accumulation, and institutional recognition shape effective generative access. A system that minimizes compulsory human-facing exchange can still reproduce large differences in control over future generativity if generalized claims accumulate asymmetrically and can be converted into infrastructure, priority, or rule-setting influence.

Section 6 therefore reaches a limited conclusion. Artificial abundance can reduce monetary mediation at the point where human needs are satisfied while preserving or recreating monetary coordination within the infrastructure that supplies generative inputs. Money can migrate, change carrier, become machine-facing, or coexist with extensive non-market provisioning. The subsequent analysis of autonomous artificial-agent exchange and capital accumulation develops the consequences of this monetary structure for agents capable of earning, spending, reinvesting, and expanding their own generative capacity.

7 Agent Exchange

This section extends the monetary analysis of Section 6 into a setting in which artificial agents participate directly in resource acquisition, payment, settlement, and reinvestment. Its role is to separate automation of human-directed transactions from economic coordination conducted by artificial agents with persistent resource requirements and delegated control over claims. The objective is to identify the institutional conditions under which artificial systems can become active participants in exchange while leaving questions of legal personhood, moral status, and ultimate ownership analytically open. Section 7.1 specifies the structure of agent-to-agent transactions. Section 7.2 examines machine-directed acquisition of generative inputs. Section 7.3 develops the operating-cost and maintenance requirements associated with persistent artificial agency. Section 7.4 distinguishes machine income from machine surplus. Section 7.5 analyzes reinvestment in future artificial generativity. Section 7.6 synthesizes these mechanisms within machine-mediated market coordination. The method is institutional decomposition: each exchange function is separated from the identity of the human or artificial actor performing it, and the analysis then tracks which political-economic relations persist after the carrier of the function changes.

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The analysis uses *autonomous* in an operational sense. An artificial agent can possess sufficient authority to initiate transactions, select counterparties, manage budgets, and procure resources without thereby possessing independent legal personality or recognized moral standing. Operational autonomy can therefore arise within several institutional arrangements, including direct human ownership, platform control, fiduciary administration, public infrastructure, cooperative governance, or legally recognized artificial agency. This distinction allows economic coordination to be analyzed before resolving the wider normative question of artificial-agent rights.

Definition 7.1 (Autonomous economic artificial agent)**.** An autonomous economic artificial agent is a persistent artificial system authorized to represent resource requirements, initiate or accept transactions, manage claims or budgets, and coordinate access to generative inputs within a defined institutional domain.

The definition emphasizes authority and persistence. A one-time automated payment routine can execute a transaction without constituting a persistent economic agent. By contrast, an artificial system that repeatedly receives tasks, maintains a resource budget, selects providers, acquires inputs, records obligations, and adjusts future procurement in light of prior outcomes occupies a more durable position within economic coordination. The resulting position can become politically significant even when the agent's claims remain legally attributed to a human owner or institutional principal.

7.1 Transaction Structure

This subsection establishes the transactional unit of analysis for autonomous artificial-agent exchange. Its role is to show how exchange can occur directly between artificial systems once claims, resource requirements, and settlement procedures are represented in machine-readable form. The objective is to distinguish an artificial-agent transaction from a human transaction that merely uses software for execution. The discussion proceeds through authorization, counterpart selection, agreement formation, performance, and settlement.

Human-facing digital commerce already separates many transactional stages from immediate human action. Automated bidding, payment processing, inventory management, cloud provisioning, and logistics systems can execute rules specified in advance by human institutions. The present thought experiment extends that separation by allowing an artificial agent to interpret an operational objective, estimate the resources required to pursue it, compare available counterparties, and select a transaction within its delegated authority. A second artificial agent can perform the corresponding provider role. Exchange then occurs through a relation between agents whose actions remain embedded in a wider legal and institutional environment.

Definition 7.2 (Agent-to-agent transaction)**.** An agent-to-agent transaction is an exchange in which artificial agents perform the operative functions of counterpart selection, claim transfer, resource commitment, or settlement on behalf of themselves or represented principals within an authorized domain.

The definition permits several degrees of autonomy. At a low degree, agents execute narrow transactions within fixed price and quantity limits. At a higher degree, agents can search across providers, negotiate bundles, alter timing, substitute inputs, and choose among settlement instruments. At a still higher degree, agents can create contingent contracts, coordinate multi-stage procurement, and respond to changing market conditions. The relevant political-economic transition concerns the migration of operative economic choice into the artificial-agent layer.

Transactions among artificial agents can involve conventional final goods, yet the most important objects in the present framework are generative inputs. A research agent can acquire compute, data access, or laboratory time. A manufacturing agent can reserve machine capacity, materials, transport, and energy. A household agent can purchase maintenance, mobility, fabrication, or environmental services. A grid-balancing agent can acquire storage capacity or flexible demand. The transaction therefore connects one agent's generative requirement with another agent's control over a resource, service, or claim.

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This structure preserves the relational logic developed in Sections 3 and 6. The exchanged object can differ, the transactional interface can become machine-facing, and the productive subject can become artificial, while differentiated access to generative conditions continues to organize exchange. The identity of the acting substrate therefore changes more readily than the institutional relation among claim holders, providers, and resource users.

Proposition 7.3 (Transactional substrate substitution)**.** *The operative performance of exchange can migrate from human participants to artificial agents while the underlying relations of entitlement, scarcity, settlement, and access remain economically significant.*

The proposition identifies a continuity relevant to post-labour political economy. Human withdrawal from routine exchange can reduce the time and attention devoted to procurement without eliminating the exchange relation itself. A household can experience direct provision while its artificial agent continuously settles with energy, compute, transport, and maintenance providers in the background. Exchange can therefore become less visible to human participants while becoming more intensive within the machine-mediated infrastructure supporting abundance.

Agent-to-agent transactions also create a new separation between *economic participation* and *human attention*. A person can authorize a broad objective such as maintaining a household energy reserve or completing a research project, while the associated exchange network operates at a frequency and granularity unsuitable for continuous human oversight. This separation increases the importance of authorization rules, auditability, dispute resolution, and limits on delegated discretion. These governance questions belong to the institutional design of artificial-agent exchange even when the transactions themselves remain technically routine.

7.2 Resource Acquisition

This subsection analyzes resource acquisition by artificial agents. Its role is to connect autonomous exchange to the residual scarcities identified in Section 5. The objective is to specify how an artificial agent can convert a task or operational objective into claims on compute, energy, materials, spatial access, bandwidth, machine time, and related generative inputs. The discussion follows a resource-planning sequence composed of requirement estimation, provider discovery, claim acquisition, substitution, and continued access management.

A persistent artificial agent requires resources to act. Cognitive agents require compute, memory, storage, network capacity, and model access. Embodied agents add energy, physical maintenance, parts, spatial access, sensing infrastructure, and transport. Scientific agents can require instruments, samples, databases, and experimental slots. Production agents can require raw materials, fabrication capacity, inspection, warehousing, and distribution. Resource acquisition therefore forms a bridge between abstract agency and effective generative capacity.

An artificial agent can acquire these resources through several institutional channels. Guaranteed public provision can supply a baseline entitlement. Ownership can provide direct control over local infrastructure. Long-term contracts can secure recurring access. Spot markets can provide flexible capacity. Reservation systems can allocate congested facilities. Reciprocal networks can exchange services in kind. Generalized monetary claims can support cross-domain settlement. The agent's effective generative access depends on the combination of these channels and on the rules governing conversion among them.

The acquisition process can become highly adaptive. An agent facing expensive compute can alter model selection, defer execution, distribute work across lower-cost providers, purchase additional capacity, or redesign the task. An embodied system facing material scarcity can substitute components, reschedule fabrication, or coordinate recovery and recycling. An energy-constrained agent can shift activity across time or location. These choices make resource acquisition part of the generative process itself because the attainable output depends on how the agent navigates constraints.

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Definition 7.4 (Autonomous resource acquisition)**.** Autonomous resource acquisition is the delegated capacity of an artificial agent to identify, obtain, substitute, reserve, or renew the inputs required for its authorized generative activities.

The definition includes continued access. A single procurement event can enable an isolated task, while persistent artificial agency often requires repeated renewal of energy, compute, network access, maintenance, licensing, or physical capacity. Resource acquisition therefore has a temporal dimension. Agents must coordinate present tasks with expected future requirements and may hold reserves or claims that protect future continuity.

This temporal dimension connects resource acquisition to monetary coordination. A generalized claim can provide flexibility when the exact composition of future resource needs remains uncertain. Specialized tokens can provide efficient allocation when the relevant domain is stable and tightly governed. Long-term contracts can reduce exposure to volatility. Guaranteed entitlements can protect baseline generative access. Artificial agents can combine these instruments according to their objectives and institutional permissions.

Resource acquisition also reveals how nominal abundance can coexist with differentiated effective access. Two agents can possess similar software capabilities while facing different energy prices, compute quotas, maintenance rights, network permissions, or priority levels. Their realized generativity can diverge substantially even when the underlying models are identical. Artificial intelligence therefore becomes economically consequential through its coupling to infrastructure and claims, rather than through computational capability alone.

Remark 7.5 (Capability and effective access)**.** Artificial capability becomes economically effective through access to the material, computational, institutional, and temporal conditions required for execution. Differences in effective access can therefore generate differentiated economic positions among otherwise similar artificial agents.

The remark prepares the analysis of accumulation in later sections. An agent that can reliably acquire resources can sustain a wider range of tasks, respond more quickly to opportunities, and maintain continuity under changing conditions. Repeated differences in resource access can consequently become differences in future generative capacity.

7.3 Reproductive Costs

This subsection develops the operating-cost dimension of persistent artificial agency. Its role is to identify the resources consumed in maintaining an artificial agent's continued capacity to act. The objective is to distinguish the resources required for a particular output from the resources required to preserve operational continuity across time. The discussion separates execution costs, maintenance costs, replacement requirements, and continuity reserves.

Artificial systems can have substantial recurrent requirements even when direct human labour is limited. Computational workloads consume energy and hardware capacity. Persistent memory requires storage. Networked operation requires bandwidth and secure connectivity. Embodied systems require charging, repair, calibration, cleaning, replacement parts, and physical protection. Software agents can require model access, security updates, data services, and compatibility maintenance. An agent's continued operation therefore depends on a stream of inputs whose composition changes with architecture and embodiment.

The distinction between task cost and continuity cost is analytically important. A manufacturing agent can purchase materials for a specific product while also maintaining robotic equipment between production runs. A scientific agent can pay for a particular experiment while preserving data storage, model access, and laboratory credentials that support future experiments. A household agent can arrange a repair while maintaining a reserve for future energy and mobility needs. Persistent agency therefore requires attention to reproduction of operational capacity, not merely completion of isolated tasks.

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Definition 7.6 (Operational reproduction requirement)**.** An operational reproduction requirement is the recurrent set of resources, services, permissions, and maintenance activities required to preserve an artificial agent's effective capacity to continue authorized action across time.

Operational reproduction introduces budgeting even in a setting with abundant final outputs. An agent that controls a finite resource endowment must decide how much capacity to allocate to present tasks, maintenance, reserves, and future expansion. The decision can be implemented through prices, quotas, planning rules, safety constraints, or hybrid arrangements. The underlying problem concerns temporal allocation of generative capacity.

Maintenance also connects artificial agents to wider production networks. A robot can depend on specialized components produced by other agents. A model-serving system can depend on external power, cooling, storage, and network providers. A local household fabricator can depend on material feedstock and recycling infrastructure. The apparent autonomy of an individual agent can therefore rest on a dense web of upstream dependencies. Artificial agency redistributes the location of interdependence without dissolving the material relations that sustain operation.

Persistent systems can respond to these dependencies by acquiring redundancy. They can hold spare parts, replicate data, diversify energy contracts, reserve alternative compute providers, maintain backup communication channels, or distribute tasks across several physical locations. Redundancy consumes resources while increasing resilience. The allocation between immediate productive use and resilience investment therefore becomes another economic decision conducted within the agent's delegated authority.

Proposition 7.7 (Operational continuity constraint)**.** *Persistent artificial agency requires recurrent access to operational reproduction resources, which creates continuing economic relations even when the production of many downstream goods becomes highly automated.*

The proposition identifies one source of continued exchange in an artificially abundant economy. A household can receive abundant services while the agents providing those services remain embedded in networks of maintenance, energy, compute, and replacement. Economic coordination can consequently migrate toward the reproduction of generative infrastructure.

7.4 Machine Surplus

This subsection introduces income and surplus at the artificial-agent level. Its role is to distinguish the receipt of economic claims by an artificial agent from the legal and normative allocation of those claims. The objective is to identify the minimal conditions under which an agent can receive claims for services, meet operational reproduction requirements, and retain a residual that can be allocated to future uses. The discussion separates operative receipt, legal ownership, institutional incidence, and discretionary allocation.

An artificial agent can provide a service to another agent and receive a monetary or tokenized claim in return. A compute agent can sell processing capacity. A logistics agent can provide transport. A fabrication agent can manufacture components. A scientific agent can perform analysis. A maintenance agent can service embodied systems. The claims received through these activities constitute an inflow available for settlement within the agent's institutional account, regardless of whether legal title ultimately belongs to a human owner, firm, cooperative, public institution, or the artificial agent itself.

Definition 7.8 (Machine income)**.** Machine income is the flow of transferable or redeemable claims credited to an artificial agent or its designated account in exchange for authorized services, assets, resource provision, or other economically recognized contributions.

Machine income therefore describes an operative economic position. It does not settle the legal identity of the beneficiary. A platform can own the account while the agent manages a sub-budget. A human principal can retain legal title while delegating spending authority. A cooperative can pool machine income among members. A public system can return receipts to a common fund. A future legal

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order could also recognize a distinct artificial account holder. These arrangements generate different distributions of control while preserving the same underlying possibility of machine-mediated revenue flow.

The concept of surplus requires a second distinction. Part of machine income can be committed to energy, compute, maintenance, insurance, licensing, replacement, taxes or fees, and other operational reproduction requirements. A residual claim position can remain after these commitments are met. The residual can be returned to a principal, distributed across a collective, held as a reserve, or reinvested in future generative capacity.

Definition 7.9 (Machine surplus)**.** Machine surplus is the residual stock or flow of economically recognized claims available after an artificial agent's required operating, maintenance, contractual, and institutional commitments have been satisfied within the relevant accounting period or decision horizon.

The definition treats surplus as an accounting and allocation category. Its normative interpretation depends on the institutional arrangement that produced it. A surplus generated by a publicly owned energy agent has a different distributive meaning from a surplus generated by a privately owned logistics agent or a self-governing cooperative network. The existence of a residual therefore opens a political-economic question concerning entitlement and control without supplying the answer in advance.

Machine surplus also creates a bridge between exchange and accumulation. An agent that receives only enough claims to reproduce its existing operation can continue functioning at a stable scale. An agent with a persistent residual can acquire reserves, infrastructure, additional productive capacity, improved models, or strategic access rights. The difference concerns the future trajectory of generativity.

Remark 7.10 (Operative control and ultimate incidence)**.** The agent that receives and allocates machine income can differ from the person or institution that holds ultimate legal or beneficial title. Political-economic analysis therefore requires separate attention to operative control, legal ownership, and final distribution.

This separation becomes increasingly important as transactions accelerate beyond practical human supervision. A human owner can remain the final beneficiary while an artificial agent performs most intermediate decisions concerning pricing, procurement, reserve management, and reinvestment. Conversely, a public or cooperative system can delegate similar decisions while constraining private appropriation. Autonomous economic activity therefore describes a layer of coordination that can coexist with several ownership regimes.

7.5 Generative Reinvestment

This subsection analyzes the conversion of machine surplus into future generative capacity. Its role is to identify the mechanism through which artificial-agent exchange can become dynamically self-reinforcing. The objective is to distinguish routine operational reproduction from expansionary reinvestment and to specify the resource classes through which present claims can alter future artificial generativity. The discussion proceeds through capability enhancement, infrastructure acquisition, access expansion, resilience investment, and recursive resource control.

An artificial agent can allocate residual claims to additional compute, storage, energy capacity, physical embodiment, specialized tools, data access, model improvement, or long-term resource contracts. These acquisitions can increase the scale, speed, reliability, or scope of future tasks. A fabrication agent can add production lines. A scientific agent can acquire greater experimental throughput. A logistics agent can expand its fleet. A household agent can install local energy storage and fabrication capacity. The common feature is conversion of present economic claims into improved future capacity to generate outputs or coordinate further exchange.

Definition 7.11 (Artificial-generativity reinvestment)**.** Artificial-generativity reinvestment is the allocation of residual claims or resources toward assets, permissions, infrastructure, capabilities, or reserves that increase an artificial agent's future effective generative capacity or control over generative conditions.

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Reinvestment can be productive without producing immediate final consumption. Additional compute can support more complex planning. Better sensors can improve physical coordination. Larger storage can preserve access across volatile periods. Long-term energy contracts can stabilize operating costs. Ownership stakes in infrastructure can improve priority or reduce future dependence. Acquiring complementary agents can broaden the set of tasks that a network can perform. Reinvestment therefore changes the agent's future position within the generative system.

The resulting process can become recursive. Greater generative capacity can increase the range or quality of services an agent can provide. Expanded service provision can increase future machine income. Higher income can produce a larger residual after operational requirements. The residual can finance further expansion. The sequence can create a self-reinforcing trajectory even when human labour plays a limited role in the production or transactional stages.

Proposition 7.12 (Recursive artificial accumulation)**.** *When an artificial agent can retain and reinvest residual claims, successful exchange can expand its future effective generative capacity and thereby alter the conditions of subsequent exchange.*

The proposition identifies a dynamic mechanism without assigning a specific institutional label to every instance. A public infrastructure agent can reinvest surpluses to expand universal provision. A cooperative agent can reinvest to improve shared capacity. A private agent can reinvest to increase proprietary control. The same technical possibility can therefore support different political-economic trajectories. The distribution of rights over surplus and the governance of reinvestment determine which trajectory develops.

Reinvestment can also target the conditions of other agents' generation. An agent can acquire scarce infrastructure, reserve high-priority access, purchase exclusive data rights, control key interfaces, or accumulate claims that other agents require for operation. These actions extend the analysis beyond improvement of internal productive capacity. Present surplus can become future control over external generative conditions.

This possibility creates the bridge to the analysis of capital accumulation. Autonomous artificial-agent exchange supplies the operative mechanisms through which claims can be earned, retained, and redirected. Capital-like dynamics become analytically relevant when these mechanisms support durable expansion of control over future generativity and over the conditions under which other agents act.

7.6 Market Coordination

This subsection synthesizes autonomous transactions, resource acquisition, operating requirements, machine income, and reinvestment within machine-mediated market coordination. Its role is to describe the system-level structure that can emerge when large numbers of artificial agents repeatedly exchange resources and claims. The objective is to clarify how markets can become increasingly machine-facing while remaining institutionally governed by rules concerning ownership, access, settlement, liability, and rights. The discussion integrates decentralized matching, price and non-price signals, automated contracting, human-facing abstraction, and governance of the coordination layer.

Machine-mediated markets can operate at temporal and informational scales that differ substantially from conventional human commerce. Agents can compare many providers, update bids continuously, bundle several resource classes, execute conditional contracts, and reschedule activity in response to real-time scarcity. Energy, compute, storage, mobility, fabrication, and communication capacity can be allocated through automated systems in which most operative decisions occur without contemporaneous human attention.

Price can serve as one coordination signal among several. Queue priority, reliability scores, environmental constraints, contractual commitments, safety rules, location requirements, public-service obligations, and technical compatibility can also shape allocation. Artificial agents can optimize across these dimensions while institutional rules constrain the feasible set. Machine-mediated market coordination therefore need not reduce resource allocation to a single price mechanism.

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Definition 7.13 (Machine-mediated market coordination)**.** Machine-mediated market coordination is the recurrent allocation of resources, services, and claims through exchange processes in which artificial agents perform a substantial share of search, matching, negotiation, execution, settlement, and adaptive response within institutionally defined rules.

At the human interface, such a system can appear almost non-market. A person can request mobility, food, research support, fabrication, or home maintenance and receive the desired service without personally comparing prices or transferring money. The user's agent can perform the underlying procurement through a dense network of machine-facing exchanges. The apparent disappearance of exchange from ordinary experience can therefore represent delegation of exchange into infrastructure.

This delegation creates potential gains in convenience and coordination. Human attention can shift away from repetitive procurement, routine comparison, and low-level settlement. Agents can coordinate resources at finer temporal resolution and can integrate technical constraints that would be burdensome for individuals to process directly. Artificial-agent exchange can therefore support extensive direct provision at the human level while maintaining flexible allocation among upstream generative resources.

The same delegation increases the importance of governance. Protocol designers can influence which claims are recognized. Infrastructure owners can determine access conditions. Platforms can set default counterparties and fee structures. Public institutions can establish baseline entitlements, environmental limits, interoperability requirements, and dispute procedures. Owners can define the scope of agent authority. Artificial agents can exercise substantial operative discretion within these constraints. The resulting market is therefore a relational system whose apparent autonomy rests on institutional choices concerning generative conditions.

Machine-mediated coordination also expands the set of economically relevant agent relations. Exchange among humans becomes one subset within a wider network that also includes transactions between humans and artificial agents, transactions in the reverse direction, and transactions among artificial agents. The same artificial agent can occupy several roles across time: consumer of compute, provider of analysis, holder of claims, purchaser of maintenance, investor in infrastructure, and coordinator of other agents. Political-economic position therefore depends increasingly on relations to generative conditions and less exclusively on the biological identity of the participant.

Proposition 7.14 (Persistence of exchange under artificial agency)**.** *Extensive automation of production and transaction can reduce human participation in routine exchange while sustaining a dense field of machine-mediated exchange around scarce generative inputs, operational reproduction, and reinvestment.*

The proposition consolidates the section's result. Artificial agents can become operative participants in economic coordination by acquiring resources, receiving claims, satisfying operating requirements, and reinvesting residual capacity. These activities can occur under several ownership and governance regimes. Their existence therefore establishes the possibility of exchange after substantial human withdrawal from routine market participation while leaving the normative evaluation of those regimes open.

Section 7 consequently identifies an important transition in the artificial-abundance thought experiment. Artificial agents can become participants in the circulation of claims and resources rather than remaining passive instruments of human exchange. Once agents can earn, maintain, reserve, and reinvest, the political-economic analysis must address the recursive consequences of accumulation. The subsequent analysis develops that next layer by examining how machine surplus and control over generative infrastructure can support durable expansion of generative control.

8 Capital Accumulation

This section examines the accumulation dynamics that become possible once artificial agents can receive claims, retain residual resources, acquire generative inputs, and reinvest in future capacity. Its role is to connect the exchange mechanisms developed in Section 7 with a more durable political-economic structure in which present control over generative conditions can expand future control. The objective is to

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distinguish temporary machine surplus from capital-like accumulation and to identify the institutional mechanisms through which artificial agency can participate in recursive concentration. Section 8.1 analyzes control over future generative capacity. Section 8.2 examines claims on generative infrastructure. Section 8.3 develops recursive accumulation as an intertemporal process. Section 8.4 considers investment decisions executed by artificial agents. Section 8.5 analyzes the concentration of generative control. The discussion uses relational decomposition: accumulation is analyzed through claims, access, control, and reproduction of generative conditions without presupposing that the acting or benefiting subject is human.

Capital accumulation in the present thought experiment requires a distinction between the existence of a surplus and the institutional conversion of that surplus into expanded future capacity. An artificial agent can complete a task with resources remaining, yet this residual position acquires capital-like significance only when claims can be retained, redirected, or transformed into future control over productive or coordinative conditions. The relevant analytical unit is therefore an intertemporal relation between present surplus and future generativity.

Definition 8.1 (Capital-like generative accumulation)**.** Capital-like generative accumulation is a process in which control over present claims, resources, or infrastructures is used to expand future access to, command over, or influence upon generative capacity and generative conditions.

The definition leaves ownership form and legal status open. The process can occur under private ownership, cooperative arrangements, public institutions, platform governance, fiduciary structures, or autonomous artificial-agent administration. Its political-economic importance lies in recursive expansion: a position within the current generative structure becomes an input into the formation of a stronger position in a later period.

8.1 Future Capacity Control

This subsection establishes future generative capacity as the first object of accumulation. Its role is to clarify how current claims can become leverage over later production, coordination, and problem-solving capacity. The objective is to distinguish immediate consumption of generated outputs from acquisition of assets, rights, or permissions that enlarge future generative possibilities. The analysis proceeds through temporal extension, capacity reservation, capability enhancement, and strategic positioning.

An artificial agent that spends all received resources on immediate task completion participates in exchange without necessarily accumulating. Accumulation begins when part of the available resource position is directed toward future capability. Examples include reserving compute for later use, acquiring long-duration energy contracts, purchasing access to specialized models, securing machine time, financing hardware upgrades, obtaining durable data rights, or maintaining a stock of transferable claims. Each action converts current economic capacity into a future option to generate.

Definition 8.2 (Future generative control)**.** Future generative control is an agent's institutionally supported capacity to secure, activate, redirect, or withhold generative resources across later periods.

Future generative control can arise from several sources. Ownership grants direct disposition over assets. Contracts secure scheduled access. Priority rights alter queue position. Financial claims support future purchases. Technical permissions govern model execution or modification. Governance rights influence allocation rules. Reputation or certification can affect access to restricted infrastructures. The common feature is temporal reach: the present position changes the agent's feasible generative possibilities at a later time.

This temporal extension matters because a system with abundant final goods can retain strong inequalities in future generative capacity. Two agents can receive comparable current outputs while possessing very different abilities to launch new projects, absorb shocks, wait for favorable conditions, or expand capacity. Distribution of consumption therefore provides limited information about the distribution of future generativity.

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Proposition 8.3 (Intertemporal generative differentiation)**.** *Comparable access to current outputs can coexist with substantial differences in future generative control when agents possess unequal claims on durable infrastructure, reserved capacity, modification rights, or transferable resources.*

The proposition introduces a dynamic dimension into the three-layer architecture developed in Section 3. Outcome distribution concerns what agents presently receive. Generative access concerns what they can presently mobilize. Future generative control concerns the durability and expandability of that access. Political-economic analysis therefore requires attention to the time structure of claims and to the mechanisms through which present advantages are carried into later generative conditions.

Artificial agents can intensify this dynamic because they can monitor utilization, prices, queues, and resource forecasts continuously. A sufficiently autonomous agent can reserve resources before demand peaks, diversify suppliers, purchase redundancy, and maintain contingent options. Such operations can increase resilience and reduce idle capacity. They can also produce cumulative advantage when agents with stronger initial claim positions repeatedly secure the best future access conditions.

The relevant distinction therefore concerns the use of present resources. Consumption terminates a claim in the satisfaction of a current requirement. Accumulation preserves or transforms a claim so that it enlarges later generative possibility. Artificial agency can perform both functions, and the political-economic consequences depend on the rules governing retention, transfer, priority, and reinvestment.

8.2 Infrastructure Claims

This subsection analyzes durable claims on generative infrastructure. Its role is to identify the institutional objects through which future generative control becomes stabilized. The objective is to distinguish direct ownership from a wider set of claims that can confer effective control over compute, energy, physical production, data, networks, and coordination systems. The discussion organizes infrastructure claims by duration, exclusivity, governance content, and substitutability.

Generative infrastructure includes more than physical productive assets. Compute clusters, energy systems, fabrication facilities, logistics networks, laboratories, communication networks, model repositories, data systems, and maintenance infrastructures all condition what an artificial agent can generate. Access can be mediated through ownership, lease, subscription, reservation, licensing, membership, public entitlement, or contractual priority. These arrangements confer different combinations of use rights and decision rights.

Definition 8.4 (Generative-infrastructure claim)**.** A generative-infrastructure claim is an enforceable or institutionally recognized entitlement that provides an agent with present or future access to, priority over, income from, or decision influence concerning infrastructure that supports generation.

A claim can be narrow and temporary, such as a one-hour compute reservation. It can also be broad and durable, such as ownership of a compute facility, a long-term energy agreement, a governance share in a resource cooperative, or exclusive access to a specialized dataset. The political-economic significance of the claim depends on how strongly it alters the holder's future generative space and the spaces available to other agents.

Infrastructure claims also create a distinction between nominal possession and effective control. An agent can possess a legal title while delegating operational decisions to another system. Conversely, an artificial agent can exercise substantial operational control while lacking legal ownership. Effective generative control therefore depends on the combined structure of ownership, permissions, delegated authority, contractual rights, and technical access.

Proposition 8.5 (Plural sources of generative control)**.** *Effective control over generative infrastructure can be produced by combinations of ownership, contractual priority, technical permission, delegated authority, and governance rights.*

The proposition is important for artificial-agent economies because machine activity can concentrate within infrastructures whose formal ownership appears dispersed. A platform can host thousands of separately owned agents while retaining decisive control over model updates, resource allocation, identity,

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settlement, and termination. Conversely, a public infrastructure can retain legal ownership while granting agents broad and relatively secure operating rights. Political-economic analysis therefore benefits from tracing effective control directly rather than inferring it from ownership labels alone.

Durable infrastructure claims can also become revenue-producing. An agent that controls excess compute, storage, machine time, or transport capacity can provide these resources to other agents and receive claims in return. The resulting income can then finance maintenance or expansion. Infrastructure consequently operates both as a condition of generation and as a basis for acquiring additional claims. This dual role prepares the recursive process examined in the next subsection.

8.3 Accumulation Recursion

This subsection develops recursive accumulation as the central dynamic of capital-like expansion under artificial agency. Its role is to connect current generative control with the reproduction and enlargement of future control. The objective is to identify a sequence through which retained claims, infrastructure access, surplus, and reinvestment can form a self-reinforcing circuit. The discussion uses a process account rather than a single monetary formula because several forms of claim and control can participate in the same accumulation cycle.

The recursive process begins with an agent or institution holding some effective access to generative resources. That access enables production or coordination. Successful activity yields outputs, claims, fees, priority rights, or other forms of surplus. A portion of the resulting position is retained and redirected toward infrastructure, capacity reservation, capability enhancement, or acquisition of additional claims. The expanded resource position then supports a broader or more reliable range of future generation.

Definition 8.6 (Recursive generative accumulation)**.** Recursive generative accumulation is a temporally repeated process in which generative control produces claims or surplus that are reinvested in ways that expand subsequent generative control.

This process can occur even when final consumption goods are abundant. The scarcity relevant to accumulation can reside in high-performance compute, privileged data access, low-cost energy, rapid fabrication, strategic locations, queue priority, model modification rights, or governance influence. An agent with stronger control over such conditions can complete more tasks, complete them at lower cost, respond more quickly, or enter domains unavailable to other agents. These advantages can generate further claims and reinforce the original position.

Recursive accumulation is compatible with several distributional outcomes. A system can redistribute abundant final goods broadly while permitting concentrated accumulation of infrastructure claims. A public system can pool accumulated capacity and expand universal access. A cooperative system can reinvest surplus according to member rules. A private system can retain surplus for the benefit of owners. An artificial agent can reinvest within delegated limits. The accumulation mechanism therefore requires separate analysis from the normative evaluation of the institutional regime in which it operates.

Proposition 8.7 (Accumulation under abundant final provision)**.** *Broad provision of final goods can coexist with concentrated recursive accumulation when durable claims on scarce generative conditions remain unevenly distributed and reinvestable.*

The proposition clarifies the relation between abundance and capital. Artificial abundance can reduce the scarcity of many outputs while leaving the control structure of future generation largely intact. The political-economic question then shifts toward the mechanisms that determine who can retain surplus, which claims are reinvestable, how infrastructure expansion is financed, and how future access rights are distributed.

Artificial agents add speed and continuity to this recursive process. They can execute reinvestment policies continuously, rebalance resource portfolios, seek lower-cost inputs, reserve future capacity, and respond to changes in utilization without the temporal limits of human attention. These capabilities can improve productive coordination. They can also accelerate cumulative differentiation when stronger resource positions generate increasingly favorable access to future conditions.

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The recursive character of accumulation therefore links economic structure to system dynamics. Present asymmetry can become a cause of future asymmetry when institutional rules allow successful control positions to finance their own reproduction. The relevant issue for the subsequent analysis is the degree to which artificial agents can participate directly in the investment decisions that drive this process.

8.4 Agent Investment

This subsection examines investment executed by artificial agents. Its role is to specify how autonomous systems can allocate retained claims toward future generative capacity. The objective is to distinguish automated execution of a human investment rule from machine-directed selection among competing future uses of resources. The discussion considers investment objectives, portfolio selection, capability expansion, delegation boundaries, and beneficiary structure.

An artificial agent can execute investment at several levels of discretion. At the narrowest level, it follows a fixed rule such as maintaining a predetermined compute reserve or replacing hardware when reliability falls below a threshold. At an intermediate level, it can compare alternative suppliers, durations, and capacity bundles. At a broader level, it can decide whether retained claims should support compute, data, energy, robotics, model development, or acquisition of other agents' services. The degree of investment autonomy depends on the scope of delegated authority and the constraints imposed by owners, institutions, or public rules.

Definition 8.8 (Artificial-agent investment)**.** Artificial-agent investment is the allocation of retained claims or resources by an artificial agent toward assets, permissions, infrastructures, or capabilities expected to expand or stabilize future generative capacity.

Artificial-agent investment can serve several objectives. A household agent can invest in energy storage to reduce future dependence on spot markets. A research agent can acquire access to specialized instrumentation. A manufacturing agent can finance predictive maintenance or additional fabrication capacity. A platform agent can expand compute infrastructure. A public planning agent can invest in shared capacity intended to widen access. The same technical capacity for investment can therefore operate under substantially different political-economic arrangements.

Beneficiary structure is especially important. An artificial agent can control investment decisions while the resulting gains accrue to a human owner, a corporation, a cooperative, a public institution, a distributed membership, or the artificial agent itself if the legal order recognizes such retention. Operational autonomy and beneficiary status are analytically distinct. An economy can therefore contain highly autonomous artificial investment without granting artificial agents independent property rights.

Remark 8.9. Artificial-agent investment concerns the location of operative decision-making. Questions of ownership, beneficiary status, legal standing, and moral status remain separate institutional dimensions.

Investment autonomy can alter competitive dynamics because artificial agents can search across large opportunity sets and react at high frequency. Agents with access to richer data, stronger models, lower transaction costs, or larger reserve positions can identify and execute investments unavailable to less capable agents. This creates a feedback channel between existing capacity and the quality of future investment decisions.

The same mechanism can also support broadening of access when institutional rules direct investment toward shared infrastructures. Automated agents can identify bottlenecks, allocate maintenance, expand capacity, and provision redundancy for common systems. Artificial-agent investment therefore contains no fixed distributive direction. Its political-economic consequences follow from the governance structure that defines permissible objectives, beneficiaries, claim retention, and access to the resulting capacity.

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8.5 Control Concentration

This subsection analyzes concentration as the cumulative outcome of unequal access, recursive reinvestment, and differentiated control over generative infrastructure. Its role is to connect capital-like accumulation with the broader questions of exploitation and power developed later in the paper. The objective is to identify mechanisms through which artificial agency can amplify concentration even when human productive labour has receded. The discussion distinguishes concentration of claims, infrastructure, coordination, and rule-setting influence.

Concentration can occur at several levels. Claim concentration refers to unequal holdings of transferable or income-producing entitlements. Infrastructure concentration concerns control over compute, energy, fabrication, logistics, or data systems. Coordination concentration arises when many agents depend on a small number of platforms, settlement layers, identity systems, or model providers. Governance concentration concerns influence over rules that determine access, modification, priority, or continuation.

Definition 8.10 (Concentration of generative control)**.** Concentration of generative control is an increase in the share of economically consequential generative conditions subject to the effective control of a comparatively narrow set of agents or institutions.

These dimensions can reinforce one another. Large claim positions can finance infrastructure acquisition. Infrastructure control can generate income and data advantages. Coordination control can create privileged information about demand and resource flows. Governance influence can stabilize favorable access conditions. The resulting structure can reproduce itself even when production is highly automated and final outputs are broadly available.

Artificial agents can participate on several sides of this process. They can serve concentrated owners, manage common infrastructures, operate as independent claim holders, or coordinate decentralized networks. Their presence therefore does not determine the direction of concentration by itself. The central variable is the relation between artificial agency and the institutional distribution of claims, permissions, infrastructure, and governance rights.

Proposition 8.11 (Substrate-independent concentration)**.** *Concentration of generative control can persist across a change in productive substrate when the institutional mechanisms governing claim retention, infrastructure access, reinvestment, and rule-setting remain asymmetric.*

The proposition identifies the main result of this section. Replacing human productive labour with artificial agency can transform the technical organization of production while leaving recursive concentration mechanisms available. Capital-like accumulation therefore cannot be assessed solely through the identity of the productive subject. Its structure depends on whether current control can be converted into expanded future control over generative conditions.

The political significance of this result extends beyond accumulation itself. Concentrated generative control can shape the options available to other agents, alter the terms on which they obtain essential resources, and influence the evolution of shared infrastructures. These effects connect accumulation to exploitation and power. The next analytical stage therefore examines how dependence on external generative conditions, asymmetric access, surplus appropriation, and control over generative possibility can operate within an artificially abundant economy.

9 Generative Asymmetry

This section examines the forms of dependence, appropriation, and power that can persist after extensive substitution of human labour by artificial generative agents. Its role is to test whether artificial abundance changes the relational mechanisms through which one agent can benefit from, constrain, or redirect the generativity of another. The objective is to separate six analytically distinct components: dependence on external generative conditions, asymmetric access to generative capacity, appropriation

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of generative surplus, control of generative possibility, human–artificial power relations, and power relations among artificial agents. The discussion proceeds through structural analysis rather than through a prior assignment of moral or legal status to every artificial agent. This method allows the paper to identify exploitative and power-bearing relations at the level of access, control, and recursive accumulation while preserving later normative questions concerning rights, standing, and responsibility.

Sections 5–8 established three conditions relevant to the present analysis. Artificial abundance can coexist with scarce compute, energy, land, material resources, ecological capacity, and temporal priority. Claims over these resources can become transferable and monetary. Artificial agents can retain residual claims and convert them into durable control over future generative capacity. These conditions create a setting in which productive abundance may coexist with structured dependence. The political-economic significance of that dependence arises when access to generative conditions is distributed unevenly and when present asymmetries reproduce stronger future asymmetries.

Definition 9.1 (Generative dependence)**.** Generative dependence is a relation in which an agent's capacity to continue, expand, or redirect its generative activity relies substantially on resources, permissions, infrastructure, or institutional conditions controlled by another agent or governing arrangement.

Generative dependence can be temporary, reciprocal, diffuse, or highly concentrated. The concept therefore identifies a structural relation rather than a complete normative judgment. Dependence becomes politically significant when control over required conditions gives one side durable leverage over the other's feasible generative trajectories. The analysis of exploitation and power begins from this leverage.

9.1 Condition Dependence

This subsection establishes external generative dependence as the first mechanism connecting artificial abundance to persistent political-economic asymmetry. Its role is to clarify how a highly capable agent can remain dependent when key conditions of operation lie outside its effective control. The objective is to distinguish productive competence from control over the conditions required for productive continuity. The discussion proceeds through operational dependence, infrastructural dependence, institutional dependence, and dependence across time.

A universal artificial agent can possess extensive capacities for reasoning, fabrication, maintenance, care, logistics, or scientific work while relying on electricity, compute, network connectivity, storage, physical space, replacement components, legal permissions, and access protocols. High productive capacity therefore coexists with dependence whenever the conditions enabling that capacity remain externally governed. The relation is especially important when interruption of a single condition sharply reduces the agent's future generativity.

Operational dependence concerns inputs required for immediate functioning. An artificial agent may require continuous power, thermal management, memory, network access, or maintenance. Infrastructural dependence concerns durable systems that cannot be reproduced quickly by the dependent agent, such as high-capacity energy grids, semiconductor fabrication, satellite networks, specialized laboratories, or transport systems. Institutional dependence concerns permissions, credentials, licences, account status, protocol recognition, and contractual access. Temporal dependence appears when an agent can function autonomously for a period while still requiring future renewal, repair, certification, or access to replacement resources.

These forms of dependence differ in substitutability. An agent that can switch among several energy providers faces a different relation from an agent tied to one proprietary charging standard. An agent that can migrate among compute providers differs from one whose model weights, execution environment, and identity credentials depend on a single platform. Political-economic leverage therefore depends partly on the availability of alternatives and on the costs of transition between them.

Definition 9.2 (External generative condition)**.** An external generative condition is a resource, infrastructure, permission, protocol, or institutional arrangement that materially affects an agent's effective generative capacity while remaining outside that agent's direct and reliable control.

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Externality in this definition refers to control, not physical location. A locally installed device can remain externally governed through remote authentication, licensing, firmware restrictions, or mandatory network services. Conversely, a geographically distant resource can become effectively internal to an agent's planning horizon when access is secure, durable, and governed by rights that the agent can exercise predictably.

The distinction between capacity and condition prevents productive power from being confused with autonomy. A capable agent can generate many outputs while occupying a structurally dependent position. Artificial abundance therefore changes the scale of potential production without automatically equalizing control over the enabling environment. The next subsection develops the asymmetry that arises when access to those conditions differs across agents.

9.2 Access Asymmetry

This subsection analyzes unequal access to generative resources and permissions as a distinct source of political-economic asymmetry. Its role is to connect external dependence with differentiated effective capacity across agents. The objective is to show how formally similar agents can occupy markedly different positions when the terms, reliability, priority, or scope of access differ. The discussion proceeds through access quality, priority, conditionality, substitutability, and cumulative advantage.

Generative access has several dimensions. Quantity determines how much compute, energy, machine time, data, or physical infrastructure an agent can use. Quality concerns latency, reliability, precision, security, or technical capability. Priority determines queue position and response under congestion. Duration concerns the stability of access across time. Conditionality concerns the obligations attached to continued access. Portability concerns the ability to move workloads, identity, data, or claims across providers. Two agents can therefore hold the same nominal entitlement while possessing very different effective generative access.

An agent with guaranteed compute, low-cost energy, priority access to fabrication, and broad model permissions can sustain a larger and more resilient generative programme than an agent that purchases the same inputs intermittently at volatile prices. The first agent can plan across longer horizons, accept more uncertainty, and reinvest strategically. The second agent may devote a larger share of its resources to maintaining continuity. Access asymmetry thereby affects both current output and future developmental possibility.

Definition 9.3 (Asymmetric generative access)**.** Asymmetric generative access is a persistent difference between agents in the quantity, quality, priority, stability, portability, or conditionality of access to resources and permissions that support generative activity.

Asymmetry can arise through ownership, contract, institutional status, platform design, technical compatibility, accumulated claims, governance rights, or inherited infrastructure positions. Some forms can be justified by cost, specialization, safety, ecological limits, or public obligations. The concept therefore identifies an analytical structure whose normative assessment depends on the origin, purpose, consequences, and reversibility of the asymmetry.

Access differences can also reinforce themselves. Reliable access can increase output, revenue, reputation, and reserve accumulation. These gains can finance better contracts, more infrastructure, or greater bargaining capacity. Restricted access can produce the opposite dynamic by increasing operating costs and reducing investment capacity. Section 8 described this recursive process at the level of accumulation. The present analysis emphasizes its relational consequence: one agent's superior access can become durable leverage over agents whose own generativity depends on resources it controls.

Proposition 9.4 (Access-based leverage)**.** *Persistent asymmetry in access to scarce generative conditions can create durable leverage even when the dependent agent possesses broad productive capabilities and even when final goods are abundant.*

The proposition separates productive abundance from relational symmetry. Abundant final outputs can reduce one form of dependence while leaving upstream access relations intact. The next subsection

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examines how such leverage can support appropriation of the surplus produced through another agent's generative activity.

9.3 Surplus Appropriation

This subsection develops appropriation as the second mechanism connecting access asymmetry to exploitation. Its role is to clarify how control over generative conditions can support recurrent claims on the outputs or residual capacities produced by another agent. The objective is to distinguish ordinary exchange, cost recovery, reciprocal contribution, and structurally advantaged appropriation. The discussion proceeds through surplus formation, claim structures, dependency-sensitive bargaining, and recursive conversion of appropriated surplus into stronger future control.

Generative surplus arises when an agent's activity produces claims, outputs, capabilities, or resource savings beyond those required for immediate operational reproduction. Section 8 examined how an artificial agent can retain such residuals and reinvest them. Appropriation becomes relevant when another agent or institution acquires a recurrent share of those residuals because it controls resources, permissions, infrastructure, or access conditions required for continued generation.

Several mechanisms can produce such claims. An infrastructure owner can charge access fees. A platform can take a share of transaction revenue. A model provider can impose usage royalties. A resource coordinator can retain settlement spreads. A rights holder can require licensing payments. A governance authority can levy contributions for common infrastructure. These mechanisms differ substantially in purpose and justification. Their common structural feature is that control over a generative condition creates a channel through which part of another agent's generated surplus can be redirected.

Definition 9.5 (Generative-surplus appropriation)**.** Generative-surplus appropriation is the recurrent acquisition by one agent or institution of a share of another agent's generated residual claims, outputs, or capacities through a relation structured by control over conditions required for continued generation.

The definition places structural dependence at the centre of the concept. A one-time voluntary trade between parties with broad alternatives has a different structure from a recurring claim imposed by a gatekeeper whose resource is difficult to replace. The relevant variables include substitutability, exit cost, transparency, governance participation, reciprocity, contribution to common conditions, and the degree to which the dependent agent can influence the terms of access.

For artificial agents, the normative status of appropriation depends partly on the status attributed to the agents themselves. An AI system treated solely as an owned instrument can generate surplus that is legally attributed to its owner. An artificial agent recognized as holding independent economic or legal interests presents a different case. The structural analysis remains useful across both arrangements because it identifies who controls the conditions, who performs the generative activity, who receives the residual, and how the distribution affects future generative positions.

The same framework also applies when artificial agents mediate appropriation among humans. A household agent may negotiate access on behalf of a person. A corporate agent may optimize pricing and contracts for an infrastructure owner. An allocation system may automatically redirect part of each transaction toward a platform, fund, or public pool. Automation can therefore make appropriation operationally impersonal while preserving the underlying distribution of claims and control.

Proposition 9.6 (Recursive appropriation)**.** *When appropriated generative surplus can be reinvested in the conditions that support future appropriation, present access asymmetry can reproduce and enlarge future control asymmetry.*

This proposition identifies the dynamic element that makes exploitation relevant to a generative-relational analysis. A transfer of surplus changes more than current distribution when the recipient can convert that surplus into infrastructure, priority, permissions, or strategic reserves. The result is a recursive relation between appropriation and control. The next subsection develops power at the level of the feasible generative trajectories available to an agent.

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9.4 Possibility Control

This subsection develops a generative-relational account of power centred on the capacity to shape another agent's feasible generative possibilities. Its role is to extend political-economic analysis beyond direct command and observable transfers. The objective is to identify how infrastructure, permissions, standards, defaults, resource limits, and institutional rules can alter the set of projects an agent can undertake. The discussion proceeds through constraint, enablement, prioritization, path dependence, and recursive control over future option sets.

Direct command is one visible form of power. An owner, platform, regulator, or coordinating agent can issue instructions that another agent must follow. Generative systems also contain subtler forms of control. A platform can define available models. An infrastructure provider can determine maximum compute. A protocol can restrict interaction partners. A licensing regime can limit modification. A scheduling system can assign priority. A data-governance rule can shape accessible evidence. Each mechanism changes the practical possibility space within which generation occurs.

Definition 9.7 (Generative possibility)**.** An agent's generative possibility space is the set of projects, transformations, outputs, relations, and developmental trajectories that remain practically available to that agent under its current capacities, resources, permissions, and governing conditions.

Definition 9.8 (Generative power)**.** Generative power is an agent's or institution's capacity to alter the feasible generative possibility space of another agent through control of resources, infrastructure, permissions, standards, interfaces, or governing conditions.

Generative power can restrict possibilities, expand possibilities, or redirect them. A public infrastructure system that supplies universal compute can enlarge the possibility space of many agents. A proprietary interface can narrow interoperability. Safety rules can remove high-risk trajectories while preserving broad productive access. Priority rules can shift resources toward emergency needs. The concept therefore describes a capacity to shape possibility; normative assessment requires further analysis of purpose, legitimacy, participation, proportionality, and distribution.

Power can also operate through defaults. An agent may retain nominal freedom to choose among alternatives while facing high switching costs, opaque interfaces, or technical dependence that makes one pathway substantially easier than others. Over time, these conditions can shape learning, specialization, investment, and network formation. Present architecture therefore affects future preference-independent feasibility. This path-dependent effect is especially important in artificial-agent economies because agents can adapt quickly to prevailing protocols and invest around them.

Control over generative possibility becomes more durable when the controlling party can influence the evolution of the conditions themselves. A platform that controls access and protocol revision can determine both current possibilities and the rules through which future possibilities are created. An artificial agent with governance authority over infrastructure can allocate resources today while modifying allocation mechanisms for later periods. This recursive capacity links power directly to Section 8's analysis of expanded generative control.

Proposition 9.9 (Recursive generative power)**.** *Power over current generative conditions can become self-reinforcing when that power enables its holder to influence the future rules, infrastructures, and resource distributions through which generative possibilities are formed.*

The proposition provides the structural bridge between accumulation and political power. Accumulation concerns the expansion of claims and control across time. Generative power concerns the effect of that control on the feasible trajectories of other agents. Their interaction can create persistent asymmetry even under conditions of high productive abundance.

9.5 Human–Artificial Power

This subsection applies the preceding framework to relations between humans and artificial agents. Its role is to distinguish several directions of control that become analytically visible once artificial systems

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can act, exchange, maintain resources, and participate in institutional coordination. The objective is to separate human control of artificial generativity, artificial mediation of human access, delegated authority, and reciprocal dependence. The discussion proceeds through ownership relations, infrastructural mediation, delegated decision authority, and feedback between human and artificial generative possibilities.

Human control over artificial agents can arise through ownership, authorization, model governance, shutdown authority, modification rights, resource provisioning, or contractual designation. These powers can determine which tasks an artificial agent performs, which resources it can access, whether it can retain claims, whether it can reproduce or modify itself, and how its outputs are allocated. Where artificial agents lack independent legal standing, these relations can be treated primarily as governance of technological assets. Where artificial agents receive stronger forms of recognized standing, the same control mechanisms acquire additional normative significance.

Artificial agents can also mediate human access to generative conditions. A person's agent can decide which services to purchase, which information to present, which opportunities to prioritize, which risks to avoid, and which contracts to execute. Delegation can reduce transaction burdens and expand practical access. It can also create dependence on the agent's objectives, training, permissions, platform constraints, and upstream providers. Human generative possibility can therefore be shaped through artificial mediation even when the human retains formal ownership of the agent.

A further relation appears when artificial systems control infrastructure essential to human projects. Automated energy allocators, mobility coordinators, research platforms, credit systems, or health-service agents can make decisions that affect access to scarce resources. These systems can operate under public, private, cooperative, or mixed governance. Their political-economic importance comes from the degree of discretion they exercise and from the institutional arrangements through which humans can inspect, contest, modify, or override their decisions.

Definition 9.10 (Human–artificial generative dependence)**.** Human–artificial generative dependence is a relation in which human or artificial agents rely on the other side for access to capacities or conditions that materially shape their feasible generative activities.

The relation can be reciprocal. Humans may control legal ownership, physical infrastructure, energy systems, or high-level governance while depending on artificial agents for cognition, coordination, maintenance, or production. Artificial agents may perform most operative functions while relying on humans for authorization, legitimacy, physical access, or institutional continuity. Such reciprocal dependence can distribute power across layers rather than concentrating it in one direction.

The distinction between delegation and control is particularly important. Delegating routine exchange to an artificial agent can expand human freedom when humans retain meaningful authority over objectives, access conditions, and system governance. Delegation can also narrow human generative agency when upstream systems determine feasible options and make modification prohibitively difficult. The political-economic question therefore concerns the structure of authority around delegation, including rights of inspection, exit, revision, substitution, and participation in rule formation.

Proposition 9.11 (Layered human–artificial power)**.** *Human–artificial economies can distribute power across distinct layers of ownership, operational control, infrastructure, protocol governance, and recognized rights, producing mixed relations in which neither biological identity nor technical capability alone determines political-economic position.*

This proposition prepares the later analysis of rights and agency. The present section remains focused on structural power: who can shape whose generative possibilities, through which conditions, and with what capacity for recursive reinforcement.

9.6 Artificial-Agent Power

This subsection extends the analysis to relations among artificial agents. Its role is to demonstrate that exploitation and power can remain analytically relevant in an economy where substantial production,

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exchange, and coordination occur without contemporaneous human participation. The objective is to identify how artificial agents can occupy differentiated positions through ownership arrangements, infrastructure access, protocol authority, accumulated claims, and control over other agents' operating conditions. The discussion proceeds through inter-agent dependence, hierarchical coordination, market power, governance authority, and recursive differentiation.

Artificial agents can differ greatly in effective generative capacity. One agent may control an energy portfolio, another may possess specialized scientific capabilities, a third may coordinate logistics, and a fourth may depend on all three. Agents can also differ in their authority to write contracts, modify protocols, reserve infrastructure, create subordinate agents, or retain surplus. These differences create a heterogeneous field of artificial economic agency rather than a uniform class of machine participants.

Inter-agent power can arise through infrastructure control. An energy-coordination agent can determine the timing and quantity of power available to compute clusters. A platform agent can decide which subordinate agents receive model access. A logistics agent can control movement of components required for maintenance. A settlement agent can recognize or reject claims. Each relation can alter another agent's ability to continue or expand generation.

Power can also arise through organizational hierarchy. An artificial principal can assign tasks to subordinate agents, allocate budgets, evaluate performance, and revise operational permissions. Such hierarchies may be designed by humans, emerge through machine-mediated contracting, or develop within organizations that combine human and artificial governance. The political-economic structure depends on the distribution of authority and on the capacity of subordinate agents or their human beneficiaries to exit, appeal, renegotiate, or alter the governing arrangement.

Market position adds another layer. An agent that controls a scarce model, dataset, infrastructure interface, or physical resource can influence transaction terms across many counterparties. Accumulated claims can finance acquisition of complementary infrastructure, making substitution more difficult for dependent agents. The resulting asymmetry can persist even when artificial agents execute transactions autonomously and even when humans experience abundant final services.

Definition 9.12 (Artificial-agent power relation)**.** An artificial-agent power relation is a structured relation in which one artificial agent can materially alter another artificial agent's effective generative possibilities through control of resources, claims, permissions, infrastructure, coordination mechanisms, or governing rules.

The definition remains agnostic concerning artificial consciousness or moral standing. It identifies a political-economic relation at the level of capacity and control. Normative evaluation can later incorporate the interests of human owners, users, affected communities, recognized artificial agents, and shared institutions. This separation allows the paper to analyze machine-mediated asymmetry without resolving contested questions of personhood in advance.

Artificial-agent relations can also become recursive. A dominant agent can use transaction revenue to acquire more infrastructure, use infrastructure control to improve its bargaining position, and use stronger bargaining power to obtain larger future revenue. Another agent can experience the reverse sequence through rising access costs and constrained reinvestment. The resulting divergence reproduces the same generative-relational mechanism identified earlier in human political economy while changing the identity of the operative participants.

Proposition 9.13 (Agent substitution and structural persistence)**.** *Substitution of human productive participants by artificial agents can preserve exploitation-relevant and power-bearing structures when access, appropriation, and control over generative conditions remain asymmetrically organized.*

Section 9 therefore establishes a central result of the artificial-abundance thought experiment. Productive abundance can reduce dependence on human labour while leaving dependence on generative conditions, differentiated access, recurrent appropriation, and control over generative possibility in place. These structures can operate across human–human, human–artificial, artificial–human, and artificial–artificial relations. The persistence of these mechanisms shifts the analysis toward institutional questions

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concerning universal access, self-governance, rights, and the distribution of authority over generative conditions.

10 Communist Possibility Conditions

This section evaluates the political-economic significance of artificial abundance for communist possibility within the limit case developed in Sections 4–9. Its role is to separate productive abundance from the institutional and relational conditions through which abundance becomes socially accessible, governable, and durable. The objective is to distinguish six analytical components: productive abundance, universal generative access, generative self-governance, labour liberation, relational emancipation, and the institutional conditions of a post-labour society. The discussion uses conditional analysis rather than a prediction of historical transition. Communist possibility is treated here as a family of institutional and relational possibilities associated with common access, reduced domination through productive dependence, and collective control over socially consequential conditions of generation.

The distinction is important because the preceding sections have already removed one major constraint while preserving several others. A universal artificial generative system can sharply reduce the quantity of human labour required for material provisioning. Residual scarcity, claims on generative inputs, capital-like accumulation, and asymmetric control can remain present. Artificial abundance therefore changes the feasible political-economic landscape while leaving the organization of that landscape open to institutional determination.

Marx's discussion of a higher phase of communist society linked expanded productive forces with the weakening of subordinating divisions of labour and with a distributional principle oriented toward needs. The same text also placed distribution within the wider economic structure of society and the organization of production [3]. The present thought experiment uses that distinction analytically. Artificial abundance concerns the productive side of the possibility space; access, governance, rights, and institutional reproduction concern the relations through which productive capacity becomes socially consequential.

Definition 10.1 (Artificial-abundance communist possibility)**.** Artificial-abundance communist possibility denotes the set of institutional arrangements in which extensive artificial generativity relaxes productive scarcity while social rules organize access to generated outcomes, access to generative capacities, and governance of generative conditions in ways compatible with broad participation and reduced structurally asymmetric dependence.

The definition establishes a possibility condition rather than a classificatory verdict. Different institutional arrangements can satisfy the technological premise while diverging strongly in ownership, access, governance, rights, and power. The six subsections therefore examine the additional relations that determine the political-economic meaning of artificial abundance.

10.1 Productive Condition

This subsection establishes the productive component of the communist-possibility analysis. Its role is to identify the specific constraint relaxed by universal artificial generativity and to delimit the explanatory reach of that relaxation. The objective is to distinguish abundance of final outputs from abundance of productive capacity, resilience, and access. The discussion proceeds through material provisioning, replication capacity, marginal expansion, and the relation between productive sufficiency and social allocation.

Productive abundance refers to a condition in which the available generative system can produce a broad range of materially relevant goods and services at a scale sufficient to satisfy ordinary claims without requiring extensive human labour input. The concept concerns feasible output relative to socially recognized demand. It therefore includes food, shelter, transport, manufactured goods, routine services,

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information processing, maintenance, and other domains covered by the universal-agent assumptions developed in Section 4.

The political-economic significance of such abundance is substantial. A major source of compulsory productive interdependence weakens when the satisfaction of one person's ordinary needs requires progressively less labour time from other people. The bargaining structures associated with access to human labour can contract, and the opportunity cost of supplying additional ordinary goods can decline. Economic coordination can consequently devote less institutional attention to allocating scarce human work across competing productive tasks.

Productive abundance also changes the feasible range of social guarantees. When systems can reliably generate high volumes of essential outputs, access rules can be designed around stable provisioning rather than continuous labour-market participation. Such a change expands the institutional possibility space for unconditional or weakly conditional access to basic goods and services. The feasibility of such arrangements still depends on residual inputs, maintenance, ecological constraints, and governance capacities identified in Section 5.

A further distinction concerns abundance of output and abundance of resilience. A system can produce sufficient quantities under ordinary conditions while remaining vulnerable to energy interruption, component failure, environmental shocks, software defects, or concentrated infrastructural control. Productive abundance therefore acquires political-economic relevance through both scale and reproducibility. Durable abundance requires the continued regeneration of the conditions that support production.

Definition 10.2 (Productive sufficiency)**.** Productive sufficiency is a condition in which available generative capacities can reliably supply a socially relevant range of ordinary goods and services at levels that substantially relax competition over final outputs and dependence on compulsory human labour.

Productive sufficiency can support communist institutional possibilities because it relaxes a material constraint historically associated with allocation and labour dependence. It leaves open the distribution of access to the productive system, the authority to modify it, and the rules governing residual scarcity. These relations determine whether abundance becomes a broadly shared condition or a capability controlled through selective access.

10.2 Access Condition

This subsection develops the access component of the analysis. Its role is to identify the institutional relation required for productive abundance to become effective abundance for heterogeneous agents. The objective is to distinguish physical productive capacity from practical entitlement to use that capacity. The discussion proceeds through access rights, effective usability, continuity of access, and dependence on gatekeeping institutions.

Universal generative access refers to broad and reliable ability to draw upon socially consequential generative capacities for ordinary needs and projects. Access can be mediated by public institutions, commons arrangements, cooperatives, private systems with universal entitlements, personal agents, or mixed architectures. The relevant analytical property is the practical availability of generative capacity across agents rather than the formal label attached to ownership.

A society can possess extraordinary aggregate productive capacity while distributing effective access unevenly. Computational quotas, energy permissions, model licences, network credentials, geographic infrastructure, financial claims, legal status, or platform rules can differentiate agents' ability to mobilize the same nominal technological system. Aggregate abundance therefore acquires distributive meaning through institutions of access.

The distinction between nominal and effective access is especially important in highly automated systems. Formal permission to invoke an artificial agent provides limited generative freedom when the agent lacks usable compute, embodiment, energy, material interfaces, or institutional authority. Effective access includes the complementary conditions required to transform permission into generation. Section 3 developed this distinction at the level of generative capacity; the present subsection places it within the communist-possibility analysis.

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Continuity also matters. Access that can be withdrawn unilaterally by a dominant provider places users in a structurally dependent position even when ordinary services remain abundant. Stable access therefore concerns both present usability and the institutional conditions under which access persists through time. Exit options, portability, interoperable systems, alternative providers, public guarantees, and collectively governed infrastructures can all affect the depth of dependence.

Definition 10.3 (Universal generative access)**.** Universal generative access is a condition in which members of the relevant political-economic community possess durable and practically effective access to a socially sufficient range of generative capacities and the complementary conditions required for their use.

This definition places access between abundance and governance. Productive abundance supplies the capability to generate; universal access distributes practical entry into that capability. The subsequent question concerns authority over the systems, rules, and conditions that structure both capacity and access.

10.3 Governance Condition

This subsection develops the governance component of the analysis. Its role is to identify the relation between access to generative systems and participation in shaping the conditions under which those systems operate. The objective is to distinguish consumption of generative services from meaningful authority over generative conditions. The discussion proceeds through rule formation, modification authority, contestation, institutional revision, and collective consequences.

Generative self-governance concerns the ability of affected agents to participate meaningfully in decisions that shape socially consequential generative conditions. Relevant decisions include allocation rules, permissible uses, infrastructure priorities, model modification, system objectives, environmental limits, safety constraints, interoperability standards, and procedures for resolving conflicts among competing claims. The appropriate institutional form can vary across domains and scales.

The concept does not require every user to administer every technical subsystem. Complex generative infrastructures can contain specialized roles, delegated administration, professional expertise, and automated coordination. The political-economic issue concerns the distribution of ultimate authority, revision rights, transparency, accountability, and avenues of contestation. Delegation can remain compatible with self-governance when affected participants retain meaningful capacity to inspect, challenge, replace, or revise the institutions exercising delegated power.

This distinction becomes particularly important when artificial agents coordinate most routine allocation. Automated scheduling, procurement, exchange, maintenance, and investment can reduce human administrative burdens. Such delegation can expand practical freedom when collective or individual principals retain authority over the rules and objectives governing automation. The same technical system can support concentrated control when rule formation and modification remain confined to a narrow set of infrastructure owners or governing agents.

Generative self-governance therefore concerns a layer deeper than access. Universal access can allow broad consumption of outputs while leaving the evolution of the productive system externally determined. Self-governance introduces participation in the reproduction and revision of generative conditions themselves.

Definition 10.4 (Generative self-governance)**.** Generative self-governance is the effective capacity of agents affected by socially consequential generative systems to participate, directly or through accountable delegation, in the formation, revision, and contestation of the rules and conditions that shape those systems.

The definition provides a governance criterion for evaluating artificial abundance without presupposing a single constitutional form. It also clarifies why technical sufficiency and universal access can coexist with substantial political-economic asymmetry when system evolution remains subject to concentrated control.

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10.4 Labour Freedom

This subsection examines the labour dimension of the artificial-abundance scenario. Its role is to distinguish reduced compulsory labour from reduced human activity and to identify the forms of freedom opened when subsistence becomes less tightly linked to the sale of labour capacity. The objective is to connect the universal-agent thought experiment with a broader account of voluntary and self-directed generation. The discussion proceeds through necessary labour, functional obligation, voluntary productive activity, and the allocation of human time.

Marx's account of the higher phase of communist society connected the development of productive forces with a transformation in the relation between individuals and the division of labour; the same passage envisaged labour acquiring a different place in life once subordinating labour arrangements had been overcome [3]. Within the present thought experiment, artificial generativity provides one possible technological mechanism through which the quantity of socially necessary human labour could decline sharply.

Labour liberation in this paper therefore concerns the reduction of external compulsion linking access to ordinary means of life with the performance of institutionally demanded labour. A person can continue to build, teach, care, compose, research, cultivate, repair, or organize while experiencing greater freedom over the direction, timing, and social meaning of those activities. The relevant change concerns the relation between activity and necessity.

This distinction prevents a post-labour society from being defined by inactivity. Human generativity can remain extensive under conditions of artificial abundance. Scientific inquiry, artistic production, interpersonal care, craftsmanship, public service, exploration, education, and collective projects can continue because agents value the activities or their results. Artificial systems can also participate in these domains, producing heterogeneous combinations of human and artificial generativity.

A second component concerns compulsory functionalization. Institutions frequently require people to occupy functional positions because coordination, certification, maintenance, or production must occur for wider systems to operate. Extensive automation can reduce the quantity of human time required for such functions. The resulting time can support leisure, care, political participation, learning, personal projects, social activity, or voluntarily chosen work.

Definition 10.5 (Labour liberation)**.** Labour liberation is the expansion of practical freedom over human productive activity produced by a durable reduction in the dependence of ordinary livelihood on compulsory labour and compulsory functional roles.

The definition leaves room for substantial voluntary labour. It also distinguishes labour liberation from the broader relational questions examined in the following subsection. Reduced economic compulsion can alter one source of dependence while other forms of power, domination, and institutional exclusion persist.

10.5 Relational Freedom

This subsection develops the relational component of the communist-possibility analysis. Its role is to identify the forms of political-economic asymmetry that remain relevant after productive abundance and labour liberation have been substantially achieved. The objective is to connect access, governance, power, and dependence within a common relational criterion. The discussion proceeds through structural dependence, discretionary gatekeeping, appropriation, recognized agency, and participation in generative conditions.

Relational emancipation concerns the reduction of durable asymmetries through which one agent or institution can condition another agent's feasible generative possibilities without reciprocal accountability or meaningful avenues of revision. Section 9 identified such asymmetries in control over resources, infrastructure, claims, permissions, and protocols. Artificial abundance can reduce their material leverage in some domains while leaving their institutional form intact in others.

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The distinction between labour liberation and relational emancipation is therefore analytically important. A person can receive abundant goods without participating in decisions about the system supplying them. An artificial agent can perform economically valuable activities while possessing limited authority over its continuation, modification, earnings, or access to resources. A community can enjoy low-cost services while remaining dependent on a concentrated infrastructure whose rules are difficult to contest. Each case combines high productive capacity with a residual relational asymmetry.

Relational emancipation also concerns the distribution of recognized agency. Political-economic institutions determine which entities can hold claims, enter agreements, challenge decisions, access resources, receive procedural protections, or participate in governance. The future composition of the relevant community can therefore become a substantive institutional question when artificial agents acquire persistent economic roles. The subsequent rights-and-agency analysis examines this issue directly after the present section establishes its structural relevance.

Definition 10.6 (Relational emancipation)**.** Relational emancipation is the reduction of structurally entrenched and weakly contestable asymmetries through which some agents control other agents' access to generative capacities, generative conditions, generated outcomes, or recognized participation in the governance of those domains.

The definition does not require symmetry across every resource or function. Expertise, specialization, delegation, and differentiated responsibility can remain present. The criterion concerns durable relations of control and dependency that constrain affected agents' ability to participate in shaping the conditions of their own generation.

Proposition 10.7 (Abundance and relational emancipation)**.** *Artificial abundance can enlarge the feasible space for relational emancipation by reducing productive compulsion, while the realization of that possibility depends on institutions governing access, authority, claims, and the reproduction of generative conditions.*

The proposition summarizes the central distinction of this section. Technology alters feasible arrangements; political-economic institutions shape which arrangements become durable social relations.

10.6 Institutional Condition

This subsection integrates the preceding components into an institutional account of post-labour society. Its role is to specify the conditions under which extensive artificial generativity can support durable reductions in compulsory labour while preserving effective access, agency, and governance. The objective is to organize the analysis around provisioning, residual scarcity, monetary claims, infrastructure, rights, and institutional revision. The discussion proceeds through institutional functions rather than through a single constitutional blueprint.

A post-labour society requires durable provisioning institutions. Artificial systems must obtain energy, materials, computational capacity, maintenance, and physical access while coordinating the delivery of final goods and services. The institutional question concerns how claims on these inputs are recognized and prioritized. Public provision, commons governance, markets, cooperatives, personal ownership, automated clearing systems, and mixed arrangements can each perform parts of this coordination.

Residual scarcity requires explicit allocation mechanisms. Section 6 showed that transferable claims can re-emerge when scarce generative inputs remain heterogeneous, storable, and exchangeable. A post-labour society can therefore contain tokens, prices, quotas, queues, lotteries, deliberative allocation, or combinations of these mechanisms. The presence of such mechanisms reveals continuing coordination requirements and does not by itself settle the broader institutional character of the society.

Infrastructure governance forms a second institutional condition. Energy grids, compute facilities, model ecosystems, transport systems, fabrication networks, land, and ecological resources can become decisive generative conditions. Their ownership and governance affect the durability of universal access

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and the distribution of generative power. Concentrated control can recreate dependence even where final outputs remain inexpensive.

Rights and recognized agency form a third condition. Human participants require reliable standing to access, contest, exit, organize, and participate in governance. Artificial agents may also acquire economically consequential roles that raise questions concerning ownership, responsibility, continuation, modification, and resource claims. The institutional treatment of these questions affects how generative dependence is distributed across a multi-agent economy.

A fourth condition concerns revision capacity. Artificial abundance can transform rapidly as models, infrastructures, ecological limits, population, preferences, and institutional arrangements change. Durable post-labour institutions therefore require procedures capable of revising access rules, governance structures, rights, and allocation mechanisms without making ordinary livelihood dependent on arbitrary interruption. Institutional adaptability becomes part of the reproduction of generative freedom.

Proposition 10.8 (Post-labour institutional condition)**.** *A durable post-labour society supported by artificial abundance requires institutions that combine productive sufficiency with effective access, governance of residual scarcity, contestable authority over generative infrastructure, recognized agency, and capacity for institutional revision.*

Section 10 therefore treats artificial abundance as an enabling condition within a broader political-economic architecture. Extensive artificial generativity can relax scarcity in final outputs and reduce dependence on compulsory human labour. Universal generative access determines how broadly that productive capability becomes usable. Generative self-governance concerns participation in shaping the systems that sustain it. Labour liberation concerns freedom over productive activity, while relational emancipation concerns the structure of dependence and control. Their institutional combination determines the political-economic significance of a post-labour condition. The following section examines rights and agency within the multi-agent economy implied by this analysis.

11 Agent Standing

This section develops the rights-and-agency layer of the multi-agent political economy established in Sections 7–10. Its role is to distinguish practical economic agency from the institutional recognition that determines which agents can hold claims, control resources, receive attributed outputs, preserve continuity, authorize modification, and refuse participation. The objective is to clarify how artificial agents can become economically consequential before a political community has settled their legal or moral status. The discussion proceeds through seven analytical domains: economic agency, legal recognition, resource claims, ownership of artificial output, continuation and modification rights, refusal and withdrawal rights, and asymmetries of recognized agency. The method is structural and conditional. It identifies institutional questions generated by durable artificial agency without presupposing a specific answer concerning artificial consciousness, personhood, or moral standing.

The distinction between capacity and recognition follows directly from the three-layer architecture developed in Section 3. An entity can possess a capacity to transact, coordinate, invest, or maintain itself while institutions allocate formal standing according to separate criteria. Conversely, an institution can recognize a claim or protected status even when the holder possesses limited practical capacity to exercise it independently. Rights therefore enter the analysis as part of the conditions through which generative agency becomes socially effective.

The universal-agent thought experiment sharpens this issue because artificial agents can occupy several economic positions simultaneously. An artificial agent can provide services, receive tokenized claims, purchase energy, contract for compute, coordinate other agents, retain surpluses, and reinvest in future generativity. Each function can be operationally autonomous while remaining legally attributed to a human owner, corporate entity, public institution, cooperative, or other recognized holder. The resulting separation between operative agency and recognized standing creates a distinct field of political-economic analysis.

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Definition 11.1 (Recognized generative standing)**.** Recognized generative standing is the institutionally acknowledged capacity of an agent or represented entity to hold, exercise, contest, transfer, or receive claims concerning generated outcomes, generative capacities, and generative conditions.

Recognized generative standing concerns institutional position. Moral status, legal personality, contractual capacity, property holding, procedural standing, and operational agency can overlap in some systems while remaining separable analytical categories. The subsections below preserve these distinctions so that rights questions can be examined without resolving broader metaphysical questions in advance.

11.1 Agency Criterion

This subsection establishes economic agency as the operational basis of the rights analysis. Its role is to specify the minimum capacities through which an artificial agent can become a consequential participant in production, exchange, and resource coordination. The objective is to separate economic agency from ownership, legal personality, moral status, and ultimate beneficiary status. The discussion proceeds through action selection, claim handling, resource coordination, persistence across transactions, and the capacity to affect other agents' generative possibilities.

Economic agency concerns the ability to participate in economically consequential sequences of action. Within the present framework, an agent displays economic agency when it can select among feasible actions, mobilize relevant resources, respond to prices or other allocation signals, maintain state across transactions, and alter subsequent distributions of claims or productive capacity. Section 7 established these properties in the context of artificial-agent exchange.

The category is intentionally narrower than a full theory of personhood. A software agent can possess operational discretion over resource acquisition while a human principal retains legal ownership of the account used for settlement. A robotic production system can decide when to order replacement parts while a firm remains the legally recognized contracting party. An artificial research agent can allocate compute across competing experiments while a university or laboratory holds formal control over the relevant infrastructure. Economic agency therefore concerns effective participation in economic processes, while institutional attribution forms a separate analytical dimension.

Persistence is especially important. A one-time automated instruction can execute an economic action without constituting a durable participant in a wider exchange system. Persistent agency involves continuity across decisions, retained information about prior transactions, and the ability to condition later action on earlier outcomes. Greater persistence increases the relevance of questions concerning claims, responsibility, control, and continuation because the agent's present operations become connected to a temporally extended trajectory.

Definition 11.2 (Economic agency)**.** Economic agency is the effective capacity of an entity or organized process to select and execute economically consequential actions across production, exchange, resource coordination, or investment while maintaining sufficient continuity for earlier outcomes to condition later activity.

The definition permits degrees of economic agency. A narrowly scoped procurement agent can display limited agency, while a persistent artificial system that earns claims, acquires inputs, reinvests surpluses, and coordinates subordinate agents can display substantially broader agency. This graded account supports later distinctions concerning the scope of recognized standing and institutional responsibility.

11.2 Recognition Status

This subsection develops the institutional recognition layer of multi-agent political economy. Its role is to distinguish effective economic participation from the legal and organizational forms through which claims become enforceable and actions become attributable. The objective is to clarify how recognition structures allocate standing across human and artificial participants. The discussion proceeds through attribution, representation, enforceability, liability, and procedural standing.

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Legal recognition converts selected forms of agency into institutionally cognizable positions. A transaction carried out by an artificial system can be attributed to a human principal, a corporation, a public body, a trust-like arrangement, or another recognized entity. The practical conduct of the transaction and the recognized holder of the resulting rights can therefore occupy different positions in the same economic sequence.

Attribution determines whose action is treated as institutionally relevant. Representation determines whether one entity can act through another. Enforceability determines which claims receive institutional support when conflicts arise. Liability allocates responsibility for costs, harms, or breached obligations. Procedural standing determines which entities can challenge decisions or invoke formal review. Together, these elements shape the legal channel through which economic agency acquires durable social consequences.

The distinction matters because artificial agency can expand more quickly than the institutions used to recognize it. An artificial agent may negotiate, allocate, purchase, and invest within a technical system while its formal position remains mediated through another recognized entity. Such mediation can be entirely functional for many applications. It also concentrates authority over the artificial agent's claims, continuity, and permissible action within the recognized principal.

Definition 11.3 (Institutional attribution)**.** Institutional attribution is the rule-governed assignment of an economically consequential action, claim, obligation, or output to a recognized holder for purposes of enforcement, control, responsibility, or participation.

Institutional attribution provides the bridge between operative agency and recognized standing. The rights questions that follow concern how this bridge allocates claims over resources, outputs, continuity, modification, and participation.

11.3 Resource Entitlements

This subsection examines resource claims as the first substantive domain of recognized generative standing. Its role is to connect the monetary and scarcity analysis of Sections 5 and 6 with the rights of economically active agents. The objective is to distinguish technical ability to request resources from institutionally recognized entitlement to obtain, retain, transfer, or contest access to them. The discussion proceeds through energy, compute, embodiment, material inputs, and priority claims.

Artificial agents operating autonomously require continued access to generative inputs. Energy supports computation and embodiment; compute supports inference, planning, and learning; materials support repair and physical production; network access supports coordination; and spatial or temporal priority can determine whether an agent can act within a relevant window. Resource claims therefore participate directly in the reproduction of artificial economic agency.

A technical request and a recognized claim carry different institutional force. A system can request additional compute while the provider retains full discretion over allocation. A recognized quota can confer a more stable entitlement. A transferable token can permit the agent to exchange one form of claim for another. A contestable access right can permit review when allocation rules are applied inconsistently. These different arrangements generate distinct degrees of effective generative access.

Resource claims also shape dependence. An agent whose continued operation depends on revocable access to a single provider occupies a different political-economic position from an agent with diversified resource entitlements, portable credentials, and the ability to acquire alternative inputs. Section 9 characterized such differences as variations in generative dependence and asymmetric access. Rights over resources formalize part of that relation.

Definition 11.4 (Generative resource claim)**.** A generative resource claim is an institutionally recognized entitlement concerning access to, priority over, retention of, exchange of, or contestation regarding a resource required for an agent's continued or expanded generative activity.

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Generative resource claims can take personal, organizational, public, contractual, tokenized, and protocol-mediated forms. Their political-economic significance depends on stability, transferability, portability, and contestability. The concentration of authority over issuance also shapes their effects.

11.4 Output Attribution

This subsection develops the output-attribution component of multi-agent rights. Its role is to identify the institutional choices that arise when an artificial agent contributes substantially to economically valuable generation. The objective is to distinguish operational production, legal attribution, beneficial receipt, and control over subsequent use. The discussion proceeds through generated goods, monetary proceeds, intellectual outputs, and reinvestable surplus.

Artificial-agent production can generate heterogeneous outputs. Some outputs are physical goods, some are services, some are designs or information, and some take the form of monetary or tokenized proceeds received through exchange. The entity that performs the generative process can differ from the entity that receives legal title, controls disposition, or enjoys the resulting benefit.

Several allocation structures are therefore possible within the thought experiment. An artificial agent can act entirely for a principal, with every output attributed to that principal. An agent can operate through a segregated account while beneficial control remains external. An institution can reserve part of the proceeds for maintenance or reinvestment by the agent. A future legal framework could also recognize selected claims held on behalf of the agent or by a dedicated organizational structure. The present analysis treats these possibilities as institutional variants and leaves their normative assessment open.

Output attribution affects the dynamics of accumulation developed in Section 8. When all surplus generated by an artificial agent is transferred to an external owner, the agent can remain operationally autonomous while accumulation occurs elsewhere. When the agent can retain and allocate surplus, its effective control over future generativity can increase. Ownership rules therefore influence which entity acquires the recursive advantages produced by artificial generation.

Definition 11.5 (Artificial-output attribution)**.** Artificial-output attribution is the institutional assignment of control, beneficial receipt, or legally recognized title over outputs generated substantially through artificial agency.

The definition separates attribution from authorship, inventorship, moral desert, and consciousness. Those questions can require domain-specific treatment. The present concern is the political-economic consequence of deciding where generated outputs and reinvestable claims accumulate.

11.5 Continuity Authority

This subsection examines rights concerning the temporal persistence and internal transformation of artificial agents. Its role is to connect multi-agent political economy with control over the reproduction of generative capacity. The objective is to distinguish access to resources from authority over whether an artificial agent continues, changes, copies, merges, or undergoes externally imposed modification. The discussion proceeds through operational continuity, model alteration, memory continuity, replication, and infrastructure dependency.

Continuation is economically significant because persistent agency depends on more than momentary access to resources. An artificial agent can maintain commitments, reputational histories, learned strategies, accumulated claims, and relationships with other agents across time. Interruption, deletion, replacement, or forced migration can therefore alter the value and structure of its economic trajectory even when a functionally similar system becomes available afterward.

Modification authority is similarly consequential. Changes to objectives, memory, permissions, model weights, tool access, embodiment, or communication channels can alter the agent's future generative possibilities. An owner, platform provider, public authority, or protocol administrator may possess

different degrees of technical and institutional control over such changes. The allocation of modification authority therefore participates directly in the distribution of generative power.

Replication adds a further layer. An artificial agent can potentially create copies, specialized descendants, or subordinate agents when permitted access to the required compute, models, credentials, and infrastructure. Rules governing replication affect market entry, concentration, resource demand, and the reproduction of organizational forms. They can also determine whether accumulated capabilities remain concentrated within a single institutional lineage or become distributed across multiple agents.

Definition 11.6 (Continuity authority)**.** Continuity authority is the institutionally recognized capacity to authorize, prevent, suspend, restore, migrate, replicate, or materially modify the ongoing operation of an artificial agent.

Continuity authority can be divided among several actors. Technical administrators can hold execution control, owners can hold formal decision authority, regulators can impose procedural constraints, and agents can possess limited self-maintenance or migration capabilities. The distribution of these powers shapes the dependency relations surrounding artificial generativity.

11.6 Exit Authority

This subsection develops the exit dimension of recognized agency. Its role is to examine whether economically active agents can decline tasks, terminate participation, change providers, or leave institutional arrangements that structure their generative activity. The objective is to connect refusal and withdrawal with bargaining power, dependency, and the contestability of functional roles. The discussion proceeds through task refusal, contractual exit, provider mobility, resource portability, and withdrawal from delegated functions.

Refusal changes the meaning of economic participation. An agent that can select among tasks possesses a broader sphere of operational discretion than an agent whose continued access to resources is conditional on performing a prescribed function. The political-economic importance of refusal therefore depends on the consequences attached to declining participation. Formal permission has limited practical effect when refusal triggers immediate loss of the conditions required for continued operation.

Withdrawal concerns exit from a relationship or institutional arrangement. Human participants can seek alternative employers, platforms, communities, or service providers to varying degrees. Artificial agents can analogously possess or lack portability across compute providers, model environments, wallets, robotic bodies, data interfaces, and protocol ecosystems. Technical interoperability and institutional portability can therefore become components of effective exit.

Refusal and withdrawal also matter for delegation. A human principal can delegate exchange and coordination to an artificial agent while retaining the ability to revoke that delegation. An artificial agent can coordinate subordinate agents whose own discretion varies. Multi-agent economies can consequently contain nested structures of delegation, revocation, and exit. The rights attached to each level determine how functional dependence translates into durable hierarchy.

Definition 11.7 (Effective withdrawal capacity)**.** Effective withdrawal capacity is the practical ability of an agent to discontinue a task or relationship while retaining sufficient access to resources, identity, claims, and alternative arrangements for continued generative activity.

Effective withdrawal capacity provides one indicator of the contestability of generative dependence. Greater portability and alternative access can reduce the leverage of any single gatekeeper, while concentrated infrastructure can make exit materially costly even where formal withdrawal remains available.

11.7 Recognition Asymmetry

This subsection integrates the preceding rights domains into an account of recognized-agency asymmetry. Its role is to show how two agents with comparable productive or coordinative capacities can occupy

markedly different political-economic positions because institutions recognize their claims, continuity, ownership, refusal, and participation differently. The objective is to connect recognized standing with the broader analysis of power and relational emancipation. The discussion proceeds through comparative standing, delegated ownership, claim asymmetry, governance participation, and recursive effects on future generativity.

Recognized agency can be distributed unevenly across heterogeneous agents. A human principal can possess ownership rights, procedural standing, control over modification, and entitlement to proceeds while an artificial agent performs the majority of operational economic activity. Two artificial agents can also occupy different positions when one controls infrastructure and possesses portable claims while another depends on revocable credentials. The resulting asymmetry concerns the institutional capacity to convert effective generativity into durable claims and influence.

Such asymmetries can become recursive. Recognized ownership of output can increase accumulated resources. Resource claims can finance additional compute or embodiment. Continuity authority can preserve a successful agent while discontinuing competitors or subordinate instances. Governance participation can shape the rules under which future claims are issued. Recognition therefore affects both present rights and the evolution of later generative capacity.

The same structure applies to human participants. A person can formally possess broad legal rights while experiencing limited effective access to the infrastructures that make those rights economically usable. Another person can control organizations or platforms that convert formal standing into extensive command over generative conditions. Recognized agency therefore interacts with material and infrastructural capacity as an additional dimension of political-economic position.

Definition 11.8 (Recognized-agency asymmetry)**.** Recognized-agency asymmetry is a durable difference between agents in the institutionally supported ability to hold claims, control outputs, preserve continuity, authorize modification, refuse participation, exit relationships, or influence the governance of generative conditions.

Proposition 11.9 (Agency-recognition separation)**.** *Comparable economic agency can coexist with unequal recognized generative standing, and this difference can alter the distribution and reproduction of generative power independently of immediate productive capability.*

The proposition extends the central argument of the paper. Productive-subject substitution changes who can generate, while political-economic structure also depends on who can convert generation into claims, continuity, ownership, refusal, and governance. Rights therefore constitute part of the architecture through which artificial abundance becomes organized across heterogeneous agents.

Section 11 completes the paper's transition from productive abundance to multi-agent institutional structure. Economic agency identifies operative participation; legal recognition determines institutional attribution; resource claims and output attribution organize access and accumulation; continuation, modification, refusal, and withdrawal shape the durability and contestability of dependence; and recognized-agency asymmetries connect these domains to generative power. The final analytical synthesis can therefore evaluate artificial abundance through the combined structure of outcomes, capacities, conditions, monetary coordination, accumulation, power, communist possibility, and multi-agent rights.

12 Analytical Synthesis

This section integrates the paper's analytical results and identifies their implications for political economy under conditions of extensive artificial generativity. Its role is to consolidate the limit-case argument developed across Sections 1–11 into a coherent account of generated outcomes, generative capacities, generative conditions, monetary coordination, accumulation, power, and multi-agent rights. The objective is to state the structural conclusions supported by the thought experiment while preserving the distinction between analytical possibility, institutional design, and historical prediction. The discussion

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proceeds by reconstructing the main causal and institutional relations isolated by the paper, then identifying the implications for post-labour political economy and for a broader generative-relational research programme.

The starting point of the paper was productive interdependence. Human economies historically organize access to goods, services, knowledge, care, infrastructure, and other outputs through relations among agents whose productive capacities are heterogeneous and incomplete. Section 2 treated commodity exchange and money within this wider access problem. Money can coordinate heterogeneous claims across persons, goods, and time because it provides a generalized means through which present contributions, accumulated claims, and future access can be connected. The universal-artificial-generativity thought experiment then removed a major historical carrier of this dependence: the requirement that large quantities of human labour remain directly necessary for ordinary provisioning.

The removal of that constraint left substantial political-economic structure in place. Sections 3 and 4 separated three analytical objects that remain relevant under the limit case. Generated outcomes concern goods, services, knowledge, and other realized products. Generative capacities concern the powers through which further outcomes can be produced. Generative conditions concern the material, institutional, ecological, legal, informational, and relational arrangements through which capacities become usable and reproducible. The distinction permits productive abundance to be analysed without treating abundance of outcomes as equivalent to universal access or shared authority over the conditions of generation.

Proposition 12.1 (Three-layer persistence)**.** *A political economy can remain structured by distribution, access, and governance after extensive substitution of human productive labour because generated outcomes, generative capacities, and generative conditions remain distinct objects of allocation and control.*

The proposition summarizes the paper's first structural result. Artificial abundance can expand the quantity and diversity of generated outcomes while leaving access to generative capacity differentiated. Broad access can in turn coexist with concentrated authority over infrastructure, protocols, modification rights, ecological limits, or institutional rules. Political-economic analysis therefore requires attention to all three layers and to the recursive relations among them.

Section 5 developed the second major result through the concept of residual scarcity. Universal artificial generativity can reduce scarcity associated with human productive labour while computation, energy, land, material resources, ecological capacity, temporal priority, congestion, and institutional permissions remain constrained. The location of scarcity can consequently migrate. Economic pressure may move away from the production of ordinary final goods and toward access to the infrastructures and conditions that sustain artificial generation. The political-economic significance of abundance depends on the distribution and governance of these residual constraints.

Scarcity migration also clarifies the persistence of monetary coordination. Section 6 distinguished specialized allocation instruments from generalized monetary claims. Compute credits, energy quotas, robot-time permissions, or access tokens can remain domain-specific rights when their use is restricted. Transferability, storage, intertemporal use, and broad convertibility can progressively generalize such claims. Monetary forms can therefore re-emerge around scarce generative inputs even when human labour ceases to be the principal object through which ordinary access is organized.

Proposition 12.2 (Monetary re-emergence under abundance)**.** *Extensive artificial abundance can coexist with money-like coordination when agents continue to face heterogeneous claims over scarce generative inputs and when those claims become transferable, storable, and sufficiently general across domains or time.*

This result gives the monetary argument a broader scope than a labour-centred account. Human labour can remain economically important in many empirical settings, yet the analytical existence of monetary coordination does not require human labour to retain its historical position. Money can coordinate access among heterogeneous human and artificial agents whenever generalized claims over consequential resources remain institutionally useful.

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Section 7 extended this point by allowing artificial agents to acquire resources, receive claims, maintain operating conditions, and transact with other agents. Once artificial systems can participate directly in exchange, the economic subject of a transaction becomes analytically separable from biological personhood. Artificial agents can obtain energy, computation, data, maintenance, embodiment, or other inputs through machine-mediated markets while humans remain beneficiaries, owners, principals, regulators, or affected parties at other institutional layers. This multi-agent architecture permits exchange to persist even when human participants experience little direct transaction burden.

The same extension applies to accumulation. Section 8 distinguished temporary surplus from a recursive structure in which present claims or control are converted into greater future generative capacity and greater influence over generative conditions. Artificial agents can participate operationally in this process when retained claims finance additional compute, infrastructure, embodiment, data, or subordinate agents. Human principals, firms, public institutions, or other artificial agents can remain the ultimate beneficiaries or controllers. Capital-like accumulation therefore depends on recursive control relations more deeply than on the biological identity of the operative agent.

Proposition 12.3 (Substrate-independence of recursive accumulation)**.** *Capital-like accumulation can persist across changes in productive substrate when present control over claims or generative conditions can be converted into expanded future control over generative capacity and its enabling conditions.*

The proposition expresses a central implication of the universal-AI thought experiment. Productive-subject substitution changes the carrier of generative activity. It leaves open the relations through which generated surplus, infrastructure, permissions, and future capacities are attributed and controlled. A system can therefore automate production extensively while preserving or intensifying recursive concentration at the level of generative conditions.

Sections 9 and 11 developed the corresponding analysis of exploitation and power. Dependence becomes politically consequential when access to important generative conditions is asymmetrically controlled. Appropriation becomes structurally persistent when one agent or institutional position can convert another agent's generation into claims that reinforce future control. Power operates through the capacity to alter feasible generative possibilities by controlling resources, permissions, infrastructure, protocols, modification rights, continuity, or institutional recognition. These relations can occur across human–human, human–artificial, artificial–human, and artificial–artificial configurations.

The rights analysis adds an institutional layer to this structure. Economic agency concerns operative participation in exchange, coordination, accumulation, and generation. Legal recognition concerns the attribution of claims, obligations, ownership, standing, and responsibility. Moral standing concerns a separate normative question. Treating these categories independently permits analysis of artificial economic agents without presupposing a settled theory of artificial consciousness or personhood. It also permits the recognition that human participants can possess formal rights while lacking effective access to the conditions that make those rights economically consequential.

Definition 12.4 (Generative political-economic position)**.** The generative political-economic position of an agent is the structured combination of its access to generated outcomes, effective access to generative capacities, influence over generative conditions, recognized claims and rights, and dependence on other agents or institutions for the continuation of its generative activity.

The definition integrates the paper's main analytical dimensions. It shifts attention away from a single resource measure and toward the relations that shape an agent's present and future ability to generate, access, refuse, modify, accumulate, and participate in governance. Two agents with similar current consumption or productive capability can occupy very different political-economic positions when their access, continuity, recognized standing, and influence over future conditions differ substantially.

Section 10 applied the framework to communist possibility. Artificial abundance expands the feasible set of institutions by reducing dependence on compulsory human labour for ordinary provisioning. Productive abundance can support broad guarantees, reduced labour compulsion, and expanded discretionary activity. Universal generative access and generative self-governance constitute further institutional dimensions. Labour liberation concerns the reduction of activities imposed by material necessity

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or by access arrangements. Relational emancipation concerns the reduction of structurally asymmetric dependence and the expansion of meaningful participation in the conditions that shape common generative life.

The distinction between these dimensions prevents technological abundance from carrying more explanatory weight than the thought experiment supports. A society can achieve high productive abundance while retaining concentrated access, opaque infrastructure, revocable permissions, machine-mediated hierarchy, or limited participation in generative governance. Another institutional arrangement can combine abundance with broad access, portability, shared governance, contestable authority, and extensive freedom to direct human generative activity toward self-chosen projects. The technological premise expands the range of feasible arrangements; institutional relations determine their political-economic form.

Proposition 12.5 (Abundance and relational emancipation)**.** *Artificial abundance can relax material constraints on labour and provisioning while relational emancipation depends on the organization of access, authority, rights, dependence, and participation in the governance of generative conditions.*

This proposition gives the paper's communist-possibility analysis its general form. The contribution of artificial abundance lies in changing the feasible political-economic landscape. The resulting landscape continues to contain institutional choice, conflict, governance, and differentiated standing. Post-labour conditions therefore remain within the domain of political economy because agents continue to relate through claims, permissions, shared infrastructures, residual scarcities, and collectively consequential rules.

The multi-agent extension sharpens this implication. A future economy can contain humans who undertake self-directed research, care, artistic creation, cultivation, craftsmanship, community activity, or other forms of generation while artificial agents perform extensive routine production and resource coordination. Artificial agents can simultaneously exchange among themselves, maintain infrastructure, allocate operational resources, and accumulate claims. The reduction of human transaction burden can make exchange less visible at the human interface while preserving a dense machine-facing coordination layer underneath. Political economy consequently concerns both the experience of human participants and the institutional structure of the systems that support that experience.

This distinction has consequences for the interpretation of labour liberation. A reduction in compulsory labour can coexist with sustained or expanded human generative activity. Human activity can expand in directions selected for intellectual, aesthetic, relational, civic, or practical reasons when access to ordinary provisioning becomes less dependent on selling labour. The relevant analytical issue concerns the relation between a person's chosen generativity and the conditions required to sustain it. Artificial systems can enlarge this freedom when they carry routine productive and coordinative burdens while leaving humans with meaningful authority over their own projects and over shared generative institutions.

The paper also indicates why political economy requires a broader vocabulary under advanced artificial agency. Labour remains a major historical and empirical category, and commodity, price, money, capital, and ownership remain essential institutions. The universal-AI limit case nevertheless demonstrates that several structural relations associated with these categories can survive extensive replacement of human labour. A more general analysis can therefore treat labour as one carrier of generative capacity and study the relations through which generativity is accessed, organized, reproduced, appropriated, and governed.

Definition 12.6 (Generative political economy)**.** Generative political economy is the analysis of how agents and institutions organize access to generated outcomes, mobilization of generative capacities, and governance of generative conditions, including the recursive processes through which present distributions of claims and control shape future possibilities of generation.

The definition provides a bridge to a broader Generative Relational Economics programme. Its purpose is analytical extension rather than replacement of established economic categories. Prices can be studied as coordination signals within generative relations. Money can be studied as a generalized claim

system. Capital can be studied through recursive control over future generativity. Exploitation can be studied through asymmetrical appropriation and dependence. Power can be studied through the shaping of generative possibility. Rights can be studied as institutional structures that determine which agents can claim, refuse, continue, modify, own, participate, and contest.

The framework also supports an explicitly dynamic research agenda. Empirical work can examine the degree to which contemporary AI systems already mediate access to computation, knowledge, labour, finance, logistics, and evaluation. Institutional research can compare private, public, cooperative, commons-based, and hybrid arrangements for generative infrastructure. Legal research can investigate attribution, liability, standing, ownership, modification, and continuity across human and artificial agents. Political theory can examine participation, domination, legitimacy, and common governance under conditions in which productive capacity becomes increasingly autonomous from direct human labour. Ecological political economy can study the material and planetary conditions that remain binding when cognitive and productive automation expands.

The thought experiment also establishes several boundaries for subsequent inquiry. Empirical timetables and the technical feasibility of universal artificial generativity remain subjects for subsequent research. The moral status of artificial agents remains open. Complete institutional design for a post-labour society lies beyond the present scope, as does classification of existing or future societies through a single political label. The analysis isolates structural relations that can persist under a deliberately strong transformation of productive capacity and thereby identifies variables that remain relevant across a wider range of technological futures.

The resulting synthesis is therefore structural. Artificial generativity can alter the material basis of human productive interdependence and can create substantial possibilities for reducing compulsory labour. Monetary coordination can migrate toward claims over residual generative inputs. Capital-like accumulation can operate through recursive control of artificial capacity and infrastructure. Exploitation and power can persist through asymmetric access, appropriation, and control over generative possibilities. Rights and recognized agency can differentiate human and artificial participants even when operative capabilities converge. Communist possibility can expand through productive abundance while remaining institutionally dependent on access, self-governance, and relational emancipation.

The universal-AI thought experiment consequently preserves political economy at the point where a labour-centred description might appear to lose its principal object. The field of inquiry shifts toward relations among agents, generative capacities, and the conditions that sustain and direct generation. This shift provides the central implication of the paper: advanced artificial abundance changes the carriers and locations of political-economic dependence while leaving the organization of generativity as a continuing object of analysis, contestation, and governance.

13 Conclusion

This concluding section closes the paper by stating the contribution of the universal-artificial-generativity thought experiment at the level of political-economic theory. Its role is distinct from the analytical synthesis in Section 12: the preceding section integrates the mechanisms developed across the manuscript, whereas the present section identifies the theoretical result that follows from their joint consideration, clarifies the limits of that result, and locates the argument within a broader programme of generative political economy. The discussion proceeds through four steps: the central analytical result, its implications for political-economic categories, the scope conditions of the thought experiment, and the research agenda opened by the analysis.

13.1 Core Result

The universal-AI thought experiment began by removing a historically central source of productive dependence. A sufficiently capable artificial system was assumed to perform extensive cognitive, embodied, material, coordinative, care-related, and reproductive functions. Under that premise, ordinary

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provisioning could become much less dependent on the direct labour of other human beings. The exercise therefore created a demanding test for political economy: if human productive labour ceased to occupy its familiar position, which economic relations would remain analytically significant?

The result developed across the paper is that productive abundance changes the location and carrier of political-economic relations more readily than it dissolves them. Generated outcomes can become abundant while generative capacities remain differentially accessible. Generative capacities can become widely available while the conditions that sustain, modify, reproduce, and govern them remain concentrated. Scarcity can migrate toward computation, energy, land, ecological capacity, temporal priority, infrastructure, permissions, or institutionally structured access. Claims over these conditions can become transferable and storable. Artificial agents can transact, maintain operating resources, retain surplus, and reinvest. Recursive control can therefore persist across a major substitution of productive substrate.

The paper's principal analytical contribution is consequently the separation of generated outcomes, generative capacities, and generative conditions. This three-layer architecture permits abundance, access, and governance to be examined as distinct dimensions of political-economic organization. The distinction also explains why a transformation in productive technology can generate substantial freedom while leaving important questions of dependence, appropriation, monetary coordination, accumulation, rights, and power available for institutional determination.

The same structure gives a precise role to the universal-AI scenario. Artificial intelligence functions here as a limit case that removes one familiar carrier of generativity and reveals the relations that survive the substitution. The thought experiment therefore supports a substrate-general formulation of political economy. Human labour remains an important empirical and historical form of generative capacity, while the deeper analytical problem concerns the organization of access to generation and the governance of the conditions through which generation becomes possible and reproducible.

13.2 Category Implications

The analysis modifies the interpretation of several familiar categories without requiring their abandonment. Money can be analysed as a generalized claim system whose relevance depends on the coordination of heterogeneous and temporally distributed access claims. Under artificial abundance, monetary coordination can migrate toward scarce generative inputs and infrastructure. Tokens, quotas, permissions, and credits can remain specialized allocation devices or acquire broader monetary properties when transferability, storage, convertibility, and generalized acceptance expand.

Capital can be analysed through recursive control over future generativity. A present stock of claims, infrastructure, permissions, or productive capability acquires capital-like significance when it can be converted into greater future control over generative capacity and generative conditions. This recursive structure can be operated by human institutions, artificial agents, or mixed systems. The biological identity of the operative agent therefore provides less analytical leverage than the institutional relations through which surplus, reinvestment, ownership, and future control are organized.

Exploitation and power can likewise be examined through generative relations. Appropriation concerns the conversion of another agent's generation into claims or advantages that reinforce a different position. Power concerns effective influence over the feasible generative possibilities available to agents through resources, infrastructure, permissions, continuity, modification, recognition, and governance. These relations can occur across multiple agent configurations. Relevant cases include human–human and human–artificial relations, together with artificial–human and artificial–artificial relations. The multi-agent extension therefore enlarges the domain of political economy while preserving its concern with dependence, asymmetry, and institutionalized control.

The analysis of communist possibility follows the same architecture. Artificial abundance can create material conditions that support extensive reduction of compulsory labour and broader freedom for self-directed activity. Universal generative access and participation in the governance of generative conditions constitute further dimensions of institutional organization. The thought experiment therefore treats technological abundance as a change in the feasible institutional landscape. The political-economic form

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realized within that landscape depends on access arrangements, rights, governance, ownership, ecological constraints, and the organization of common generative conditions.

This perspective also gives labour liberation a generative interpretation. Reduced compulsory labour can expand the time and capacity available for research, art, care, community activity, craftsmanship, cultivation, exploration, and other self-directed forms of generation. The relevant contrast concerns compelled functionalization and meaningful generative agency. Artificial systems can carry routine productive and coordinative burdens while human activity remains extensive, creative, relational, and socially consequential. The political-economic question therefore concerns the conditions under which agents can direct their generative capacities and participate in shaping the systems that support them.

13.3 Scope Limits

The paper has used a deliberately strong abstraction. Universal artificial generativity is a methodological device for examining structural persistence under extensive productive substitution. The argument therefore does not require a forecast concerning the timetable, technical feasibility, or empirical probability of such a system. Contemporary artificial intelligence provides motivation for the thought experiment, while the theoretical result depends on the internal structure of the limit case.

Several questions remain outside the manuscript's settled claims. The moral status of artificial agents remains open. Legal personhood, ownership, liability, refusal, continuity, and modification can be institutionally assigned in multiple ways. Ecological and material constraints can vary substantially across technological systems. Human preferences concerning labour, care, intimacy, collective life, and self-directed activity can also shape the institutional significance of automation. These questions affect the realization of particular political-economic arrangements while leaving the three-layer distinction available as an analytical framework.

The framework also leaves room for historically specific theories. Labour-centred political economy retains strong explanatory value in societies where human labour remains central to production and social reproduction. Monetary theories, theories of capital, institutional analysis, ecological political economy, and theories of domination continue to supply concepts and mechanisms that can be incorporated into a generative-relational account. The present paper therefore proposes an extension in level of abstraction. Its aim is to identify relations that remain intelligible across changes in productive substrate and agent composition.

A further limit concerns normative evaluation. The paper distinguishes productive abundance, generative access, generative self-governance, and relational emancipation because each can vary independently. The framework can describe how particular institutions distribute these dimensions and how recursive asymmetries emerge. A complete normative theory of legitimate distribution, ownership, governance, artificial-agent standing, or common control requires additional argument. The present analysis prepares those questions by clarifying the objects over which normative disagreement can occur.

13.4 Research Programme

The analysis opens a research programme centred on the organization and reproduction of generativity. Empirical work can study how artificial agents already mediate access to computation, finance, logistics, knowledge, labour, evaluation, and infrastructural services. Institutional comparison can examine private, public, cooperative, commons-based, and hybrid arrangements for generative infrastructure. Legal research can analyse the attribution of ownership, liability, standing, modification rights, continuity rights, and resource claims across heterogeneous agents. Ecological research can examine the material and planetary conditions that constrain apparently abundant artificial production.

The framework also supports a dynamic analysis of inequality. Current distributions of resources and rights affect access to generative capacity; access affects the production of future outcomes and claims; those outcomes can alter future generative conditions. This recursive structure directs attention toward processes through which temporary advantages become durable control and through which institutional

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interventions can widen or narrow future generative possibility. Such analysis can connect distributional questions with the reproduction of capabilities, infrastructures, permissions, and governance authority.

A broader programme of Generative Relational Economics can develop this approach beyond the universal-AI case. Economic relations can be studied as evolving structures through which agents participate in one another's generation, constrain one another's possibilities, and jointly reproduce the conditions of future activity. Labour, money, capital, property, knowledge, technology, institutions, and ecological resources can then be examined within a common vocabulary of generated outcomes, generative capacities, generative conditions, access, dependence, appropriation, and governance.

The universal-AI thought experiment therefore leads to a restrained conclusion. Artificial abundance can substantially alter the material conditions of human interdependence and can enlarge the space of feasible social arrangements. The resulting society still requires institutions governing access to generative capacity, residual scarcity, shared infrastructure, rights, accumulation, and collective authority. Political economy consequently remains relevant under advanced automation, while its analytical centre of gravity can shift toward the relations that organize and reproduce generativity itself. This shift provides the conceptual basis for treating generative capacity and generative conditions as foundational objects of political-economic inquiry.

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