AI-Mediated Academic Labour and the Political Economy of Liberation: From Peer Review to Post-Labour Society

Wanhong HUANG
huangwanhong@serendip.ngo

Abstract

This paper uses the rapid automation of academic work as an empirical entry point for reconsidering labour and liberation under advanced artificial intelligence. Recent systems can mediate literature processing, idea generation, experimentation, manuscript writing, and peer review, while conferences are beginning to govern AI-generated evaluation and AI-mediated authorship at institutional scale. The paper distinguishes knowledge-generative activity from the circulatory, evaluative, administrative, and coordinative labour required to reproduce scholarly systems. It then examines whether automation can release scholars from compulsory functional roles while preserving self-directed participation in knowledge generation. Academic work is treated as a compact political economy in which production, verification, credit, scarce attention, resources, and institutional recognition interact. The resulting analysis extends beyond academia toward a broader post-labour question: liberation may concern the reorganization of compulsory functionalization and generative agency as much as the quantitative reduction of work.

Keywords: AI-mediated academic labour; peer review; knowledge circulation; labour automation; post-labour political economy

Research Programme Note

This paper examines academic work as a compact and empirically visible political economy of generation, circulation, evaluation, recognition, and resource coordination. Its point of departure is the rapid expansion of AI-mediated research activity across literature processing, hypothesis formation, experimentation, manuscript preparation, and peer review. These developments provide a bounded case through which broader questions about labour, functionalization, delegation, and liberation can be studied before the stronger post-labour scenarios considered elsewhere in the wider research programme.

The manuscript distinguishes activities that directly contribute to inquiry from activities required to circulate, certify, coordinate, and reproduce scholarly work. The distinction is analytical and leaves intrinsic valuation open. It creates a vocabulary for examining whether automation can reduce compulsory functional labour while preserving or expanding self-directed participation in knowledge generation. Peer review is particularly useful for this purpose because it combines epistemic judgment with a system-maintenance function: scholars evaluate work partly to sustain the collective circulation and certification of knowledge.

The paper proceeds from a current empirical entry point toward a broader political-economic argument. Academic automation is first decomposed into production, circulation, evaluation, institutional reproduction, and resource coordination. The analysis then examines epistemic credit, functional reification, AI-mediated de-functionalization, self-directed scholarly generativity, recursive AI–AI knowledge circuits, scarcity migration, epistemic capital, delegated coordination, generative sovereignty, and the relation between academic labour and general labour. The final sections use these components to reconsider liberation in a post-labour setting.

The paper uses AI-mediated academic work as a bounded case of present institutional change. Broader future-society scenarios remain separate hypotheses. Academic systems provide a tractable domain in which partial automation is already visible and institutional responses are already forming. The resulting case can therefore illuminate a broader distinction between automation of required functions and transformation of the relations through which agents obtain time, resources, recognition, and participation in generative governance.

DRAFT

Responsible Use and Rights Reservation

This section separates requested scholarly conduct from the legal permissions stated on the following page. It records an ethical request for responsible use and defines the narrower scope of retained legal rights.

The author encourages good-faith discussion, criticism, independent inquiry, and responsible use of the material in this work. Separately from the licence's terms, the author asks users to consider foreseeable harms when adapting or applying the proposed framework. This ethical request leaves the licence's permissions and legally authorized uses unchanged.

The author retains the rights preserved under CC BY-NC 4.0 and may pursue remedies to which the author is legally entitled for breach of the licence or violation of independently applicable rights. Reuse remains independent from authorial endorsement. Third-party rights require authorization from their respective holders where applicable. Copyright exceptions and limitations remain fully available.

Notices

This page consolidates the manuscript's publication status, licence, development disclosure, and relation to the wider research programme.

Status. This working draft records an evolving stage of the author's position and is circulated for discussion. Definitions, section structure, formal statements, and terminology remain subject to revision. The current compiled version contains the front matter and Sections 1–18. The manuscript remains a working draft and will receive further conceptual, bibliographic, and stylistic development.

Licence. Except where otherwise indicated, copyright 2026 Wanhong Huang. This work is made available under the Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0). Subject to its terms, the licence permits sharing and adaptation for noncommercial purposes with appropriate attribution, a link to the licence, and an indication of changes. The licence deed and legal code are available at `https://creativecommons.org/licenses/by-nc/4.0/`.

Statement on the use of language models. The exploratory discussions and preparation of this paper involved OpenAI's ChatGPT. ChatGPT supported exploratory dialogue, conceptual reconstruction, argumentative criticism, source discovery followed by website verification before external references were introduced, 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.

DRAFT

1 Empirical Baseline

This section establishes the empirical entry point for the paper. Its role is to identify the parts of contemporary scholarly work that have already become susceptible to AI mediation and to separate observed institutional developments from broader philosophical extrapolation. The discussion proceeds across six functions: scholarly production, literature processing, experimentation, writing, peer review, and integrated research workflows. The method uses a selective set of recent, verifiable cases to define the analytical problem that later sections examine as a political economy of academic labour.

Table 1 summarizes the selected developments used in this section. The table records institutional and technical signals within the present empirical scope of the paper.

DRAFT

Table 1: Selected empirical signals of AI-mediated academic work, 2024–2026.

Academic function	Observed development	Analytical role
Research workflow	End-to-end agentic systems perform ideation, literature search, experiment planning and execution, analysis, manuscript writing, and automated review [4].	Establishes the technical possibility of coupling multiple scholarly functions within one machine-mediated pipeline.
Peer review	AAAI-26 supplied a clearly identified AI-generated review to every paper entering full review; 22,977 AI reviews were generated in less than a day [2].	Shows that evaluative labour can be machine-mediated at conference scale while human decision authority remains institutionally retained.
Review-system scale	AAAI-26 reported almost 29,000 main-track submissions and roughly 23,000 papers under review after compliance filtering [1].	Makes reviewer time, verification, workflow capacity, and institutional coordination visible as scarce scholarly resources.
Scholarly writing governance	NeurIPS 2026 Position Paper organizers reported extensive detector-flagged AI involvement and introduced auditing and desk-rejection procedures under a track-specific human-writing policy [3].	Shows that automation changes the allocation of verification costs, attribution duties, and institutional monitoring.

1.1 Production Automation

This subsection defines the productive scope of the empirical case. Its objective is to identify the scholarly activities that can now be organized through AI-mediated workflows and to establish a terminology broad enough to include partial assistance, delegated execution, and integrated autonomous pipelines. The discussion uses recent end-to-end research systems as evidence of technical integration while preserving a distinction between demonstrated capability and ordinary academic practice.

Recent systems have moved beyond isolated assistance with prose or coding. The 2026 Nature report on end-to-end automation describes a research pipeline that generates ideas, performs literature search, plans and executes experiments, analyzes results, writes manuscripts, and conducts automated peer review [4]. The significance of this development for the present paper lies in the coupling of functions that academic institutions historically distribute across researchers, collaborators, reviewers, and support systems.

Definition 1.1 (AI-mediated academic labour)**.** AI-mediated academic labour is scholarly activity whose execution, coordination, transformation, evaluation, or circulation is materially performed through artificial systems, while institutional responsibility and beneficiary structures may remain human, organizational, artificial, or mixed.

The definition treats mediation as a property of the work process. It therefore covers several levels of delegation: local assistance with a bounded task, agentic execution of a research stage, and integrated pipelines connecting multiple stages. This wider scope is needed because the political-economic question concerns where functional labour is located within the system, how its burdens are allocated, and which agents retain authority over the resulting generative process.

DRAFT

1.2 Literature Automation

This subsection isolates literature processing as the first major coordination layer in scholarly production. Its role is to show how search, contextualization, prior-art comparison, and synthesis can become machine-mediated inputs into later research stages. The discussion treats literature processing as a generative condition for inquiry because it influences which questions appear available, novel, connected, or already resolved.

The end-to-end research system reported by Yamada and colleagues explicitly incorporates literature search within a pipeline that proceeds through ideation, experimentation, analysis, writing, and review [4]. Literature processing occupies an upstream position in hypothesis formation. Retrieval and synthesis influence the field of candidate questions, the identification of baselines, the interpretation of novelty, and the construction of related-work contexts.

Automated literature processing also changes the labour structure of scholarship. Database search, paper screening, citation tracing, comparative synthesis, and literature summarization have traditionally required substantial researcher time. Machine mediation can lower the time cost of these functions while increasing the importance of provenance, coverage, verification, and selection criteria. The relevant political-economic shift therefore concerns both labour saving and the governance of the filters through which prior knowledge becomes visible to later stages of generation.

1.3 Experiment Execution

This subsection examines experimentation as the material execution layer of the academic workflow. Its objective is to distinguish automated prose production from systems that can alter code, run experiments, evaluate results, and iteratively redirect research activity. The distinction matters because automation of experimentation expands AI mediation from symbolic presentation into the production of empirical evidence.

Current end-to-end systems can formulate research ideas, implement code, execute experiments, analyze data, and use the resulting evidence to develop complete manuscripts [4]. The reported workflow also uses agentic search across experimental trajectories, making experimentation an iterative machine-mediated process across successive experimental checkpoints.

Definition 1.2 (Experimental automation)**.** Automated experimental labour is the machine-mediated execution and iterative adjustment of procedures through which a scholarly system produces, transforms, measures, or evaluates empirical or computational evidence.

The political-economic relevance of this category concerns access to execution environments, compute, data, tools, and verification. As experimental labour becomes delegable, the scarcity structure can migrate toward the infrastructures that permit experimentation and toward the authority to define acceptable evidence. Later sections return to this migration when examining epistemic capital and generative sovereignty.

1.4 Writing Automation

This subsection locates scholarly writing within the wider automation process. Its role is to separate writing as an expressive and argumentative activity from writing as a required conversion of research into a standardized circulatory object. The discussion uses current conference governance as evidence that AI-mediated writing already affects the distribution of verification, attribution, and review burdens.

Automated research systems can produce complete scientific manuscripts from machine-mediated research workflows [4]. At the same time, institutional responses show that the meaning of automated writing remains contested. The NeurIPS 2026 Position Paper Track required submissions to be substantially human-written and argued that extensive AI-generated prose can transfer verification costs to reviewers and complicate the attribution of intellectual responsibility [3].

DRAFT

The same NeurIPS report illustrates the methodological difficulty of measuring AI writing. Under the organizers' default detector configuration, 28.2% of submissions received a detector score indicating AI classification across all default text windows; alternative window sizes produced substantially different proportions, and the organizers explicitly documented these sensitivities [3]. The statistic is therefore used here as evidence of institutional pressure and measurement difficulty, while direct estimation of the proportion of manuscripts authored by AI remains outside its evidentiary scope.

Scholarly writing consequently occupies two positions within the political economy of knowledge. It can be a generative practice through which arguments are formed and clarified, and it can be a mandatory format through which work becomes legible to journals, conferences, indexing systems, and reviewers. AI mediation can affect these positions differently, which makes writing a useful case for the later distinction between generative activity and circulatory labour.

1.5 Review Automation

This subsection examines peer review as the clearest current case of AI entering a scholarly circulation and certification function. Its objective is to establish the empirical basis for treating review labour as a political-economic problem involving scarce expert time, epistemic credit, verification, and institutional authority. The discussion distinguishes generation of review content from authority over publication decisions.

AAAI-26 reported an unusually large review burden: almost 29,000 main-track submissions were received, with roughly 23,000 papers remaining under review after policy-compliance filtering [1]. Within that environment, the conference's AI review pilot generated one clearly identified AI review for each of the 22,977 papers entering full review, completing the full set in less than a day [2]. The conference preserved human ratings and human decision authority while using AI-generated reviews as supplementary evaluative material.

Definition 1.3 (AI-mediated evaluative labour)**.** AI-mediated evaluative labour is machine-performed activity that contributes to the assessment, criticism, verification, synthesis, or certification of scholarly work within an institutional evaluation process.

This case is analytically important because it separates two functions that are often fused in conventional peer review: producing evaluative content and possessing institutional authority. A system may generate criticism at scale while publication decisions remain governed by human committees. Later sections use this separation to examine functional de-reification, delegated coordination, and the persistence of generative governance after routine evaluative labour becomes machine-mediated.

1.6 Workflow Integration

This subsection integrates the empirical components into a single analytical object. Its role is to identify the emerging possibility of a research circuit in which literature processing, idea generation, experimentation, writing, review, and resource coordination can increasingly be connected through artificial agents. The discussion remains at the level of structural possibility and observed partial integration; subsequent sections analyze its implications for labour and liberation.

The contemporary evidence already spans both production and evaluation. End-to-end research systems integrate literature search, ideation, experimentation, manuscript preparation, and automated review [4]. Conference institutions have also begun to deploy AI-generated peer review at scale while developing new policies for AI-mediated writing and verification [2, 3]. These developments create the possibility of an academic loop in which an increasing share of the functional work required for knowledge generation and circulation can occur through machine-mediated processes.

Definition 1.4 (Integrated academic automation)**.** Integrated academic automation is the coordinated machine mediation of multiple scholarly functions across knowledge generation, evaluation, circulation, resource coordination, and institutional reproduction.

DRAFT

Integrated automation provides the empirical bridge to the political-economic analysis developed in the remainder of the paper. The central issue is the redistribution of functions, time, authority, verification burdens, and access to generative conditions. Academic work is therefore used here as a small-scale domain in which the relation between automation and liberation can be studied with unusually visible institutions, norms, and resource constraints.

2 Labour Architecture

This section develops the functional decomposition required for the paper's political-economic analysis of academic automation. Its role is to separate activities that contribute directly to inquiry from activities that circulate, evaluate, reproduce, and coordinate the conditions of scholarly production. The objective is analytical differentiation across system roles, with questions of intrinsic worth left open. The discussion proceeds through five functions—knowledge generation, knowledge circulation, evaluation and certification, institutional reproduction, and resource coordination—and treats the same concrete task as capable of combining several functions. The method is therefore functional and relational: academic labour is classified by the role an activity performs within the scholarly system, while the identity of the human or artificial agent performing that activity remains a separate variable.

The resulting architecture provides a basis for the later analysis of peer review, epistemic credit, functionalization, and labour liberation. Automation can affect each function at a different rate and with different institutional consequences. A system that automates circulation may leave knowledge generation largely self-directed; a system that automates evaluation may alter the distribution of certification authority; a system that automates resource coordination may change the visible burden of administration while leaving allocation rules intact. Treating academic labour as a differentiated architecture therefore allows the paper to analyze which functions are delegated, which capacities remain scarce, and where governance continues to reside.

2.1 Generative Function

This subsection specifies the generative component of academic labour. Its objective is to identify activities whose proximate role is to alter the content, structure, or range of articulated knowledge possibilities. The discussion includes question formation, conceptual construction, observation, experimentation, interpretation, synthesis, and argument development. The analysis focuses on functional contribution and therefore applies to human, artificial, and hybrid research processes.

Definition 2.1 (Knowledge-generative activity)**.** Knowledge-generative activity is activity whose proximate scholarly function is to create, transform, connect, test, or interpret epistemic content in ways that enlarge or reorganize the space of available claims, questions, explanations, methods, or observations.

Knowledge generation includes more than the production of final propositions. The formulation of a question can reorganize a field of possible inquiry; the construction of an experimental design can make a previously inaccessible relation observable; interpretive work can change the significance assigned to existing evidence; and conceptual synthesis can connect previously separated bodies of knowledge. These activities differ in method and epistemic status, yet they share a direct orientation toward the production or reorganization of inquiry.

The generative function also helps distinguish scholarly activity from the institutional requirements through which scholarly work becomes visible. A researcher may spend an hour developing a conceptual distinction and another hour converting the resulting argument into the formatting, metadata, and submission conventions required by a venue. Both activities contribute to the research process, while their system functions differ. The first modifies epistemic content directly; the second helps that content enter an organized circulation system.

DRAFT

Proposition 2.2 (Generative participation under functional automation)**.** *Automation of academic system functions can reduce the human labour required for scholarly circulation, evaluation, reproduction, or coordination while preserving substantial human participation in knowledge generation.*

The proposition is central to the later account of liberation. A reduction in compulsory academic labour can coexist with sustained or expanded intellectual activity. Researchers may redirect time released from routine system functions toward individually chosen inquiry, reading, experimentation, teaching, artistic activity, or other forms of generation. The political-economic question therefore concerns the relation between automation and control over one's generative activity, together with access to the conditions that make such activity possible.

2.2 Circulatory Function

This subsection isolates the circulatory function of academic labour. Its role is to identify activities that make scholarly outputs transmissible, discoverable, legible, and reusable across persons and institutions. The objective is to distinguish the movement and presentation of knowledge from the generation of epistemic content while preserving their frequent overlap in practice. The discussion covers manuscript preparation, editing, formatting, metadata production, submission, indexing, dissemination, translation, archiving, and related communicative operations.

Definition 2.3 (Knowledge-circulatory labour)**.** Knowledge-circulatory labour is activity whose proximate scholarly function is to render epistemic outputs transferable, discoverable, interpretable, or institutionally processable across a knowledge community.

Circulation is constitutive of organized scholarship because knowledge that remains inaccessible to other agents has limited capacity to participate in collective inquiry. Manuscript conventions, bibliographic metadata, repositories, indexing systems, editorial workflows, and dissemination channels provide infrastructures through which locally generated work can enter wider epistemic relations. Their operation requires labour even when the underlying claim has already been produced.

Writing occupies a mixed position within this architecture. Writing can be generative when linguistic formulation changes the structure of an argument, reveals an inconsistency, or produces a new conceptual relation. Writing can also be circulatory when it converts settled content into a required format, standardizes terminology, prepares metadata, or adapts a manuscript to a venue's presentation requirements. The functional classification therefore applies to concrete episodes of work, and the relevant category may vary within the same occupation or medium.

Definition 2.4 (Circulatory dependency)**.** Circulatory dependency is the dependence of effective scholarly participation on access to the channels, formats, infrastructures, and recognitional procedures through which epistemic outputs become available to other participants.

Circulatory dependency is politically significant because a researcher can possess substantial generative capacity while lacking effective means of dissemination, discoverability, or institutional legibility. AI-mediated tools may lower some circulation costs by automating editing, translation, formatting, indexing, and submission support. The distributive significance of that automation depends on who can access the tools, which channels remain institutionally authoritative, and how automated circulation affects visibility and attention.

2.3 Certification Function

This subsection identifies the evaluative and certifying functions of academic labour. Its role is to distinguish the production of assessments from the institutional assignment of epistemic or professional status. The objective is to clarify the work performed by reviewers, editors, programme committees, examiners, replication efforts, benchmarking systems, and related mechanisms. The discussion separates evaluative content, verification activity, and certification authority so that later sections can analyze AI-mediated peer review while preserving their distinct institutional roles.

DRAFT

Definition 2.5 (Evaluative labour)**.** Evaluative labour is activity whose proximate scholarly function is to assess the validity, relevance, originality, clarity, reproducibility, significance, or methodological adequacy of epistemic work.

Evaluative labour can generate substantive intellectual content. A careful review may identify an unstated assumption, propose an alternative interpretation, reveal a methodological weakness, or suggest a new research direction. The evaluative function nevertheless remains analytically distinct because the activity is organized around the assessment of another epistemic object within a recognized procedure.

Definition 2.6 (Epistemic certification)**.** Epistemic certification is the institutional assignment of a recognized status to scholarly work through an authorized evaluative procedure.

Certification can take forms such as acceptance, rejection, revision status, degree award, benchmark recognition, replication status, or inclusion within an authorized archive. The distinction between evaluation and certification matters under automation. An artificial system can generate detailed criticism or verification signals while a conference, journal, university, laboratory, or professional body retains authority over the status conferred by those signals.

The separation also makes visible a scarcity that persists under abundant text generation: trusted evaluation remains institutionally consequential. If the cost of producing manuscripts declines rapidly, the number of objects requesting attention and certification can expand faster than the capacity of established evaluative institutions. Automation can increase evaluative throughput, yet the design of certification rules and the attribution of authority remain governance questions. Later sections develop this point through epistemic credit and the political economy of recognition.

2.4 Reproductive Function

This subsection identifies the labour required to reproduce the organizations and procedures within which academic activity occurs. Its role is to distinguish the maintenance of scholarly institutions from the generation, circulation, and evaluation of particular epistemic objects. The objective is to make visible the recurrent work through which venues, laboratories, departments, professional associations, repositories, and review systems preserve their capacity to operate across time. The discussion focuses on procedural maintenance, policy formation, committee work, reviewer recruitment, conflict management, record keeping, mentoring structures, and related forms of institutional continuity.

Definition 2.7 (Academic institutional-reproductive labour)**.** Academic institutional-reproductive labour is activity whose proximate function is to maintain, renew, or adapt the organizational conditions that allow scholarly production, circulation, evaluation, and coordination to continue across time.

Institutional reproduction often appears peripheral when scholarship is described primarily through published outputs. Its importance becomes clearer when a conference must recruit reviewers, enforce conflict-of-interest rules, maintain submission infrastructure, resolve appeals, update policy, preserve archives, and allocate responsibility across committees. Similar reproductive requirements exist in laboratories, journals, universities, repositories, and research collaborations.

This category is central to the paper's account of compulsory functionalization. Scholars frequently participate in institutional reproduction because their fields require these functions to continue operating. Such participation can express professional solidarity, collective self-government, or intellectual commitment. It can also consume time that researchers would otherwise direct toward self-chosen inquiry. Automation therefore raises a more precise question than simple workload reduction: which reproductive functions can be delegated while preserving meaningful participation in institutional governance?

Proposition 2.8 (Reproductive automation and governance retention)**.** *Automation can reduce the labour required for institutional reproduction while leaving the authority to define institutional rules, priorities, and accountability structures as a distinct governance function.*

DRAFT

The proposition separates the execution of recurrent procedures from the authority to shape those procedures. Automated systems may recruit reviewers, detect conflicts, schedule meetings, route submissions, monitor deadlines, or maintain records. The resulting labour reduction acquires emancipatory significance when scholars retain credible means of participation in the governance of the systems that organize their work.

2.5 Coordination Function

This subsection completes the functional architecture by specifying the coordination of scarce and conditionally available scholarly resources. Its role is to connect academic labour to the wider political economy of generative conditions. The objective is to identify the work required to acquire, schedule, match, and administer access to funding, computation, data, laboratories, equipment, personnel, collaboration opportunities, publication channels, and institutional permissions. The discussion separates operational coordination from the rules that determine entitlement and priority.

Definition 2.9 (Academic resource-coordinative labour)**.** Academic resource-coordinative labour is activity whose proximate function is to acquire, allocate, schedule, match, monitor, or administer resources required for scholarly generation and circulation.

Grant applications, procurement, compute allocation, laboratory booking, data-access requests, collaboration matching, travel administration, and publication budgeting are familiar examples. These activities often require specialized knowledge and substantial time while contributing indirectly to the epistemic content of a project. Their political-economic significance lies in their relation to generative access: a research question may be intellectually available while remaining practically inaccessible without the resources needed to investigate it.

Artificial agents can increasingly mediate resource coordination by searching for funding opportunities, preparing administrative materials, negotiating machine-readable services, scheduling equipment, monitoring budgets, and routing requests across platforms. In a more integrated system, artificial agents could also exchange resource claims among themselves while researchers interact mainly with a higher-level research interface. Such delegation could make exchange and coordination less visible to scholars while leaving the underlying distribution of claims, priorities, and access rights institutionally consequential.

Definition 2.10 (Operational delegation of academic coordination)**.** Operational delegation of academic coordination is the transfer of routine resource-matching, scheduling, transactional, or administrative activity to artificial systems while the governing criteria for access and priority remain separately specifiable.

This distinction provides the bridge to the later political economy of liberation. Academic labour can be reduced through automation at the level of circulation, evaluation, reproduction, and coordination while researchers continue to participate actively in knowledge generation. The institutional consequences depend on the organization of access, authority, and governance across these functions. The functional architecture developed in this section therefore supplies the analytical basis for examining peer review, reification, generative freedom, AI–AI knowledge circuits, scarcity migration, epistemic capital, and post-labour political economy in the sections that follow.

3 Review Circulation

This section examines peer review as a concentrated site in which evaluative labour, certification, circulation, and institutional recognition are joined within a single academic procedure. Its role is to connect the functional architecture developed in Section 2 to the paper's later analysis of functionalization, reification, and liberation. The objective is to distinguish the labour performed by reviewers from the institutional

DRAFT

statuses generated through review and from the circulation effects that follow those statuses. The discussion proceeds through six components—review labour, certification functions, circulation functions, reviewer functionalization, epistemic credit, and institutional recognition—and uses a relational method that tracks how scholarly judgment is translated into system-level consequences.

Peer review is especially useful for this analysis because the same act can participate simultaneously in several academic functions. A reviewer may identify a methodological weakness, contribute a new interpretation, assign a score, support an editorial decision, and thereby alter the future visibility of a manuscript. Recent experiments with AI-mediated review make these functional distinctions more visible by showing that evaluation can be partially delegated while certification authority and institutional responsibility remain organized separately [2, 1]. The analytical task therefore concerns the relations among judgment, status assignment, circulation, and recognition.

3.1 Review Function

This subsection specifies peer review as a form of academic labour. Its role is to identify the activities contributed by reviewers before those activities are translated into scores, recommendations, or editorial outcomes. The objective is to distinguish the intellectual content of review from the institutional use made of review outputs. The discussion focuses on reading, verification, interpretation, comparison, criticism, recommendation, and written justification as recurrent components of evaluative work.

Definition 3.1 (Review labour)**.** Review labour is scholarly activity whose proximate function is to examine an epistemic object and produce evaluative information that can be used by an academic institution, scholarly community, or subsequent reader.

Review labour contains heterogeneous activities. A reviewer may verify whether an argument follows from the reported evidence, inspect the adequacy of a method, compare a contribution with an existing literature, test the clarity of a conceptual distinction, identify missing controls, or assess the significance of a result. These activities often require domain expertise and sustained attention. Their contribution therefore exceeds the final numerical score or recommendation through which an evaluation may later be represented.

The labour character of review also derives from its temporal and organizational setting. Review is commonly performed under deadlines, assigned workloads, conflict-of-interest rules, confidentiality requirements, and venue-specific criteria. These institutional conditions shape the form in which judgment is produced. The same scholar may approach a manuscript differently when writing an informal commentary, supervising a student, reviewing for a journal, or serving on a programme committee because each setting organizes responsibility and expected output differently.

Proposition 3.2 (Evaluative-content compression)**.** *When review labour is incorporated into a formal selection procedure, a multidimensional evaluative process can be compressed into a smaller set of institutionally actionable representations such as scores, recommendations, confidence judgments, or categorical decisions.*

Evaluative-content compression is analytically important for later sections. Automation may reduce the human labour required to produce some evaluative information, while the institutional demand for actionable representations can remain. The distinction allows the paper to analyze whether an AI system replaces a reviewer, supplies information to a reviewer, or supplies information directly to a certification procedure.

3.2 Certification Mechanism

This subsection identifies the certification role performed by peer-review systems. Its role is to separate the production of evaluative information from the institutional assignment of scholarly status. The objective is to clarify how review contributes to acceptance, rejection, revision, recommendation, and related

DRAFT

statuses while keeping an individual review analytically distinct from the final certification act. The discussion focuses on authority allocation across reviewers, editors, area chairs, programme committees, journals, conferences, and other recognized bodies.

Definition 3.3 (Peer-review certification function)**.** The peer-review certification function is the institutional use of evaluative information to assign a recognized scholarly status to an epistemic object.

Certification depends on an institutional rule that connects evaluative inputs to authorized outcomes. A reviewer may recommend acceptance while an editor requests revision; several reviewers may disagree while an area chair synthesizes their assessments; a programme committee may apply capacity constraints after technical evaluations have been completed. The certification function therefore belongs to a wider governance structure whose outputs carry consequences for circulation, reputation, indexing, funding, hiring, and subsequent attention.

The distinction becomes especially visible under AI-assisted review. The AAAI-26 AI review pilot generated AI reviews at scale while preserving the surrounding conference process and human institutional authority [2]. Such arrangements show that the source of evaluative information and the holder of certification authority can be separated institutionally. Future systems can vary this allocation further, including human-certified AI evaluation, hybrid certification, or automated certification under rules adopted by a scholarly institution.

Definition 3.4 (Certification authority)**.** Certification authority is the recognized institutional capacity to convert evaluative information into a scholarly status with consequences for access, circulation, or recognition.

Certification authority is therefore a governance variable. Its distribution determines who can transform evaluation into institutionally consequential status. This variable remains relevant even when evaluative labour becomes abundant because the social effect of evaluation depends on the institutional procedures through which it becomes actionable.

DRAFT

3.3 Circulation Mechanism

This subsection examines the role of peer review in the circulation of scholarly work. Its role is to connect certification outcomes to the movement of manuscripts, claims, and reputational signals across academic networks. The objective is to identify the mechanisms through which review affects visibility, discoverability, uptake, and subsequent use. The discussion treats circulation as a structured process involving publication venues, archives, recommendation systems, citations, indexing services, conferences, and disciplinary attention.

Peer review affects circulation because certification changes the pathways through which an epistemic object can travel. Acceptance at a recognized venue can place a manuscript inside established indexing, presentation, dissemination, and recommendation infrastructures. Revision can redirect the object through another evaluative cycle. Rejection can delay or reroute circulation. Even when a manuscript remains publicly available through a repository, certification can alter the probability that scholars, institutions, or artificial systems allocate attention to it.

Definition 3.5 (Review-mediated circulation)**.** Review-mediated circulation is the alteration of an epistemic object's pathways of visibility, distribution, uptake, and reuse through statuses or signals produced by an evaluative procedure.

The circulation function becomes more consequential as publication volume grows. Section 1 documents recent conditions in which manuscript production and AI-mediated evaluation are both scaling rapidly. Under such conditions, the informational value of circulation signals can increase because readers and systems face a larger set of candidate objects. Review therefore participates in attention allocation even when access to manuscripts is technically open.

Proposition 3.6 (Circulation dependence on evaluative signals)**.** *As the volume of available scholarly objects increases relative to the attention available for reading and verification, evaluative and certificatory signals can acquire greater influence over the allocation of scholarly attention.*

The proposition identifies the coordination role of such signals while leaving their epistemic quality open. Systems facing abundant outputs require mechanisms for prioritization. Later sections examine how automation can alter the scarcity of attention, verification, and recognition while leaving circulation structurally important.

3.4 Functionalization Mechanism

This subsection analyzes the reviewer as an institutional function within academic circulation. Its role is to identify the process through which a scholar's heterogeneous intellectual capacities are temporarily organized around a standardized evaluative task. The objective is to distinguish participation in a review function from the wider generative identity of the scholar. The discussion focuses on role assignment, procedural obligation, output standardization, and the conversion of judgment into institutionally usable signals.

Definition 3.7 (Reviewer functionalization)**.** Reviewer functionalization is the institutional organization of a scholar's time, expertise, and judgment around the performance of a defined evaluative role required for scholarly circulation or certification.

Functionalization can support valuable collective purposes. Peer review can distribute epistemic responsibility, expose work to criticism, identify errors, and sustain procedures through which scholars evaluate each other's contributions. The political-economic issue concerns the relation between these collective functions and the scholar's control over time and generative activity. A researcher who repeatedly performs assigned review tasks contributes to the reproduction of the field while allocating finite attention away from other possible inquiry.

The concept therefore describes a relation between person and system function. A reviewer enters a procedural role with specified criteria, deadlines, confidentiality rules, and expected outputs. The scholar's broader capacities—curiosity, speculative thought, aesthetic judgment, mentoring, long-term research, or interdisciplinary exploration—remain outside much of the formal representation produced by the review procedure.

Definition 3.8 (Compulsory academic functionalization)**.** Compulsory academic functionalization is a condition in which continued participation, recognition, or institutional membership creates sustained pressure for a scholar to perform system-maintaining functions that are only partially aligned with the scholar's self-directed generative priorities.

This definition prepares the later analysis of liberation. AI-mediated review can reduce the amount of human time required for some evaluative functions. The emancipatory significance of that reduction depends on the destination of the released time, the preservation of meaningful governance, and the distribution of authority over the automated process.

3.5 Credit Mechanism

This subsection specifies the forms of credit generated and transmitted through peer-review systems. Its role is to connect evaluation to the relational signals that support knowledge circulation. The objective is to distinguish epistemic credit from truth, validity, and final epistemic value while identifying its practical role in coordinating attention and trust. The discussion focuses on the recognized statuses attached to manuscripts, venues, reviewers, authors, methods, and institutions.

Definition 3.9 (Epistemic credit)**.** Epistemic credit is a socially or institutionally recognized signal that increases the probability that an epistemic object, agent, method, or institution will receive attention, trust, access, or further evaluative consideration.

Epistemic credit can be attached to several objects at once. A publication decision can increase the visibility of a manuscript; a venue's reputation can influence initial attention; a reviewer's recognized expertise can affect the weight assigned to an evaluation; an author's prior work can shape expectations; and successful replication can strengthen confidence in a result. These signals operate within relational networks whose effects depend on the practices of readers, institutions, databases, recommendation systems, and increasingly artificial agents.

Credit also has a circulation function because it can be accumulated and reused. Recognition attached to previous work can improve access to funding, collaborators, invitations, data, compute, publication opportunities, or institutional positions. In this sense, epistemic credit can participate in the reproduction of future generative capacity. The later analysis of epistemic capital develops this recursive dimension in greater detail.

Proposition 3.10 (Credit-mediated generative access)**.** *When recognized epistemic credit affects access to scholarly resources or attention, evaluative outcomes can influence future generative capacity through the institutional distribution of opportunities.*

This proposition connects peer review to political economy. Review is involved in the production of signals that can shape future access, while the effects of those signals remain mediated by institutional rules and broader systems of recognition. Automation can alter the production cost and volume of evaluative signals, creating new questions about their scarcity, credibility, and governance.

3.6 Recognition Mechanism

This subsection completes the peer-review analysis by locating epistemic credit inside wider structures of institutional recognition. Its role is to explain how recognized statuses acquire durable consequences for scholarly trajectories. The objective is to connect review-mediated certification with appointments, funding, invitations, publication opportunities, resource access, and participation in academic governance. The discussion treats recognition as a relationally produced condition whose effects depend on both formal institutions and distributed scholarly practices.

Definition 3.11 (Institutional recognition)**.** Institutional recognition is the assignment or reinforcement of a socially consequential scholarly status through procedures, records, affiliations, credentials, or evaluative outcomes maintained by recognized academic organizations or infrastructures.

Institutional recognition can stabilize epistemic credit across time. A publication record, editorial appointment, fellowship, award, grant, conference acceptance, or institutional affiliation can become part of the informational environment through which later decisions are made. Recognition thereby connects past evaluation to future opportunities. This connection makes academic circulation recursively political-economic: statuses produced through previous rounds of evaluation can shape access to the conditions of subsequent generation.

AI-mediated academic systems can alter this mechanism in several directions. Automated evaluation can increase the volume and speed of review; recommendation systems can reorganize visibility; agent-based research infrastructures can allocate resources using machine-readable reputational signals; and artificial reviewers can participate in producing information that institutions use for certification. These changes can reduce specific forms of human evaluative labour while increasing the importance of rules governing how recognition is generated, aggregated, contested, and revised.

Definition 3.12 (Recognition-mediated academic reproduction)**.** Recognition-mediated academic reproduction is the recursive process through which institutionally recognized statuses influence access to future resources, attention, evaluative authority, and opportunities for knowledge generation.

The six components developed in this section establish peer review as a compact political-economic circuit. Review labour produces evaluative information; certification procedures convert part of that

DRAFT

information into recognized status; circulation systems distribute the resulting signals; reviewer functionalization supplies recurrent human labour; epistemic credit coordinates attention and trust; and institutional recognition carries those effects into future rounds of scholarly production. This circuit provides the analytical foundation for the next section's examination of reification in academic evaluation and for the later analysis of AI-mediated functional de-reification.

4 Evaluative Reification

This section examines the transformation of heterogeneous scholarly judgment into standardized institutional objects. Its role is to extend the analysis of peer review in Section 3 by specifying the mechanisms through which complex evaluative activity becomes portable, comparable, and administratively actionable. The objective is to identify forms of reification that arise when interpretive, contextual, and relational judgments are represented through scores, rankings, decisions, and durable scholar-level signals. The discussion proceeds through five components—institutional compression of judgment, scores and rankings, acceptance decisions, functional representation of scholars, and objectification of epistemic contribution—and uses a process-tracing method that follows evaluation from situated judgment to institutionally stabilized representation.

The term *reification* is used here in a restricted analytical sense. The concept refers to a process through which a relation, activity, or judgment acquires an object-like institutional form that can circulate independently of much of the context that produced it. This usage leaves the normative evaluation of standardized representations open to context-specific analysis. Academic systems require portable information for coordination across large numbers of manuscripts, reviewers, editors, institutions, and readers. The analytical concern lies in the relation between the richness of the underlying judgment and the narrower representation that becomes consequential for circulation, recognition, and resource allocation.

Definition 4.1 (Academic evaluative reification)**.** Academic evaluative reification is the institutional transformation of situated scholarly judgment into relatively portable objects, statuses, or signals that can be compared, aggregated, circulated, and used in subsequent decisions.

Reification therefore connects epistemic evaluation to political economy. Once an evaluative output becomes portable, it can influence access to publication, attention, funding, appointments, collaboration, and future evaluative authority. The representational object participates in the reproduction of academic opportunity even when the original judgment was richer than the signal preserved by the institution.

4.1 Judgment Compression

This subsection specifies institutional compression as the first mechanism of academic evaluative reification. Its role is to identify how situated scholarly judgment is reduced to forms that institutions can store, compare, and act upon. The objective is to distinguish the epistemic activity performed during evaluation from the compressed representation retained by the surrounding procedure. The discussion focuses on dimensional reduction, contextual loss, portability, and the organizational advantages created by standardized evaluative outputs.

A peer review can contain several kinds of judgment simultaneously: methodological criticism, interpretive uncertainty, disciplinary comparison, assessment of originality, concerns about evidence, suggestions for revision, and judgments of significance. Institutional procedures commonly require that these heterogeneous considerations be rendered into a smaller set of fields such as numerical scores, categorical ratings, confidence levels, recommendations, or structured text boxes. Compression makes evaluation administratively tractable because large-scale decision processes require information that can be aggregated across reviewers and manuscripts.

DRAFT

Definition 4.2 (Institutional compression of judgment)**.** Institutional compression of judgment is the reduction of multidimensional scholarly evaluation into a smaller set of standardized representations that can be stored, compared, aggregated, or used procedurally.

Compression changes the informational form of evaluation. A detailed assessment that distinguishes conceptual originality from empirical weakness may become a pair of scores; an ambivalent judgment may become a categorical recommendation; an interpretive disagreement may become a numerical confidence value. The resulting representation can circulate beyond the immediate reviewer-editor relation and can be processed by committees, databases, ranking systems, or artificial agents.

Proposition 4.3 (Compression-portability relation)**.** *Greater standardization of evaluative outputs can increase their portability across institutional processes while reducing the amount of local context preserved in each representation.*

The proposition identifies a structural trade-off and leaves quality assessment context-dependent. Compression supports coordination, especially under high submission volume, yet the compressed object can acquire consequences that exceed the informational scope of the original representation. This divergence becomes particularly important when automated systems consume scores or labels at scale, because machine-readable representations can become inputs to subsequent allocation and recognition processes.

4.2 Ranking Objects

This subsection analyzes scores and rankings as standardized objects produced through academic evaluation. Its role is to examine how compressed judgments become comparable across manuscripts, scholars, venues, or institutions. The objective is to identify the coordination benefits and relational consequences of ordinal and cardinal representation. The discussion focuses on comparability, aggregation, threshold formation, and the recursive use of ranked signals in academic circulation.

Scores translate evaluative judgments into a common representational space. A reviewer may assign values for soundness, originality, significance, clarity, or confidence; a programme committee may aggregate those values; a venue may rank submissions; and external systems may later use acceptance rates, citation counts, venue status, or other metrics to order scholarly objects and agents. Ranking therefore extends compression by arranging represented objects relative to one another.

Definition 4.4 (Evaluative ranking object)**.** An evaluative ranking object is a standardized representation that places scholarly objects or agents within an ordered relation used for prioritization, comparison, or allocation.

The political-economic significance of rankings emerges through their effects on scarce attention and resources. A position in a ranking can influence which manuscript receives further review, which project receives funding, which scholar receives an interview, or which result receives early visibility. The ranking object thereby mediates between evaluation and access.

Proposition 4.5 (Ranking-mediated allocation)**.** *When academic resources or attention are allocated partly through ordered evaluative signals, ranking systems participate in the distribution of future generative opportunities.*

Ranking can also generate recursive effects. Recognition gained through one ranked outcome can improve access to later opportunities, thereby altering the conditions under which future work is produced. This mechanism connects academic evaluation to the later analysis of epistemic capital and scarcity migration. Under AI-mediated systems, the scale and speed of ranking can increase substantially because machine-readable scores are inexpensive to aggregate and recombine.

DRAFT

4.3 Acceptance Objects

This subsection examines acceptance decisions as discrete institutional objects produced from distributed evaluative inputs. Its role is to clarify how plural judgments are converted into consequential status assignments. The objective is to distinguish the evaluative process from the decision object and to identify the downstream effects created by institutional acceptance. The discussion focuses on thresholding, status assignment, circulation, and the temporal persistence of decisions within academic records.

Conference and journal procedures frequently culminate in a discrete outcome such as accept, revise, reject, invite, or decline. Such decisions aggregate several layers of information: reviewer judgments, editorial interpretation, venue priorities, capacity constraints, conflict resolution, and procedural rules. The final status is therefore an institutional synthesis of a wider evaluative process.

Definition 4.6 (Institutional acceptance object)**.** An institutional acceptance object is a discrete status assigned to a scholarly submission through an authorized evaluative procedure and subsequently used to organize publication, circulation, recognition, or access.

Acceptance objects have effects beyond immediate publication. They can shape citation visibility, curriculum vitae records, hiring evaluations, grant narratives, future invitations, and access to professional networks. Their portability gives them a durable role in academic reproduction. A decision generated within one local procedure can therefore become an input to later decisions made by actors who have limited access to the original evaluative context.

Proposition 4.7 (Decision persistence)**.** *The institutional persistence of acceptance statuses allows local evaluative outcomes to influence later academic opportunities across settings external to the original review process.*

AI-mediated evaluation can alter this mechanism by changing the volume, speed, and granularity of evidence available before a decision. The reification issue remains because the downstream system often gives the status object greater operational weight than the complete evaluative history. The political-economic consequences therefore depend partly on how decision records can be interpreted, contested, revised, and contextualized.

4.4 Scholar Representation

This subsection shifts the analysis from manuscripts to persons. Its role is to examine how institutional systems represent scholars through records derived from repeated functional performance. The objective is to identify the process through which heterogeneous intellectual lives are rendered into administratively portable profiles. The discussion focuses on publication records, reviewing activity, citation indicators, grants, affiliations, service roles, and other standardized traces used to organize academic recognition.

Academic institutions rarely encounter the full generative history of a scholar. Decisions concerning hiring, promotion, funding, invitations, and committee membership rely on representations: publication lists, venue names, citation indicators, grant histories, recommendation letters, review records, teaching evaluations, and institutional affiliations. These representations can be useful because they make large-scale coordination possible. They also select particular dimensions of scholarly activity for durable institutional visibility.

Definition 4.8 (Functional representation of a scholar)**.** Functional representation of a scholar is an institutionally legible profile constructed from standardized records of scholarly outputs, roles, evaluations, affiliations, or recognized contributions.

Functional representation can influence which forms of generativity receive institutional support. Activities that produce legible outputs may accumulate recognition more readily than activities whose value is difficult to compress, such as long-horizon exploration, informal mentoring, interdisciplinary translation, failed experimentation, conceptual incubation, or maintenance of shared research infrastructure. The resulting profile can become consequential even when it captures only part of the scholar's intellectual activity.

DRAFT

Definition 4.9 (Representational narrowing)**.** Representational narrowing is the reduction of a scholar's heterogeneous generative activity to the subset of outputs and roles that remain legible within an institutional evaluation system.

The concept of representational narrowing provides a bridge to labour and liberation. When recognition depends heavily on standardized profiles, scholars can face incentives to redirect time toward activities that generate recognized traces. AI-mediated systems may reduce the labour required to produce some traces while simultaneously increasing their volume. The later question of functional de-reification therefore concerns both the automation of system-maintaining tasks and the possibility of widening the space in which self-directed generative activity can remain institutionally viable.

4.5 Contribution Objectification

This subsection completes the reification analysis by examining how epistemic contribution becomes detached from the situated relations through which it was generated. Its role is to connect compressed judgments, rankings, decisions, and scholar-level representations within a common account of objectification. The objective is to specify how epistemic contribution becomes a transferable institutional object while retaining only part of its generative history. The discussion focuses on attribution, portability, cumulative credit, and the relation between recognized objects and the broader processes that produced them.

A scholarly contribution can emerge through many relations: collaboration, criticism, shared infrastructure, inherited methods, public datasets, mentoring, technical support, prior literature, institutional funding, and collective maintenance. Academic recognition systems commonly attribute a narrower object—a paper, authorship position, citation, grant, award, or accepted contribution—to identifiable agents. Such attribution is necessary for responsibility and recognition, yet it also creates portable objects that can circulate with reduced visibility of the wider generative relations involved.

Definition 4.10 (Objectification of epistemic contribution)**.** Objectification of epistemic contribution is the institutional stabilization of a scholarly contribution into a portable credited object whose circulation can proceed with only partial representation of the relations and conditions that generated it.

Objectified epistemic contributions can accumulate. Publications, citations, awards, and affiliations can be combined into profiles and metrics that influence later access to resources. The accumulated objects thereby connect previous recognition to future generative opportunity. This mechanism resembles the broader process identified in Section 3, where epistemic credit becomes consequential through institutional circulation and reproduction.

Proposition 4.11 (Objectified-credit recursion)**.** *When portable epistemic objects influence access to future academic resources, objectified contribution can participate in a recursive cycle linking past recognition to subsequent generative capacity.*

Academic evaluative reification therefore has a dual structural role. It supports coordination by producing portable representations, and it shapes political-economic access by determining which representations become consequential in later rounds of academic production. The relevance of AI lies partly in its capacity to automate the production, aggregation, and circulation of these objects. The next section examines a complementary possibility: automation can also reduce the amount of human labour required to perform standardized evaluative and circulatory functions, creating conditions for a form of functional de-reification when scholars regain time and discretion for self-directed generative activity.

5 Functional De-Reification

This section examines the conditions under which academic automation can reduce the compulsory functionalization identified in Sections 2–4. Its role is to distinguish automation that merely relocates institutional functions from automation that changes the relation between scholars and those functions. The

DRAFT

objective is to specify a form of de-reification in which standardized evaluative and circulatory tasks require less compulsory human participation while scholars retain meaningful access to knowledge generation, judgment, and institutional contestation. The discussion proceeds through five components—routine evaluative automation, reduction of compulsory review labour, reduction of circulatory labour, reallocation of scholarly time, and voluntary epistemic participation—and uses a functional-relational method that tracks how the bearer of an academic function can change while the function itself persists.

The concept of de-reification used here concerns a change in the relation between persons and institutional functions. Academic evaluation can remain institutionally necessary even when individual scholars spend less time performing standardized evaluative operations. Likewise, circulation, certification, and coordination can continue while their routine execution is delegated to artificial systems. The relevant transformation therefore concerns the degree to which participation in system-maintaining functions is compulsory for continued access to scholarly life.

Definition 5.1 (Functional de-reification)**.** Functional de-reification is a reduction in the extent to which a person must occupy a standardized institutional function in order to retain access to valued generative activities, recognition, or material support.

Functional de-reification is relational. It depends on the institutional arrangement connecting scholars, automated systems, evaluative authority, and access to future opportunities. Automation supplies a technical condition for this transformation. Institutional design determines whether released capacity becomes available for self-directed inquiry, additional standardized production, or new forms of monitoring and control.

5.1 Evaluation Automation

This subsection specifies the class of evaluative tasks most directly exposed to automation. Its role is to separate routine evaluative operations from broader scholarly judgment. The objective is to identify which components of review can be delegated with comparatively low loss of contextual interpretation and which components remain closely tied to contestable epistemic purposes. The discussion focuses on procedural checking, consistency analysis, evidence retrieval, comparison, summarization, and preliminary assessment.

Peer review contains heterogeneous activities. Some activities involve relatively structured operations: checking formal completeness, locating related work, comparing reported values across manuscript sections, identifying missing citations, testing internal consistency, summarizing claims, tracing methodological dependencies, or verifying whether a stated procedure matches an available record. Other activities involve judgments about conceptual importance, problem selection, interpretive framing, methodological appropriateness, epistemic risk, novelty, and the significance of disagreement. Advanced AI systems can mediate both classes, yet the institutional consequences of delegating them differ.

Definition 5.2 (Routine evaluative automation)**.** Routine evaluative automation is the delegation of recurrent, comparatively structured components of scholarly assessment to artificial systems while preserving explicit institutional responsibility for the interpretation and use of their outputs.

The distinction concerns institutional role, with intrinsic task simplicity treated as a separate dimension. A technically difficult verification operation may still be routine when its purpose, evidence requirements, and decision rule are comparatively stable. Conversely, a short evaluative statement may encode substantial judgment when it determines how a field interprets novelty or significance.

Proposition 5.3 (Evaluative delegation condition)**.** *Evaluative automation contributes to functional de-reification when the delegated operation has a sufficiently specified purpose, its output remains contestable, and the delegation reduces compulsory human functional labour without removing meaningful human access to evaluative governance.*

DRAFT

This condition places the emphasis on the architecture of delegation. Automated review can lower the labour required for repetitive checking while leaving scholars free to inspect evidence, revise standards, and intervene in difficult cases. The same technical capacity can support a different institutional outcome when automated outputs become authoritative by default and opportunities for contestation narrow. The political-economic question therefore concerns the relation among automation, authority, and retained generative agency.

5.2 Review Burden Reduction

This subsection examines the labour relation created when peer review functions as a recurring obligation attached to scholarly participation. Its role is to connect evaluative automation to the concept of compulsory functionalization developed in Section 3. The objective is to clarify the sense in which automation can release scholars from part of the labour required to maintain collective certification. The discussion focuses on obligation, reciprocity, opportunity cost, and continuing evaluative agency.

Academic communities rely on large volumes of unpaid or indirectly compensated review labour. Individual scholars often participate because review sustains venues they use, signals professional membership, contributes to reciprocal norms, and can influence reputation or service expectations. These relations can be valuable forms of collective maintenance. They can also consume substantial time regardless of whether a particular review task aligns with the scholar's current generative priorities.

Definition 5.4 (Compulsory review functionalization)**.** Compulsory review functionalization is an institutional condition in which continued participation in academic life carries a recurring expectation that scholars supply evaluative labour for the maintenance of certification and circulation systems.

AI-mediated review can change this relation by absorbing part of the repetitive work attached to each assignment. A human reviewer may receive a structured evidence map, consistency report, literature comparison, or preliminary methodological audit. Under stronger automation, artificial systems may complete routine assessments while human reviewers concentrate on cases requiring interpretive disagreement, conceptual evaluation, ethical scrutiny, or field-level judgment.

Proposition 5.5 (Review-labour release)**.** *When automated systems absorb a stable share of routine review operations while human scholars retain the ability to intervene in consequential judgments, the compulsory time cost of peer review can decline without a corresponding withdrawal of human evaluative agency.*

The proposition identifies a potential form of liberation internal to academic work. The liberated element is the obligation to perform every recurring operation personally. Scholarly judgment remains available as an activity that can be exercised where participants consider it meaningful or institutionally necessary. This structure differs from a system in which scholars lose access to evaluation and merely receive machine-generated decisions.

The distribution of released labour also matters. If automation reduces review time for senior scholars while increasing monitoring, correction, or data-preparation work for less recognized participants, aggregate automation can coexist with uneven functional burdens. Functional de-reification therefore requires attention to who gains discretionary time and who inherits residual maintenance tasks.

5.3 Circulation Burden Reduction

This subsection extends functional de-reification beyond peer review to the broader labour of academic circulation. Its role is to connect review automation with the resource-coordinative and institutional-reproductive functions identified in Section 2. The objective is to specify how artificial agents can mediate routing, formatting, matching, scheduling, documentation, and dissemination while leaving research direction and evaluative standards open to scholarly governance. The discussion focuses on circulation infrastructure and the distinction between operational delegation and institutional authority.

DRAFT

Scholars devote substantial effort to moving work through academic systems. Manuscripts must be formatted, submitted, revised, resubmitted, associated with metadata, matched to venues, tracked across deadlines, linked to data and code, communicated to collaborators, and disseminated after publication. Reviewers and editors also spend time on assignment, reminders, conflict checks, discussion coordination, decision letters, and record maintenance. These activities are part of the circulatory architecture described in Section 3.

Definition 5.6 (Circulatory automation)**.** Circulatory automation is the delegation of recurrent operations required to route, document, coordinate, and disseminate scholarly objects across academic institutions and infrastructures.

Artificial agents can potentially manage many of these operations continuously. An agent can monitor venue requirements, prepare compliant submission packages, coordinate versions, schedule experiments, retrieve documentation, track review obligations, and negotiate access to computational or data resources within authorized limits. In a more developed system, machine-facing protocols may handle substantial portions of exchange among repositories, venues, compute services, and institutional databases.

Definition 5.7 (Operational delegation boundary)**.** The operational delegation boundary is the institutional boundary separating machine-executed coordination from decisions that determine research priorities, evaluative standards, resource entitlements, or rules of scholarly participation.

The boundary matters because automated circulation can make exchange less visible to scholars while leaving its governing rules highly consequential. A researcher may experience a simple request interface while artificial agents perform extensive allocation and negotiation in the background. The reduction of circulatory labour can therefore expand discretionary scholarly time, yet the governance of protocols, permissions, priorities, and resource constraints remains a political-economic issue.

Proposition 5.8 (Circulatory de-functionalization)**.** *Automation of academic circulation contributes to functional de-reification when it reduces the requirement that scholars personally perform system-maintaining coordination while preserving meaningful routes for them to inspect, contest, and modify the rules governing circulation.*

This proposition connects automation to the broader question of liberation developed later in the manuscript. Delegation can reduce the amount of life organized around maintaining circulation. Its emancipatory significance depends on whether scholars gain greater discretion over their generative activity and retain participation in the conditions through which that activity becomes possible.

5.4 Time Reallocation

This subsection examines the immediate resource released by functional de-reification: scholarly time. Its role is to connect automation of evaluative and circulatory functions to changes in the feasible allocation of attention and effort. The objective is to distinguish time saving from generative freedom and to identify the institutional conditions under which released time becomes available for self-directed inquiry. The discussion focuses on opportunity cost, organizational recapture, temporal autonomy, and heterogeneity of scholarly aims.

Time is a central generative condition of scholarship. Reading, conceptual incubation, exploratory experimentation, mathematical derivation, field engagement, writing, replication, mentoring, and interdisciplinary learning all require extended periods whose value can be difficult to represent through short-horizon productivity measures. Routine review and circulation compete directly with these activities for finite attention.

Definition 5.9 (Released scholarly time)**.** Released scholarly time is the discretionary temporal capacity created when required academic functions are completed with a lower demand on a scholar's personal labour.

DRAFT

Released time has several possible destinations. A scholar may devote it to research, teaching, mentoring, artistic activity, family life, rest, public engagement, or interests outside academia. An institution may also recapture the time by increasing expected publication volume, review throughput, teaching load, administrative surveillance, or competitive targets. Technical efficiency therefore leaves the allocation of released time institutionally open.

Definition 5.10 (Temporal recapture)**.** Temporal recapture is the institutional conversion of time saved through automation into additional compulsory output, monitoring, or standardized functional obligations.

Proposition 5.11 (Temporal autonomy condition)**.** *Automation expands scholarly generative freedom when a meaningful share of released scholarly time remains under the discretionary direction of the scholar or a collectively governed scholarly community.*

This condition makes the political economy of time explicit. A reduction in task duration can improve productivity while leaving the scholar's control over time unchanged. Functional de-reification acquires stronger emancipatory significance when the reduction of compulsory tasks also increases temporal discretion. This distinction becomes important when the manuscript later extends the academic case to general labour under advanced automation.

The content of self-directed activity can vary widely. Some scholars may intensify formal research; others may pursue long-horizon questions, speculative ideas, neglected literatures, replication, public scholarship, or nonacademic interests. The concept of generative freedom developed in later sections therefore concerns control over direction and participation, while remaining compatible with heterogeneous uses of released capacity.

5.5 Voluntary Participation

This subsection completes the account of functional de-reification by specifying the relation between reduced obligation and continued participation. Its role is to distinguish release from compulsory academic functions from withdrawal from collective knowledge formation. The objective is to define a mode of epistemic participation in which scholars can continue reviewing, debating, mentoring, experimenting, and evaluating through more discretionary forms of engagement. The discussion focuses on voluntariness, retained agency, collective maintenance, and participation in epistemic governance.

Automation creates the possibility that some activities historically performed as obligations can become more selective forms of participation. A scholar released from routine review can still evaluate a paper whose topic matters to them, join an adversarial review process, inspect an automated assessment, contribute to a replication effort, mentor a junior researcher, or participate in the revision of field standards. The change concerns the terms of participation and can preserve active participation under reduced obligation.

Definition 5.12 (Voluntary epistemic participation)**.** Voluntary epistemic participation is discretionary involvement in knowledge-generative, evaluative, or community-maintaining activity under conditions where access to basic scholarly participation remains substantially independent of a standardized quota for that function.

Voluntary participation remains socially structured. Academic communities require maintenance, and some collective obligations may remain legitimate and necessary. The concept therefore identifies a change in degree and institutional form while allowing some shared responsibilities to remain collective. Collective governance can distribute essential maintenance while automation lowers the volume of human labour required for routine operations.

Proposition 5.13 (De-reification and epistemic agency)**.** *Functional de-reification has stronger emancipatory significance when reduced compulsory functional labour is accompanied by preserved or expanded capacities for self-directed inquiry, evaluative intervention, and participation in epistemic governance.*

DRAFT

The proposition provides the transition to the next stage of the argument. AI-mediated academic automation can release scholars from portions of the functional architecture that sustains circulation and certification. The resulting condition becomes politically significant when released capacity supports self-directed generativity and when scholars remain able to influence the institutions that organize knowledge production. The next analytical stage turns from release from standardized functions to the positive organization of scholarly generativity under greater temporal and functional discretion.

6 Scholarly Generativity

This section develops the positive counterpart to the functional de-reification examined in Section 5. Its role is to specify the forms of scholarly activity that can expand when routine evaluative, circulatory, administrative, and coordinative obligations require less compulsory human participation. The objective is to distinguish a reduction in system-maintaining labour from an enlargement of researchers' capacity to choose, sustain, revise, and terminate their own epistemic projects. The discussion proceeds through five components—research autonomy, voluntary intellectual labour, exploratory inquiry, aesthetic and epistemic judgment, and individually directed research trajectories—and uses a generative-relational method that evaluates freedom through the relation between scholarly agents and the conditions governing the direction of their activity.

The relevant conception of scholarly freedom concerns direction as well as available time. Released time can be absorbed by new publication demands, expanded monitoring, intensified output targets, or additional forms of standardized evaluation. The same technical automation can therefore support different institutional trajectories. Self-directed scholarly generativity identifies the trajectory in which reduced compulsory functionalization is accompanied by increased capacity to determine the objects, pace, methods, collaborations, and continuation of inquiry.

Definition 6.1 (Self-directed scholarly generativity)**.** Self-directed scholarly generativity is the effective capacity of a scholar to initiate, orient, sustain, revise, combine, and terminate epistemic activity according to reflectively endorsed research purposes under conditions that provide sufficient access to the resources required for meaningful inquiry.

The definition treats autonomy as relationally effective. A researcher may possess wide formal discretion while lacking time, computation, data, institutional recognition, or material support. Conversely, substantial resources can coexist with narrow agenda control when access depends on externally specified topics, metrics, or output formats. Self-directed generativity therefore requires both directional agency and viable generative conditions.

6.1 Research Autonomy

This subsection specifies research autonomy as the first dimension of self-directed scholarly generativity. Its role is to identify the forms of control that scholars exercise over the direction and organization of inquiry. The objective is to distinguish nominal choice among predefined tasks from effective authority over problem selection, methodological composition, temporal pacing, collaboration, and revision. The discussion treats autonomy as a relation among scholarly intention, institutional constraints, available resources, and the ability to alter a research trajectory after new information appears.

Research autonomy has several dimensions. Agenda autonomy concerns the capacity to select or formulate problems. Methodological autonomy concerns the capacity to choose and combine investigative procedures. Temporal autonomy concerns control over the pace, sequencing, and duration of inquiry. Associational autonomy concerns the capacity to choose collaborators and intellectual communities. Revision autonomy concerns the capacity to redirect a project when emerging evidence, conceptual difficulty, or new interests alter the researcher's judgment.

DRAFT

Definition 6.2 (Effective research autonomy)**.** Effective research autonomy is the degree to which a scholar can exercise agenda, methodological, temporal, associational, and revision control while retaining practical access to the resources and institutions required to pursue the resulting research trajectory.

AI-mediated academic systems can affect each dimension differently. Automated administration may expand temporal autonomy by reducing recurrent coordination work. Automated literature mapping can enlarge agenda exploration by lowering the cost of surveying unfamiliar domains. Automated experimentation can broaden the feasible set of hypotheses that one researcher can investigate. At the same time, model-mediated recommendation systems can narrow exposure when they repeatedly prioritize already legible topics, established benchmarks, or institutionally rewarded forms of output. The political-economic question therefore concerns the organization of the interface between assistance and agenda control.

Proposition 6.3 (Automation and autonomy conversion)**.** *Reductions in compulsory academic labour increase effective research autonomy when released time and technical capacity remain available for scholar-directed agenda formation, methodological choice, and trajectory revision.*

The proposition identifies a conversion problem. Labour-saving technology creates a potential resource in the form of time and operational capacity. Institutional arrangements determine whether that resource becomes research autonomy, additional throughput, or intensified surveillance. Functional dereification therefore acquires emancipatory significance through the conditions governing this conversion.

6.2 Voluntary Labour

This subsection examines intellectual labour undertaken through reflective commitment and relative independence from institutional survival requirements. Its role is to clarify how a post-labour academic order can retain extensive human activity. The objective is to separate reductions in compulsory labour from changes in reading, writing, experimentation, teaching, interpretation, or conceptual construction. The discussion focuses on motivation, voluntariness, revisability, and the relation between activity and material dependence.

A scholar can spend long periods engaged in difficult work while experiencing the activity as freely sustained and intrinsically meaningful. The political-economic character of that activity changes when continuation is less tightly coupled to income, credential maintenance, mandatory service, or competitive output requirements. This shift concerns the conditions under which activity is undertaken and the degree of control retained over its direction.

Definition 6.4 (Voluntary intellectual labour)**.** Voluntary intellectual labour is sustained cognitive or scholarly activity undertaken through reflectively endorsed commitment under conditions that preserve basic generative access after credible acts of refusal, interruption, revision, or exit.

The definition includes an exit condition because voluntariness depends on more than subjective enthusiasm. A researcher may enjoy an activity while institutional penalties make refusal practically costly. Greater automation can reduce the quantity of compulsory tasks and, when accompanied by secure access to core resources, increase the share of intellectual activity governed by voluntary commitment.

Voluntary intellectual labour can include archival work, formal proof, field observation, model construction, translation, data collection, peer discussion, experimental repetition, and manuscript preparation. These activities remain labour-intensive in an ordinary descriptive sense. Their significance for liberation depends on whether scholars participate because the inquiry itself warrants continuation, because participation sustains a chosen community, or because access to livelihood and recognition is conditioned on compliance with externally imposed functions.

Remark 6.5 (Activity under post-labour conditions)**.** A post-labour orientation can therefore contain substantial intellectual activity. The relevant transformation concerns the relation between activity, compulsion, and generative access.

DRAFT

This distinction also clarifies the role of artificial systems. Delegating routine functions to AI can coexist with human retention of demanding intellectual activity. Scholars may deliberately retain activities that carry epistemic, educational, aesthetic, relational, or existential value even when artificial systems can perform similar operations more efficiently.

6.3 Exploratory Inquiry

This subsection develops exploratory inquiry as a form of generative activity that benefits directly from expanded temporal and agenda autonomy. Its role is to identify research whose value remains uncertain at the point of initiation and whose direction can evolve through encounter with unexpected material. The objective is to show why a reduction in compulsory functional labour can alter the distribution of attention across established programmes, marginal questions, interdisciplinary crossings, replication, negative results, and speculative investigation. The discussion uses uncertainty and option preservation as its organizing concepts.

Many research systems reward projects that can specify outputs, milestones, significance, and evaluation criteria before substantial investigation begins. Such requirements support accountability and coordination, while also influencing which inquiries receive time and resources. Exploratory inquiry occupies a different temporal structure. Its early stages often generate information about the problem itself, including whether the initial question is coherent, which methods are appropriate, and which adjacent domains contain relevant concepts.

Definition 6.6 (Exploratory inquiry)**.** Exploratory inquiry is scholarly activity organized around the discovery and revision of research possibilities under conditions where the value, method, or endpoint of the investigation remains partially open during the early stages of work.

AI can lower the cost of exploration by enabling rapid literature traversal, simulation, coding, translation, preliminary analysis, and cross-domain comparison. Released scholarly time can further increase the capacity to pursue questions whose expected institutional return is uncertain. These effects can expand the option set available to researchers before they commit to a stabilized programme.

Proposition 6.7 (Exploratory option expansion)**.** *Automation expands exploratory freedom when reduced search, coordination, and execution costs increase the number and diversity of research trajectories that scholars can examine before institutional commitment becomes necessary.*

The proposition links academic automation to a broader conception of generative freedom. A system supports inquiry through more than efficient completion of selected projects. It can also enlarge the space within which projects are imagined, compared, combined, abandoned, and reformulated. The political economy of liberation therefore includes the governance of exploratory options and the distribution of access to them.

6.4 Generative Judgment

This subsection examines the role of judgment in directing self-chosen research. Its role is to distinguish the generation of candidate claims or problems from the situated assessment of their epistemic promise, conceptual elegance, explanatory reach, difficulty, relevance, and capacity to reorganize a field of inquiry. The objective is to clarify why automation of routine academic functions can increase the relative importance of problem selection and evaluative orientation. The discussion treats aesthetic and epistemic judgment as related forms of discrimination operating under incomplete information.

When systems can generate large numbers of hypotheses, proofs, experiments, texts, or research plans, the scarcity of candidate production can decline while the need to select among candidates persists. Scholarly judgment then operates increasingly at the level of orientation: identifying which questions merit sustained attention, which anomalies deserve investigation, which conceptual structures reveal productive relations, and which lines of inquiry should be allowed to mature despite uncertain short-term returns.

DRAFT

Definition 6.8 (Generative scholarly judgment)**.** Generative scholarly judgment is the situated capacity to discriminate among possible research directions according to epistemic, explanatory, conceptual, methodological, aesthetic, ethical, or field-forming considerations before their full consequences are available.

Aesthetic judgment enters this process when researchers experience certain questions, structures, explanations, or conjectures as possessing coherence, elegance, surprise, fertility, or depth that warrants further attention. Such judgment can interact with formal evidence and methodological discipline while remaining partly prospective. Its significance lies in guiding effort before decisive validation is available.

AI systems can participate in generative scholarly judgment by ranking ideas, estimating novelty, tracing analogies, or modeling likely outcomes. Human scholars can also use AI-produced alternatives to sharpen their own evaluative criteria. The institutional question concerns whether these tools broaden the field of possible judgment or gradually standardize it around historically accumulated metrics, publication patterns, and machine-readable proxies.

Claim 6.9 (Judgment under abundant generation)**.** As the cost of producing candidate epistemic objects decreases, the allocation of sustained attention among those objects becomes a more consequential site of scholarly agency and institutional power.

This claim provides a bridge to later sections on knowledge scarcity and epistemic capital. Abundant generation changes the location of scarcity within the academic system. Selection, verification, attention, and recognition can become increasingly important generative conditions, and control over their criteria can shape the future direction of knowledge production.

6.5 Research Trajectory

This subsection integrates the preceding dimensions into a temporal account of scholar-directed research. Its role is to move from isolated acts of choice to trajectories that develop across projects, fields, methods, collaborations, and periods of intellectual transformation. The objective is to identify the conditions under which scholars can sustain coherent lines of inquiry while retaining the capacity to redirect them in response to discovery, changing judgment, or emerging interests. The discussion treats research trajectories as evolving relations between individual agency and shared epistemic infrastructures.

A research trajectory can include multiple projects whose connection becomes visible only over time. Early work can generate concepts that later migrate across fields; failed experiments can reshape problem selection; reading outside a primary discipline can create unexpected combinations; collaboration can alter methods and standards of relevance. Systems organized around short evaluation cycles can fragment these trajectories by privileging immediately legible outputs. Reduced compulsory functional labour can create temporal space for longer arcs of inquiry when institutional access remains sufficiently stable.

Definition 6.10 (Individually directed research trajectory)**.** An individually directed research trajectory is an evolving sequence of epistemic activities whose continuation, branching, integration, and revision are substantially guided by the scholar's reflectively endorsed judgments while remaining connected to shared resources, communities, and standards of inquiry.

Individual direction therefore coexists with relational dependence. Researchers draw on languages, archives, instruments, data, collaborators, institutional support, public infrastructures, prior scholarship, and critical response. Self-direction concerns the capacity to organize these relations into an evolving programme while preserving embeddedness in collective knowledge systems.

Proposition 6.11 (Trajectory freedom)**.** *Scholarly generative freedom increases when researchers possess sufficient temporal security, resource access, and revision authority to sustain and redirect research trajectories across evaluation cycles.*

DRAFT

Trajectory freedom provides a cumulative interpretation of the liberation argument developed so far. Functional de-reification releases scholars from some compulsory system-maintaining roles. Research autonomy governs the direction of the released capacity. Voluntary intellectual labour supplies sustained activity, exploratory inquiry preserves uncertain options, and generative judgment selects among emerging possibilities. Individually directed trajectories organize these elements across time.

The resulting conception of liberation remains compatible with extensive human participation in civilization's knowledge formation. Academic automation can transfer routine circulation, evaluation, and coordination to artificial systems while human scholars continue to generate questions, pursue self-chosen projects, cultivate judgment, and participate in collective epistemic life. The following section examines a complementary trajectory in which artificial systems themselves participate throughout the knowledge-production cycle, creating increasingly integrated AI–AI circuits of scholarly generation and evaluation.

7 Automated Knowledge Circuit

This section extends the analysis from human scholars using artificial systems to scholarly processes in which artificial agents occupy multiple positions within the same knowledge-production circuit. Its role is to specify how literature ingestion, problem formation, hypothesis generation, experimentation, writing, and evaluation can become linked across machine-mediated stages. The objective is to identify the functional architecture of an AI–AI circuit before the following section examines the recursive dynamics produced when generated knowledge re-enters later rounds of production. The discussion proceeds through six components—automated literature ingestion, automated problem formation, automated hypothesis generation, automated experimentation, automated writing, and automated evaluation—and uses a functional-relational method that tracks how epistemic objects move among artificial agents, tools, databases, experimental environments, and institutional interfaces.

Current end-to-end research systems already combine several of these functions within coordinated pipelines, including literature search, idea generation, experiment execution, manuscript production, and automated review [4]. The present section uses that evidence as an empirical entry point into a broader analytical scenario concerning an increasingly autonomous scholarly economy. The analytical object is a circuit in which outputs generated at one machine-mediated stage become usable inputs for another stage, with human participation varying across initiation, supervision, validation, resource provision, and institutional authorization.

Definition 7.1 (AI–AI knowledge production circuit)**.** An AI–AI knowledge production circuit is a linked scholarly process in which artificial agents or machine-mediated systems perform multiple epistemic functions and transmit intermediate or final outputs among those functions in forms that can guide subsequent stages of knowledge production, evaluation, or circulation.

The definition emphasizes functional coupling. A circuit can remain institutionally human-governed while containing extensive machine-to-machine transmission. Human actors can define objectives, authorize resources, validate claims, or retain publication responsibility while artificial systems conduct much of the intermediate search, generation, experimentation, and evaluation. The political-economic significance therefore concerns the changing allocation of scholarly functions and the conditions under which those functions are coordinated.

7.1 Literature Ingestion

This subsection examines automated literature ingestion as the informational entry layer of AI–AI knowledge production. Its role is to specify how artificial systems transform existing scholarly records into machine-usable representations that can condition later problem selection, hypothesis formation, and experimental design. The objective is to distinguish simple retrieval from the broader processes of selection, synthesis, comparison, compression, and relational mapping that determine which prior knowledge

DRAFT

becomes operationally available to downstream agents. The discussion focuses on the construction of a machine-mediated epistemic context.

Literature ingestion can include search, document retrieval, citation traversal, semantic clustering, claim extraction, methodological comparison, contradiction detection, evidence summarization, and construction of structured representations of a field. End-to-end automated research systems already incorporate literature search as an upstream component of machine-mediated research workflows [4]. When such processing is connected directly to later agents, the result is more than a convenience layer for a human reader. It becomes part of the generative environment within which downstream artificial systems form candidate research directions.

Definition 7.2 (Machine-mediated epistemic ingestion)**.** Machine-mediated epistemic ingestion is the process through which an artificial system selects, transforms, organizes, and transmits existing scholarly materials into representations that can condition subsequent epistemic operations.

Selection remains consequential because the accessible scholarly record exceeds what any bounded process can treat with equal depth. Search indices, database coverage, language access, ranking procedures, licensing, retrieval budgets, and model context constraints influence which materials enter the machine-mediated epistemic context. Automated literature ingestion therefore already contains allocative decisions. These decisions can propagate downstream even when later agents possess substantial generative capability.

The resulting epistemic context can also include AI-generated scholarly materials. As machine-produced papers, reviews, summaries, datasets, and annotations enter searchable corpora, artificial systems can increasingly ingest outputs created by other artificial systems. This possibility establishes the first link in a machine-to-machine scholarly circuit and prepares the recursive dynamics examined in the following section of the manuscript.

7.2 Problem Formation

This subsection develops automated problem formation as the stage at which machine-mediated representations of a field are converted into candidate research directions. Its role is to separate the production of a research problem from the later generation of specific conjectures or hypotheses. The objective is to identify the operations through which artificial systems can detect gaps, tensions, anomalies, underexplored combinations, benchmark weaknesses, methodological opportunities, or unexplained empirical patterns. The discussion treats problem formation as an allocation of future attention within a structured possibility space.

Research problems organize subsequent labour and resource use. A system that proposes a problem thereby influences which literature is revisited, which experiments are designed, which datasets are acquired, and which forms of evidence receive priority. Automated problem formation can therefore acquire political-economic significance even when final agenda authority remains with human researchers or institutions.

Definition 7.3 (Artificial problem formation)**.** Artificial problem formation is the machine-mediated construction, specification, and prioritization of candidate research problems from available epistemic representations, objectives, constraints, and evaluation criteria.

Problem formation can operate through several mechanisms. An agent can search for empirical residuals that existing models explain poorly, identify contradictions among published claims, combine methods and objects from different fields, detect benchmark saturation, or propose questions whose answers would discriminate among competing explanations. It can also inherit institutional objectives supplied through grants, laboratory priorities, benchmark structures, or platform-level goals.

The distinction between generation and prioritization is important. Artificial systems can produce many candidate problems while another agent, metric, institution, or human researcher determines which candidates receive further resources. An AI–AI circuit can therefore contain a division of epistemic

DRAFT

labour in which one system expands the problem space and another system allocates attention within it. The governance of that allocation becomes increasingly consequential as candidate generation becomes inexpensive relative to experimental and evaluative capacity.

7.3 Hypothesis Generation

This subsection examines automated hypothesis generation as the transition from a formulated research problem to candidate explanatory, predictive, constructive, or formal propositions. Its role is to specify how artificial agents can generate alternative mechanisms, models, proofs, designs, or expected relationships within a selected research direction. The objective is to distinguish the breadth of candidate generation from the evidentiary work required to evaluate those candidates. The discussion uses diversity, tractability, and discriminability as organizing properties of a useful hypothesis set.

Automated hypothesis generation can draw on retrieved literature, structured databases, simulation tools, code libraries, prior experimental traces, and model-internal representations at the same stage of analysis. An artificial agent can generate multiple explanations for an observed pattern, propose competing architectural changes, formulate mathematical conjectures, or produce experimental interventions designed to separate rival accounts. End-to-end automated research systems provide an early technical demonstration of machine-mediated idea generation connected to later experimental stages [4].

Definition 7.4 (Artificial hypothesis generation)**.** Artificial hypothesis generation is the machine-mediated production of candidate epistemic propositions or constructive alternatives available for analysis, proof, simulation, experiment, comparison, or other forms of evaluation.

The value of a generated hypothesis depends partly on its relation to the available testing environment. Candidate production can become extremely abundant while experimental capacity, verification time, compute, physical instrumentation, or expert attention remains scarce. The circuit therefore benefits from mechanisms that rank hypotheses according to expected information gain, feasibility, novelty, explanatory scope, or other research-specific criteria.

This stage also creates an interface with the judgment analysis developed in Section 6.4. Human scholars can remain deeply involved by selecting among machine-generated hypotheses, revising evaluation criteria, identifying aesthetically or conceptually promising structures, and redirecting the research trajectory. An AI–AI circuit can also assign those selection functions to additional artificial agents, producing a more extensive delegation of epistemic orientation.

7.4 Experiment Execution

This subsection develops automated experimentation as the stage that converts candidate hypotheses into machine-mediated encounters with empirical, computational, or formal constraints. Its role is to identify the operational processes through which artificial agents design tests, allocate experimental resources, execute procedures, monitor results, and revise subsequent actions. The objective is to clarify how experimentation can become an iterative agentic process linked directly to upstream hypothesis generation and downstream interpretation. The discussion includes computational experiments, simulations, software benchmarks, and physically embodied experimentation as variations of the same functional architecture.

Automated experimentation is already visible in research systems that generate code, execute experiments, inspect results, and use those results to guide further search [4]. The degree of autonomy can vary considerably. Some systems operate inside bounded computational environments; others can interact with laboratory automation, robotics, remote instruments, or externally managed experimental platforms. In each case, the artificial agent participates in converting epistemic candidates into evidence-producing actions.

Definition 7.5 (Automated experimental agency)**.** Automated experimental agency is the effective capacity of an artificial system to design, initiate, adapt, and evaluate evidence-producing procedures within an authorized experimental environment.

DRAFT

Experimental agency depends on access to generative conditions. Compute quotas, instrument permissions, data licences, laboratory schedules, safety constraints, energy, materials, and institutional approval determine which candidate experiments can be realized. AI-mediated scholarship therefore reproduces a central generative-relational distinction: an agent can possess extensive intellectual capacity while practical experimentation remains governed by external access relations.

Machine-to-machine coordination can become especially visible at this stage. One agent can propose experiments, another can manage resource scheduling, another can execute code or control instrumentation, and another can analyze outcomes. The result is a distributed artificial research process in which epistemic labour and resource coordination become increasingly integrated across software agents and technical infrastructures.

7.5 Manuscript Generation

This subsection examines automated writing as the representational stage through which machine-mediated research activity is converted into scholarly objects that can circulate through academic institutions. Its role is to distinguish research performance from the construction of manuscripts, reports, datasets, code documentation, supplementary materials, and other communicative artifacts. The objective is to identify how artificial systems can package upstream literature processing, hypotheses, methods, evidence, and interpretation into forms legible to reviewers, repositories, databases, and other agents. The discussion treats writing as a transformation between epistemic activity and institutional circulation.

Automated research systems can already produce complete scientific manuscripts from machine-mediated research workflows [4]. Writing in this setting performs several functions simultaneously: it records claims, supplies methodological traceability, situates contributions in relation to prior work, renders evidence inspectable, and creates an object that publication systems can classify and evaluate.

Definition 7.6 (Machine-authored scholarly representation)**.** A machine-authored scholarly representation is a communicative research artifact generated substantially through artificial systems for the purpose of recording, transmitting, evaluating, or circulating epistemic content within a scholarly environment.

The quality of such representation depends on more than linguistic fluency. Accurate provenance, faithful reporting of experimental procedures, calibrated uncertainty, citation integrity, reproducibility information, and transparent attribution remain central to epistemic use. Institutional policies can therefore distinguish among assistance with expression, machine-mediated synthesis, substantial content generation, and fully automated manuscript production.

Within an AI–AI circuit, the intended reader can also be artificial. A machine-generated paper can be indexed, summarized, scored, compared, and incorporated into later model contexts by other agents before a human scholar reads it directly. Writing therefore becomes an interface across human and artificial epistemic participants. Its political-economic role concerns both public communication and the production of standardized objects that can enter automated circulation.

7.6 Evaluation Loop

This subsection completes the circuit by examining automated evaluation. Its role is to connect machine-produced scholarly objects to processes of criticism, ranking, verification, certification support, and future resource allocation. The objective is to distinguish evaluative content from institutional authority while identifying how artificial agents can increasingly participate in the production of review information. The discussion uses the earlier peer-review analysis to situate automated evaluation within a broader machine-to-machine circuit.

The AAAI-26 AI review pilot demonstrates that artificial systems can generate evaluative reports at conference scale while human reviewers and conference institutions retain formal decision authority [2, 1]. This separation is analytically useful. Automated evaluation can supply criticism, consistency

DRAFT

checks, methodological scrutiny, novelty comparisons, or confidence estimates while certification remains institutionally allocated through separate rules.

Definition 7.7 (Artificial evaluative participation)**.** Artificial evaluative participation is the machine-mediated production of judgments, critiques, scores, comparisons, verification signals, or other evaluative information that can influence the circulation, revision, recognition, or resource allocation of scholarly objects.

When automated evaluation is connected directly to automated writing, experimentation, hypothesis generation, and literature ingestion, the circuit becomes increasingly integrated. One artificial system can evaluate the output of another, and its evaluative result can guide revision, select subsequent experiments, alter ranking, or determine which materials enter the next round of machine-mediated attention.

Proposition 7.8 (Functional closure of an AI–AI scholarly circuit)**.** *An AI–AI knowledge production circuit approaches functional closure as a larger share of literature ingestion, problem formation, hypothesis generation, experimentation, scholarly representation, and evaluation can be coordinated through artificial agents while maintaining the resource access required for repeated operation.*

Functional closure describes the degree of operational integration; epistemic self-sufficiency lies outside the definition. The circuit remains dependent on material infrastructures, inherited knowledge, data, energy, institutional permissions, experimental environments, and governance arrangements. Human participants can also remain active at multiple points. The concept identifies a shift in where scholarly functions are performed and how their outputs are transmitted.

This shift prepares the next analytical step. Once machine-generated scholarly objects and machine-generated evaluations become inputs to subsequent rounds of artificial research, knowledge functions simultaneously as produced output and as a condition of future production. The following section examines that recursive structure and its implications for accumulation, feedback, and the reproduction of epistemic conditions.

8 Epistemic Recursion

This section develops the recursive structure that emerges when scholarly outputs generated within AI-mediated research circuits become usable conditions for subsequent rounds of knowledge production. Its role is to move the analysis beyond the functional sequence developed in Section 7 and to examine how knowledge production can acquire a self-feeding temporal organization. The objective is to distinguish six analytically separate components: knowledge outputs, knowledge inputs, recursive knowledge accumulation, evaluation feedback, model updating, and epistemic reproduction. The discussion follows a generative-relational method. It tracks how scholarly objects change institutional and technical roles across successive production cycles, while preserving distinctions among production, validation, incorporation, and reproduction.

The recursive structure is especially important for the political economy of academic automation because knowledge differs from many consumptive outputs. A scholarly object can remain available after its initial production and can subsequently condition new research. Papers, datasets, code, proofs, reviews, benchmarks, annotations, and experimental records can therefore occupy multiple temporal positions within the same research ecology. An artifact produced during one cycle can become evidence, context, training material, a retrieval target, an evaluative reference, or a problem-generating resource during another cycle. Extensive artificial mediation can accelerate this role conversion by enabling machine systems to ingest, compare, transform, and recirculate large volumes of scholarly material.

Definition 8.1 (Recursive epistemic production)**.** Recursive epistemic production is a temporally extended knowledge-production structure in which outputs of prior scholarly activity become effective inputs, evaluative signals, or generative conditions for subsequent scholarly activity.

DRAFT

The definition concerns a relation among production cycles. Epistemic validity remains a separate assessment of the recirculated material. A false claim, weak benchmark, poorly specified experiment, or institutionally privileged convention can also enter a later cycle. The recursive architecture therefore raises two related questions for later sections: which objects gain continued access to the circuit, and which scarce capacities govern their verification, visibility, and future use.

8.1 Output Function

This subsection specifies the output layer of recursive epistemic production. Its role is to identify the heterogeneous scholarly objects that can leave one stage of a research process and become available for later circulation. The objective is to distinguish epistemic output from the narrower category of published prose and to clarify the technical properties that make an output reusable by human or artificial agents. The discussion proceeds through artifact type, persistence, provenance, and machine reprocessability.

Academic production generates more than papers. A research cycle can produce claims, proofs, datasets, code, experimental traces, model checkpoints, protocols, negative results, review reports, confidence estimates, citation links, benchmark scores, and structured metadata. These objects differ in their epistemic role and institutional status, yet each can influence later research when it persists in a form that another participant can retrieve and interpret.

Definition 8.2 (Reprocessable knowledge output)**.** A reprocessable knowledge output is a scholarly artifact whose representational form, provenance, and accessibility permit it to be incorporated into a later process of inquiry, evaluation, comparison, synthesis, or generation.

Reprocessability is relational. A handwritten laboratory note can be highly informative to its author and inaccessible to an automated agent. A structured dataset can be easily ingested by software and difficult to interpret responsibly without contextual documentation. A review score can be computationally simple while representing a severe compression of the underlying scholarly judgment discussed in Section 4. The practical status of an output therefore depends on the capacities of the receiving agent and the surrounding representational infrastructure.

Persistence also matters. Scholarly outputs that remain indexed, archived, cited, or linked to reusable technical objects can exert influence across longer time horizons. Ephemeral discussion can shape a research trajectory without entering a durable archive, while highly standardized artifacts can circulate widely after their original context has faded. AI-mediated research strengthens the analytical importance of this distinction because machine systems can operate on persistent representations at scales that exceed direct human reading.

Proposition 8.3 (Output persistence and recursive influence)**.** *Within a recursive knowledge-production system, the potential influence of a scholarly output on later research depends jointly on its persistence, accessibility, interpretability, and incorporation into subsequent epistemic processes.*

The proposition identifies conditions of influence; epistemic quality requires a separate assessment. High persistence can amplify valuable findings, conventional assumptions, methodological artifacts, and errors alike. The recursive structure therefore connects output production to later questions of selection and verification.

8.2 Input Function

This subsection examines the conversion of prior scholarly outputs into effective inputs for subsequent inquiry. Its role is to clarify the additional relations through which archival availability becomes operational within a later research process. The objective is to specify the access, selection, representation, and interpretive relations through which stored knowledge becomes operationally relevant to a new agent or research cycle. The discussion treats input status as an achieved relation between an epistemic object and a generative process.

DRAFT

A later research cycle can draw on prior scholarship through direct reading, database retrieval, citation traversal, retrieval-augmented generation, benchmark reuse, dataset loading, model pretraining, fine-tuning corpora, structured knowledge bases, or agent memory. These mechanisms differ technically, yet they perform a common function: they establish a pathway through which a prior artifact conditions current generation.

Definition 8.4 (Effective knowledge input)**.** An effective knowledge input is a prior epistemic object that enters a current generative process in a form capable of altering problem selection, hypothesis formation, method choice, experiment design, interpretation, evaluation, or representation.

This definition makes selection central. A repository can contain millions of artifacts while only a small subset becomes effective within a particular research trajectory. Search ranking, retrieval architecture, citation networks, metadata quality, language, access permissions, model context limits, institutional prestige, and prior evaluative signals can all affect which objects enter the usable input set.

The distinction between available knowledge and effective input also links recursive production to academic power. An artifact that is technically public can remain practically invisible when retrieval systems rarely surface it. A highly visible artifact can shape many later cycles even when alternative evidence exists. AI-mediated scholarly systems can magnify these effects because automated agents may repeatedly rely on shared indexes, benchmark collections, model priors, or ranking infrastructures.

Proposition 8.5 (Input selection as generative conditioning)**.** *Selection mechanisms that determine which prior outputs become effective knowledge inputs also participate in shaping the feasible trajectories of subsequent knowledge generation.*

The proposition places retrieval and curation inside the generative conditions of scholarship. This move prepares the later analysis of scarcity migration and epistemic capital, where attention, verification, and visibility become increasingly important once raw production capacity expands.

8.3 Accumulation Loop

This subsection develops accumulation at the level of recursively reusable scholarly material. Its role is to distinguish growth in the stock of available epistemic artifacts from improvement in verified understanding. The objective is to identify how AI-mediated production can accelerate the creation, recombination, and recirculation of scholarly objects while preserving separate questions about validation, redundancy, contradiction, and integration. The discussion treats accumulation as a structural property of the knowledge system while keeping epistemic progress as a separate evaluative question.

When reprocessable outputs enter later production cycles, the scholarly archive can grow through repeated transformation. A paper can generate summaries, replications, derivative hypotheses, code variants, new benchmarks, critical reviews, and further papers. These later artifacts can themselves reenter the circuit. Automated agents can increase the frequency and scale of such transformations by lowering the operational costs of searching, synthesizing, drafting, coding, and evaluating candidate research objects.

Definition 8.6 (Recursive knowledge accumulation)**.** Recursive knowledge accumulation is the growth of a scholarly system's stock of reusable epistemic artifacts through repeated cycles in which prior outputs contribute to the generation of additional outputs.

The definition remains neutral about the epistemic quality of accumulated material. Accumulation can include corroboration, refinement, duplication, unresolved disagreement, benchmark overfitting, inherited error, or conceptual innovation. The politically and epistemically relevant variable is therefore the relation between production capacity and the capacities for verification, discrimination, integration, and correction.

Proposition 8.7 (Accumulation-verification divergence)**.** *An increase in the rate of scholarly artifact production can enlarge the gap between available epistemic material and the capacity of a knowledge system to verify, integrate, and discriminate among that material.*

DRAFT

The proposition identifies a possible divergence whose empirical extent depends on the relative development of production and verification capacities. Verification capacity can also become automated and expand. The key analytical point is that production and verification are distinct functions with potentially different scaling properties. A recursive AI-mediated system can therefore produce abundance at one layer while intensifying scarcity at another.

Recursive accumulation also changes the meaning of novelty. When enormous volumes of machine-readable scholarship are available, a new artifact may derive value from synthesis, verification, problem reframing, or access to new evidence even when its propositional components have precedents. The later scarcity analysis therefore needs to consider capacities for selection and trustworthy differentiation alongside the volume of generated material.

8.4 Feedback Loop

This subsection examines the recursive role of evaluation once reviews, scores, critiques, acceptance outcomes, benchmark results, and other judgments become inputs to later production. Its role is to connect the peer-review analysis in Section 3 with the AI–AI circuit developed in Section 7. The objective is to identify how evaluative information can shape future attention, revision, search, and generation. The discussion distinguishes evaluation as local judgment from evaluation as a feedback signal embedded in a recursive system.

Evaluation produces information about scholarly objects. A review can identify a methodological weakness, recommend a missing comparison, question a premise, rank alternatives, or assign confidence. Once those evaluative outputs are stored and made available to later agents, they can guide subsequent actions. A writing agent can revise a manuscript according to machine-generated criticism. A research agent can prioritize experiments associated with higher predicted value. A retrieval system can rank artifacts partly through citation, acceptance, or reputation signals. An automated reviewer can also learn from earlier review corpora or institutional criteria.

Definition 8.8 (Epistemic feedback signal)**.** An epistemic feedback signal is an evaluative output that enters a subsequent knowledge-production process and alters the probability, priority, form, or direction of later epistemic activity.

Feedback can be corrective, selective, or amplifying. Corrective feedback encourages revision in response to identified weaknesses. Selective feedback allocates attention among competing objects. Amplifying feedback increases the future visibility or resource access of already recognized work. These functions can coexist in the same institutional signal.

Definition 8.9 (Recursive evaluative coupling)**.** Recursive evaluative coupling is a relation in which evaluative outputs produced during one stage of a scholarly system become generative conditions for later stages of scholarly production or evaluation.

Recursive evaluative coupling creates path dependence. Criteria embedded in repeated evaluation can stabilize useful standards, shared evidentiary practices, and methodological discipline. The same mechanism can also stabilize narrow benchmarks, stylistic conventions, prestige hierarchies, or inherited blind spots. AI-mediated evaluation increases the importance of documenting the origin, scope, and revision of evaluative criteria because machine-to-machine feedback can operate at high frequency.

Remark 8.10 (Feedback and institutional authority)**.** Recursive evaluative coupling remains analytically distinct from independent certification authority for an artificial evaluator. A system can generate influential feedback while formal recognition remains assigned to human reviewers, editors, conferences, journals, laboratories, funders, or other institutions.

This distinction preserves the analysis developed in Subsection 7.6: evaluative information and institutional authority can be distributed across different agents. Their coupling becomes a political-economic object when feedback influences visibility, resource allocation, or future generative access.

DRAFT

8.5 Model Incorporation

This subsection analyzes model updating as one pathway through which prior scholarly activity can become embedded in the capacities of future artificial agents. Its role is to distinguish immediate use of external knowledge from more durable forms of epistemic incorporation. The objective is to identify several mechanisms through which a research system can retain and reuse prior outputs without reducing the analysis to parameter training alone. The discussion covers model parameters, retrieval systems, agent memory, tool configuration, benchmark state, and workflow adaptation as distinct forms of technical persistence.

A machine-mediated research circuit can incorporate prior scholarship through multiple update mechanisms. Model retraining or fine-tuning can alter parameterized behaviour. Retrieval indexes can change which documents are accessible during inference. Agent memory can preserve summaries, decisions, unresolved questions, and prior experimental states. Tool libraries can retain generated code and protocols. Workflow policies can update search priorities or evaluation thresholds. Each mechanism creates a different relation between past epistemic activity and future generative capacity.

Definition 8.11 (Epistemic incorporation)**.** Epistemic incorporation is the technical or organizational process through which outputs, evaluations, or state information from prior scholarly activity are made durably available to influence the capacities or operating context of later epistemic agents.

Epistemic incorporation can occur at different levels of reversibility and transparency. A retrieval corpus can often expose the documents that informed a response. Parameter changes can be harder to trace to individual sources. Agent memory can preserve explicit provenance when designed to do so. Institutional workflows can change through policy updates whose origin remains documented in governance records. These differences matter for accountability, correction, and the ability to reconstruct the historical development of a knowledge system.

Proposition 8.12 (Incorporation-mediated capacity change)**.** *When prior epistemic outputs are incorporated into the operating state of an artificial research system, the resulting change can alter that system's future generative capacity even when the original artifacts are absent from the immediate interaction context.*

The proposition identifies a pathway through which knowledge becomes part of the effective conditions of future production. It also creates a preservation problem. Errors, omissions, evaluative conventions, and representational asymmetries can persist through incorporation unless correction mechanisms reach the relevant technical layer. The political economy of model updating therefore concerns both access to updating processes and authority over which materials, criteria, and corrections become durably embedded.

8.6 Reproductive Loop

This subsection integrates the preceding components into an account of epistemic reproduction. Its role is to move from repeated artifact production to the reproduction of the conditions under which a knowledge system continues to generate, evaluate, preserve, and circulate scholarship. The objective is to specify how corpora, models, evaluative criteria, technical infrastructures, institutional recognition, and resource arrangements can be carried across successive research cycles. The discussion concludes the recursive analysis and prepares the next section's examination of scarcity migration.

A scholarly system reproduces itself when it preserves enough of its generative conditions to sustain future inquiry. Human academic systems have historically relied on education, archives, journals, laboratories, professional communities, funding arrangements, methodological traditions, and peer-review institutions. AI-mediated scholarship adds models, retrieval infrastructures, agent architectures, machine-readable corpora, computational resources, automated evaluators, and technical maintenance to that reproductive structure.

DRAFT

Definition 8.13 (Epistemic reproduction)**.** Epistemic reproduction is the continued regeneration of the capacities, representations, evaluative practices, infrastructures, and institutional conditions through which a scholarly system can produce and assess further knowledge.

Epistemic reproduction therefore includes both continuity and transformation. A system can preserve established methods while revising benchmarks, incorporate new evidence while retiring obsolete representations, expand access to research tools while changing the distribution of expertise, or automate circulation while retaining human participation in problem choice and judgment. Reproduction concerns the capacity of the system to continue generating epistemic activity across time.

Proposition 8.14 (Recursive reproduction of epistemic conditions)**.** *A knowledge-production system becomes increasingly self-reproductive when outputs, evaluative signals, incorporated state, and institutional resources generated during prior cycles contribute materially to the capacities and conditions of subsequent cycles.*

Self-reproduction remains dependent on external conditions. Energy, hardware, laboratories, social authorization, legal permissions, education, public trust, and access to the empirical world continue to connect scholarly systems to broader material and institutional environments. Human scholars can also remain central through research direction, interpretation, dissent, judgment, care for archives, governance, and the creation of questions that arise from lived or disciplinary experience.

The political-economic significance lies in the relocation of scarcity and control. As recursive automation expands the capacity to produce and reprocess scholarly artifacts, constraints can migrate toward verification, trusted attention, experimental access, compute, data, infrastructural control, and the authority to modify the recursive system itself. Section 9 therefore examines scarcity migration in academic systems as the next step in the analysis.

9 Scarcity Migration

This section examines how the expansion of AI-mediated scholarly production can alter the location of scarcity within academic systems. Its role is to connect the recursive production structure developed in Section 8 with the political economy of attention, verification, recognition, and resource allocation. The objective is to distinguish six scarcity domains that become especially important when the marginal cost of producing scholarly artifacts declines: production scarcity, verification capacity, scholarly attention, institutional trust, recognition capacity, and experimental resources. The discussion follows a relational method. It treats scarcity as a property of an institutional configuration and traces how reductions in one bottleneck can increase the strategic importance of another.

The concept of scarcity migration is useful because academic automation distributes productivity gains unevenly across the knowledge system. A system may become highly capable of generating manuscripts while retaining limited capacity to verify claims, allocate attention, reproduce trust, confer recognition, or provide access to laboratories and other material infrastructures. These asymmetries change which functions constrain the rate and direction of epistemic circulation. They also change where institutional power can accumulate. An actor that controls a previously secondary bottleneck can acquire greater influence once production becomes abundant.

Definition 9.1 (Scarcity migration)**.** Scarcity migration is a change in the location of a system's effective bottlenecks produced when the relative abundance of one function increases the constraining importance of other functions, resources, or institutional capacities.

Scarcity migration therefore concerns the reorganization of constraints across a system. It can occur even when total productive capacity rises substantially. In academic settings, rapid generation can increase demand for verification, triage, curation, trusted evaluation, experimental replication, and institutional decision-making. The following subsections examine these domains separately before relating them to the political economy of epistemic capital in the next section.

DRAFT

9.1 Production Abundance

This subsection establishes the production-side condition that makes scarcity migration analytically salient. Its role is to specify how AI-mediated generation can reduce the cost of producing candidate scholarly artifacts while leaving other stages of the knowledge process comparatively constrained. The objective is to distinguish artifact production from validated knowledge production and to identify the institutional consequences of a widening gap between the two. The discussion situates production capacity as one component of a larger scholarly system and evaluates it together with validation, circulation, and use.

Academic production has historically required substantial human time for literature review, coding, data preparation, analysis, drafting, revision, and formatting. AI systems can reduce the marginal time required for several of these tasks. The resulting increase in manuscript, code, review, and hypothesis generation expands the volume of objects entering scholarly circulation. Section 1 documented recent institutional signals of this transition, while Sections 7 and 8 developed its structural implications.

Definition 9.2 (Production scarcity)**.** Production scarcity is the degree to which limited capacity to create candidate scholarly artifacts constrains the volume or diversity of epistemic objects available for subsequent evaluation, circulation, and use.

A reduction in production scarcity can occur through faster drafting, broader literature processing, automated coding, synthetic data generation, machine-assisted experimentation, or multi-agent research workflows. These mechanisms increase the supply of candidate outputs. Their epistemic value remains heterogeneous because evidential quality, originality, reproducibility, and relevance depend on additional epistemic processes.

Proposition 9.3 (Production-verification divergence)**.** *When the capacity to generate candidate scholarly artifacts increases more rapidly than the capacity to verify them, the relative scarcity of verification increases within the academic system.*

The proposition identifies a relational shift in the location of constraint within the scholarly system. A larger volume of outputs can increase the burden placed on reviewers, editors, replication systems, benchmark maintainers, curators, and readers. Automated verification can absorb part of this burden, yet automated systems themselves require calibration, oversight, provenance, and institutional rules for escalation. The practical bottleneck therefore depends on the joint capacities of generation and verification.

Declining production scarcity can also alter incentives. When producing another manuscript becomes inexpensive, publication-oriented competition can shift toward securing visibility, credible endorsement, experimental access, or scarce recognition. The next subsections examine these domains in turn.

9.2 Verification Bottleneck

This subsection analyzes verification capacity as a distinct bottleneck in an environment of abundant scholarly generation. Its role is to identify the resources required to determine whether candidate claims, methods, data, and conclusions satisfy relevant epistemic standards. The objective is to distinguish verification from evaluation in general and to show how verification burdens can become more consequential when production accelerates. The discussion focuses on technical, institutional, and temporal components of verification.

Verification includes activities such as checking derivations, reproducing analyses, inspecting code, validating datasets, testing statistical assumptions, replicating experiments, confirming citations, evaluating provenance, and comparing claims with relevant prior work. Some of these functions can be partly automated. Others depend on access to instruments, domain expertise, tacit methodological knowledge, or long-duration observation. Verification therefore combines computational, material, and institutional resources.

DRAFT

Definition 9.4 (Verification capacity)**.** Verification capacity is the effective ability of a scholarly system to test the validity, reproducibility, provenance, and evidential support of candidate knowledge claims within a given period and resource environment.

Verification capacity is relationally produced. A laboratory with automated checking tools but limited access to raw data can face a different bottleneck from a field with abundant data and limited replication infrastructure. A journal can possess many reviewers while lacking mechanisms for code execution. A machine-evaluation pipeline can process thousands of submissions while having limited access to proprietary datasets or physical experiments. These configurations create distinct verification profiles.

Definition 9.5 (Verification gap)**.** A verification gap is the difference between the volume and complexity of candidate scholarly outputs entering circulation and the effective capacity available to validate them at the level required by the relevant epistemic practice.

A widening verification gap changes the political economy of academic work. Verification services, trusted replication facilities, provenance infrastructures, benchmark custodians, and institutions capable of certifying empirical access can gain greater strategic importance. Their judgments can influence which outputs receive attention and which claims become reusable inputs in recursive knowledge production.

Verification capacity also has distributive implications. Researchers with access to specialized equipment, curated datasets, trusted repositories, or high-quality computational infrastructure can verify and contest claims more effectively than researchers whose access is restricted. Scarcity migration therefore connects technical capacity with generative access. The ability to produce a claim and the ability to establish its credibility can become increasingly separated across institutions and agents.

9.3 Attention Bottleneck

This subsection examines scholarly attention as a selection resource under conditions of abundant production. Its role is to analyze the capacity of researchers, institutions, and artificial systems to identify which objects merit reading, testing, discussion, preservation, or further development. The objective is to distinguish attention from recognition and to show how attention scarcity can become a primary coordination problem when the supply of scholarly artifacts expands. The discussion treats human and machine attention as related but institutionally different resources.

Scholarly attention is finite because reading, interpretation, comparison, replication, and discussion require time and cognitive or computational resources. AI systems can expand search and summarization capacity, yet their use also introduces ranking, retrieval, filtering, and prioritization layers. An abundant literature therefore increases the importance of mechanisms that decide which objects enter an agent's effective field of consideration.

Definition 9.6 (Scholarly attention capacity)**.** Scholarly attention capacity is the effective ability of a scholarly system to notice, inspect, compare, and sustain engagement with candidate epistemic objects across human and artificial participants.

Attention has at least three analytically distinct forms. Discovery attention determines which objects are surfaced. Interpretive attention supports sustained engagement with content. Collective attention determines which questions or findings become focal points for a community. These forms can be distributed differently across researchers, journals, search systems, recommendation models, conferences, and public institutions.

Proposition 9.7 (Attention bottleneck under production abundance)**.** *When artifact production grows faster than the capacities for discovery, interpretation, and collective focus, access to attention becomes a stronger determinant of epistemic circulation.*

The proposition explains why abundant generation can increase the strategic value of indexing, recommendation, curation, reputation, and institutional visibility. These mechanisms reduce search costs,

DRAFT

yet they also shape the distribution of epistemic opportunities. A paper that is technically available but persistently absent from retrieval systems can have limited practical circulation. Attention therefore functions as an access layer between publication and effective participation in knowledge production.

Machine-mediated attention can alter this structure further. A research agent may read thousands of documents, but retrieval policies, embedding spaces, ranking objectives, context limits, and source permissions determine which documents become actionable inputs. Control over these mechanisms can influence research trajectories at scale. Scholarly attention is therefore increasingly connected to the design and governance of epistemic infrastructure.

9.4 Trust Bottleneck

This subsection analyzes institutional trust as a coordination resource that can become more valuable when scholarly production and evaluation are extensively automated. Its role is to identify how researchers rely on institutions, procedures, provenance systems, and recognizable forms of accountability when direct inspection of every scholarly object becomes impractical. The objective is to distinguish trust from proof and to clarify how trust supports circulation under conditions of verification and attention scarcity. The discussion treats trust as a relational achievement that can be strengthened or weakened through institutional design.

Academic systems regularly operate through delegated confidence. Researchers rely on journals to apply review procedures, repositories to preserve records, laboratories to maintain instrumentation, data custodians to document provenance, and professional communities to enforce norms of correction and disclosure. These relations reduce the need for each participant to reproduce every validation step independently. AI-mediated production can increase the number and complexity of objects requiring such delegated confidence.

Definition 9.8 (Institutional epistemic trust)**.** Institutional epistemic trust is a relational condition in which agents assign provisional credibility to knowledge objects, procedures, or signals because they regard the responsible institutional processes as sufficiently reliable, inspectable, and corrigible for the relevant purpose.

Trust differs across domains and tasks. A repository can be trusted for preservation while its contents remain substantively contested. A journal can be trusted to apply a disclosed review process while individual articles retain uncertainty. An automated evaluator can be trusted for plagiarism screening while broader judgments require additional review. Institutional trust therefore has scope conditions.

Definition 9.9 (Trust-bearing infrastructure)**.** Trust-bearing infrastructure is an institutional or technical arrangement whose procedures, records, governance, or accountability mechanisms support the credible circulation of epistemic objects among agents who cannot independently verify every relevant claim.

Examples include provenance records, version histories, audit trails, reproducibility systems, conflict-of-interest procedures, correction mechanisms, and transparent review protocols. Their value increases when direct verification becomes expensive relative to production. AI systems can contribute to trust-bearing infrastructure through automated checks and provenance tracking, while governance remains important because automated outputs can themselves require validation.

Institutional trust is also vulnerable to recursive degradation. If low-quality or strategically generated artifacts enter databases, training corpora, review systems, and recommendation pipelines without effective correction, subsequent agents can inherit distorted signals. Trust therefore depends partly on the system's capacity to identify and revise its own errors. Scarcity migration toward trust is consequently linked to the maintenance of correction, provenance, and accountability mechanisms.

9.5 Recognition Bottleneck

This subsection examines recognition capacity as the institutional ability to confer differentiated standing on scholarly contributions. Its role is to connect the earlier analysis of epistemic credit and institutional

DRAFT

recognition in Section 3 with an environment of rapidly expanding production. The objective is to distinguish recognition scarcity from attention scarcity and to analyze how institutions allocate durable signals of credibility, contribution, and priority. The discussion treats recognition as a structured allocation process with consequences for future generative access.

Attention can be broad and temporary. Recognition is more durable and institutionally consequential. Acceptance at a selective venue, a prize, a grant, a citation record, a formal authorship claim, or a trusted institutional endorsement can influence future access to jobs, resources, collaborators, laboratories, and audiences. When candidate outputs proliferate, the number of contributions seeking such signals can grow faster than the institutional capacity to assess and confer them.

Definition 9.10 (Recognition capacity)**.** Recognition capacity is the effective ability of a scholarly system to evaluate, differentiate, and institutionally register epistemic contributions in ways that carry durable consequences for status, credibility, priority, or future generative access.

Recognition capacity depends on evaluative labour, institutional legitimacy, decision procedures, record systems, and the availability of categories through which contributions can be represented. AI can increase the throughput of some recognition processes, yet the authority attached to the resulting signals depends on governance and collective acceptance. A fully automated ranking can process many objects while its institutional legitimacy remains contested or domain-specific.

Proposition 9.11 (Recognition scarcity under output expansion)**.** *When the supply of candidate scholarly contributions expands faster than the institutional capacity to confer differentiated and trusted recognition, recognition becomes a stronger bottleneck in academic competition and resource allocation.*

Recognition scarcity can intensify the value of established venues, reputational networks, recommendation systems, and credentialing institutions. It can also encourage the creation of new recognition layers, including machine-readable reputation signals, automated quality labels, open verification records, or domain-specific certification schemes. Each new layer creates its own governance questions because recognition affects subsequent resource access and participation.

The distinction between attention and recognition is therefore essential. Attention determines which objects enter consideration. Recognition determines which objects or contributors acquire durable standing within institutional systems. In an AI-mediated academic economy, both can become scarce even when manuscript production becomes abundant.

DRAFT

9.6 Experimental Bottleneck

This subsection examines material and infrastructural resources as residual constraints on increasingly automated knowledge production. Its role is to anchor scarcity migration in the physical and institutional conditions required for empirical research. The objective is to distinguish the low marginal cost of generating hypotheses or manuscripts from the potentially high cost of acquiring new evidence. The discussion covers laboratories, instruments, field access, participants, compute, data rights, energy, and other resources whose availability shapes the feasible space of research.

AI systems can generate large numbers of hypotheses, analyses, simulation plans, and candidate explanations. Many claims still require interaction with empirical systems. Clinical research depends on participants, ethics approvals, and medical infrastructure. Experimental physics depends on instruments and facilities. Ecology depends on field access and temporal observation. Social research can depend on surveys, archives, permissions, or administrative data. Computational research can depend on high-performance computing, proprietary datasets, and energy-intensive training or simulation.

Definition 9.12 (Experimental resource capacity)**.** Experimental resource capacity is the effective availability of material, computational, legal, temporal, and organizational resources required to obtain or validate empirical evidence for scholarly claims.

Experimental resource scarcity can therefore persist alongside abundant symbolic production. AI can improve experiment design, scheduling, simulation, and analysis, yet the realization of many research programmes remains dependent on access to physical systems or controlled data environments. These constraints can create sharp inequalities in generative opportunity.

Definition 9.13 (Evidence-access asymmetry)**.** Evidence-access asymmetry is a difference among agents or institutions in their effective ability to acquire, produce, or validate empirical evidence because access to relevant experimental resources is unevenly distributed.

Evidence-access asymmetry can become especially consequential when idea generation is cheap. If many agents can formulate plausible hypotheses, competitive advantage can migrate toward those who can obtain decisive evidence. Control over laboratories, proprietary datasets, observational platforms, participant pools, compute clusters, or large-scale simulation environments can therefore become a central form of epistemic power.

Scarcity migration also creates feedback across domains. Limited experimental resources can increase the value of institutional recognition because recognized projects may receive priority access. Recognition can attract attention, and attention can influence funding. Trust can determine which verification claims are accepted when direct replication is unavailable. These relations show that scarcity domains form a coupled system.

Proposition 9.14 (Coupled scarcity migration)**.** *Scarcity migration in academic systems is recursively coupled when constraints in verification, attention, trust, recognition, and experimental access influence one another and jointly shape future generative opportunities.*

The proposition closes the section by locating academic scarcity within a relational structure. AI-mediated production can reduce the scarcity of some scholarly functions while increasing the relative value of capacities that validate, select, authorize, and materially ground knowledge. The political-economic significance therefore lies in the redistribution of bottlenecks and the control exercised over them. The next section examines this redistribution through the concept of epistemic capital under automated production.

10 Epistemic Capital

This section examines how academic automation can alter the composition of epistemic capital. Its role is to connect the scarcity migration developed in Section 9 with the distribution of durable advantages in knowledge generation, verification, circulation, and recognition. The objective is to distinguish six domains in which epistemic advantage can be accumulated or institutionally concentrated: knowledge possession, model access, data access, computational resources, verification infrastructure, and visibility and recommendation systems. The discussion uses a relational political-economic method. Each domain is analyzed according to its capacity to condition later scholarly activity, its dependence on complementary resources, and its potential to reproduce future advantages.

The term *epistemic capital* is used here with a restricted analytical scope. Knowledge and monetary capital remain distinct categories, while epistemic resources vary in alienability, transferability, and ownership status. The concept identifies resources and positions that can be accumulated, preserved, or institutionally stabilized and then converted into enhanced capacity to generate, verify, circulate, or secure recognition for knowledge. Under automated production, the relative importance of these resources can change because the cost of producing candidate scholarly artifacts can decline faster than the cost of securing access to trusted data, capable models, experimental infrastructure, or collective attention.

Definition 10.1 (Epistemic capital)**.** Epistemic capital is an accumulated resource, capability, institutional position, or access relation that can be converted into durable advantages in knowledge generation, verification, circulation, recognition, or the acquisition of further epistemic resources.

DRAFT

Definition 10.2 (Epistemic-capital migration)**.** Epistemic-capital migration is a change in the resources or institutional positions that provide durable epistemic advantage as the relative scarcity of production, verification, attention, recognition, and research infrastructure changes.

Epistemic-capital migration extends the scarcity-migration argument of Section 9. When manuscript production becomes less scarce, exclusive possession of routine information can lose part of its comparative importance while access to models, datasets, compute, verification systems, and visibility mechanisms becomes more consequential. The following subsections examine these domains separately and then relate them to recursive advantage within automated academic systems.

10.1 Knowledge Asset

This subsection establishes knowledge possession as the historical baseline against which later forms of epistemic capital can be compared. Its role is to identify the advantages associated with possessing information, expertise, disciplinary memory, and tacit competence. The objective is to distinguish possession of explicit knowledge from the broader capacities required to mobilize knowledge effectively. The discussion evaluates how AI-mediated retrieval and synthesis can alter the value of exclusive informational possession while preserving the importance of interpretation, provenance, and situated expertise.

Knowledge possession has long generated academic advantage through familiarity with literatures, methods, archives, datasets, technical routines, and disciplinary debates. Scholars and institutions with accumulated knowledge can formulate better-informed questions, recognize relevant precedents, avoid repeated errors, and position new work within existing conversations. Libraries, archives, laboratories, research groups, and professional networks have therefore functioned as repositories of epistemic capacity as well as stores of documents.

AI-mediated retrieval changes this configuration by expanding the speed and breadth with which explicit information can be located, summarized, compared, and recombined. A large body of public literature can become operationally accessible to agents that previously lacked the time or disciplinary breadth required for manual search. This development can reduce the advantage associated with memorizing or locally storing widely available explicit information. The reduction is uneven because access quality depends on retrieval systems, corpus coverage, language support, licensing, and the ability to evaluate retrieved material.

Definition 10.3 (Possessive epistemic advantage)**.** Possessive epistemic advantage is the durable increase in scholarly capacity produced by privileged possession of information, expertise, records, or tacit knowledge that remains costly for other agents to access or reconstruct.

The distinction between explicit and tacit components remains important. Public papers can be indexed at scale while laboratory craft, archive-specific knowledge, methodological judgment, social memory, and domain-specific interpretive skill can remain difficult to encode. AI systems can also make tacit practices partially explicit through documentation, demonstration, or multimodal capture, yet the quality of this conversion depends on the institutions that record and maintain such knowledge.

Proposition 10.4 (Declining exclusivity of routine explicit knowledge)**.** *When high-quality retrieval and synthesis make widely distributed explicit information inexpensive to access, durable epistemic advantage increasingly depends on complementary capacities such as interpretation, verification, privileged data, model capability, and institutional recognition.*

The proposition identifies a change in the composition of advantage. Knowledge possession remains consequential, yet the value of possessing information can become more tightly coupled to the capacity to use, verify, and circulate it. This coupling motivates the analysis of model access and other infrastructural forms of epistemic capital.

DRAFT

10.2 Model Asset

This subsection analyzes model access as a source of differentiated generative capacity in automated scholarship. Its role is to identify how access to artificial systems with different capabilities, tool permissions, context windows, retrieval connections, and modification rights can shape research opportunities. The objective is to distinguish nominal access to an AI service from effective access to a research-capable model configuration. The discussion treats model access as a layered relation involving technical capability, cost, permissions, integration, and continuity.

Model access can influence literature processing, coding, simulation, experimental planning, writing, evaluation, and coordination. The relevant object is therefore broader than a model name or benchmark score. A research-capable configuration can include the base model, retrieval systems, tool access, persistent memory, execution environments, domain adapters, agent orchestration, and institutional permissions. Two researchers nominally using the same model can possess substantially different effective capacities when one has access to larger context, higher usage limits, proprietary tools, private corpora, or modification rights.

Definition 10.5 (Effective model access)**.** Effective model access is the practically usable combination of model capability, invocation capacity, tool integration, data connectivity, modification authority, and operational continuity available to a scholarly agent or institution.

Effective model access can function as epistemic capital when it enables repeated advantages that feed into later research. Better models can reduce search costs, increase coding throughput, broaden hypothesis exploration, support more complex agentic workflows, or improve the quality of automated review. These gains can then produce recognized outputs, funding, data access, or institutional partnerships that further improve model access.

Proposition 10.6 (Model-access amplification)**.** *When superior effective model access increases the rate or quality of research outputs and those outputs improve subsequent access to resources or recognition, model access can participate in a self-reinforcing epistemic-capital circuit.*

The political-economic significance lies in the terms governing access. Usage quotas, pricing, licensing, geographic availability, organizational contracts, safety policies, and rights to fine-tune or self-host can all shape the effective generative space of researchers. Model access therefore links academic automation to broader questions of infrastructural governance. The same model ecosystem can support broad diffusion of capability or produce concentrated advantages depending on how access relations are organized.

10.3 Data Asset

This subsection examines data access as a distinct form of epistemic capital. Its role is to identify the advantages associated with access to empirical records, proprietary datasets, archives, observational streams, experimental measurements, and curated corpora. The objective is to distinguish the existence of data from effective, lawful, and interpretable access to data. The discussion emphasizes provenance, exclusivity, curation, and integration with automated research systems.

Automated analysis can increase the value of large and heterogeneous datasets because machine systems can process volumes of material that exceed ordinary human reading capacity. The resulting advantage depends on the quality and structure of the data. A large corpus with weak provenance, severe selection bias, incomplete metadata, or uncertain permissions can offer less research value than a smaller corpus with strong documentation and stable access conditions.

Definition 10.7 (Effective data access)**.** Effective data access is the authorized and practically usable ability to retrieve, interpret, combine, and analyze data together with the provenance, metadata, technical interfaces, and contextual knowledge required for credible scholarly use.

DRAFT

Data access can be exclusive, shared, public, time-limited, or conditional. Hospitals, observatories, platforms, laboratories, archives, firms, governments, and research consortia can each control datasets whose value derives partly from the difficulty of reproducing them. In automated research systems, exclusive data can also improve model adaptation, benchmark performance, or the discovery of patterns unavailable in public corpora.

Definition 10.8 (Data-mediated epistemic advantage)**.** Data-mediated epistemic advantage is a durable increase in generative or verificatory capacity produced by preferential access to empirical records or curated corpora that materially affect the feasible scope, quality, or credibility of research.

Data access also interacts with verification. A claim derived from inaccessible data can be difficult for other researchers to reproduce or contest. Conversely, shared data infrastructures can distribute both generative and verificatory capacity more broadly. The governance of data therefore influences who can participate in knowledge production and who can independently evaluate its outputs.

Proposition 10.9 (Data-access coupling)**.** *As automated analysis expands the capacity to process data, the relative epistemic value of well-governed, high-quality, and difficult-to-reproduce datasets can increase within fields where empirical access constrains research.*

This proposition connects data access to scarcity migration. Automation can make analytical labour less scarce while leaving empirical access comparatively concentrated. The resulting advantage can become one of the principal channels through which epistemic capital persists under abundant computational reasoning.

10.4 Compute Asset

This subsection analyzes computational resources as enabling conditions for automated knowledge production. Its role is to identify how inference capacity, training resources, storage, bandwidth, execution environments, and agent concurrency shape the scale and tempo of AI-mediated scholarship. The objective is to distinguish access to an algorithmic method from access to the computational resources required to deploy that method effectively. The discussion treats compute as a generative condition whose significance varies across research domains and workflows.

Computational resources can determine how many hypotheses an agent can explore, how many simulations can be run, how large a corpus can be processed, how many parallel reviewers can be invoked, and how frequently models can be updated or queried. In some workflows, marginal compute has modest value after a threshold. In others, additional compute expands the feasible research space through larger searches, repeated stochastic trials, richer simulations, or multi-agent coordination.

Definition 10.10 (Computational epistemic capacity)**.** Computational epistemic capacity is the effective quantity and quality of compute, storage, bandwidth, and execution infrastructure available for generating, testing, transforming, or evaluating scholarly objects.

Compute becomes a form of epistemic capital when it can be converted into persistent advantages and when those advantages improve access to future resources. A laboratory with substantial computational infrastructure can operate larger agent swarms, maintain private models, perform extensive validation, or offer services to collaborators. These capabilities can attract data partnerships, funding, talent, and institutional recognition, which can in turn expand computational capacity.

Proposition 10.11 (Computational recursive advantage)**.** *When computational epistemic capacity can be converted into research outputs or services that improve future access to funding, data, models, or collaboration, compute can participate in recursive accumulation of epistemic advantage.*

The distributional effect depends on architecture and governance. Shared public compute, university consortia, national infrastructure, commercial APIs, local hardware, and proprietary clusters create different access relations. Automated scholarship therefore makes the political economy of compute relevant to research autonomy, field entry, and the diversity of questions that can be pursued at scale.

DRAFT

10.5 Verification Asset

This subsection examines verification infrastructure as a source of epistemic capital under conditions of abundant generation. Its role is to connect the verification scarcity identified in Subsection 9.2 with institutions capable of establishing credibility at scale. The objective is to distinguish isolated checking tools from durable infrastructures that combine technical validation, empirical access, provenance, replication, and recognized certification. The discussion treats verification as both an epistemic function and an institutional resource.

Verification infrastructure can include reproducible execution environments, code and data repositories, replication laboratories, benchmark suites, provenance systems, statistical audit tools, experiment-tracking systems, trusted identity layers, and organizations capable of certifying empirical procedures. These resources can become increasingly valuable when candidate outputs are cheap to generate. A system that can credibly determine which claims survive scrutiny can influence which artifacts enter later research cycles as trusted inputs.

Definition 10.12 (Verification infrastructure)**.** Verification infrastructure is a durable technical and institutional arrangement that supports reproducibility, provenance assessment, empirical checking, methodological audit, replication, or recognized certification of scholarly claims.

Verification infrastructure can generate epistemic capital in at least three ways. First, it improves the reliability of an institution's own outputs. Second, it can provide verification services to other actors. Third, recognized verification authority can influence circulation and attention by attaching trusted signals to selected claims. These functions can reinforce one another when successful verification attracts more submissions, data, funding, or institutional reliance.

Proposition 10.13 (Verification-authority accumulation)**.** *When trusted verification infrastructure repeatedly produces credible assessments that shape circulation and resource allocation, the institution controlling that infrastructure can accumulate durable epistemic influence.*

This influence can support collective knowledge when verification infrastructure is broadly accessible and accountable. It can also create bottlenecks when access is narrow, standards are opaque, or certification authority becomes highly concentrated. The issue is therefore relational: the epistemic value of verification and the political-economic distribution of verification authority must be analyzed together.

10.6 Visibility Asset

This subsection analyzes visibility and recommendation systems as allocation mechanisms for scarce attention. Its role is to connect the attention and recognition bottlenecks identified in Section 9 with infrastructures that determine which scholarly objects enter the effective consideration sets of human and artificial agents. The objective is to distinguish publication from visibility and to identify how ranking, recommendation, retrieval, citation, and reputation signals can acquire capital-like effects. The discussion treats visibility as a relational outcome produced by socio-technical selection systems.

In an environment of abundant scholarly production, publication alone provides limited assurance that an artifact will be read, retrieved, evaluated, or reused. Search engines, recommendation systems, citation graphs, conference reputations, social networks, model retrieval pipelines, curated lists, and institutional platforms increasingly mediate exposure. Their ranking decisions shape the probability that an object receives attention and therefore the probability that it generates citations, replications, collaborations, or follow-on research.

Definition 10.14 (Visibility infrastructure)**.** Visibility infrastructure is the technical and institutional arrangement through which scholarly objects are ranked, retrieved, recommended, highlighted, or otherwise made more likely to enter the attention of relevant human or artificial agents.

DRAFT

Definition 10.15 (Visibility-mediated epistemic capital)**.** Visibility-mediated epistemic capital is a durable advantage produced when prior recognition, ranking position, network centrality, or platform placement increases the probability of future attention and thereby improves access to subsequent epistemic opportunities.

Visibility systems can generate cumulative advantage because attention can produce further signals that feed back into ranking. A paper that is initially recommended can receive more citations; citation growth can raise its retrieval priority; higher retrieval priority can increase the likelihood that later AI systems summarize, cite, or use it as an input. Similar feedback can occur at the level of authors, institutions, journals, repositories, datasets, and models.

Proposition 10.16 (Recommendation-mediated cumulative visibility)**.** *When recommendation systems incorporate prior attention or recognition signals into future ranking, visibility can become recursively self-reinforcing and thereby function as a form of epistemic capital.*

The resulting political economy concerns both access and governance. Researchers require access to visibility infrastructures, while the institutions controlling ranking criteria influence the distribution of attention. Transparency, plurality of recommendation channels, contestability, and the preservation of low-visibility research therefore affect the diversity of future knowledge generation.

Taken together, the six domains analyzed in this section show that academic automation can reorganize the composition of epistemic capital. Widely accessible explicit knowledge can reduce the value of simple informational possession while increasing the strategic importance of model capability, empirical access, compute, trusted verification, and visibility. These resources are mutually dependent: models require data and compute; verification requires access to claims and evidence; visibility systems rely on evaluative signals; recognition can improve future access to all of them. Epistemic capital under automated production is therefore best understood as a relational configuration of accumulated capacities and access positions. The next section turns to the automated coordination of those resources and the exchange mechanisms through which artificial agents can acquire, allocate, and combine them.

11 Resource Coordination

This section examines the coordination layer through which AI-mediated academic systems acquire, schedule, exchange, and allocate the resources required for scholarly production. Its role is to connect the epistemic-capital analysis of Section 10 with the later discussion of delegation and generative sovereignty. The objective is to distinguish six coordination functions: computational allocation, data acquisition, experimental scheduling, publication coordination, machine-mediated exchange, and resource tokens and credits. The discussion follows a functional-relational method. Each subsection identifies the resource problem being coordinated, the form of agency delegated to artificial systems, and the distributional or governance consequence that can arise when coordination becomes increasingly autonomous.

Academic automation depends on more than the generation of text, hypotheses, or evaluations. Research systems also require access to compute, datasets, laboratories, instruments, publication channels, and time-sensitive opportunities. These resources are heterogeneous and often subject to capacity constraints, permissions, pricing, priority rules, or institutional eligibility. As AI systems gain the ability to negotiate such constraints on behalf of researchers or other artificial agents, coordination itself becomes an increasingly important site of political-economic organization.

Definition 11.1 (Automated academic resource coordination)**.** Automated academic resource coordination is the delegation of resource discovery, acquisition, allocation, scheduling, exchange, or settlement functions to artificial systems acting within the rules and infrastructures of scholarly production.

The definition is intentionally broader than automated purchasing. Coordination can occur through queues, permissions, quotas, reservations, grants, institutional credits, reciprocal access agreements, or internal scheduling systems. The common feature is that artificial agents increasingly mediate the relation between a research objective and the resources required to realize it.

DRAFT

11.1 Compute Allocation

This subsection analyzes computational allocation as the coordination of scarce or differentiated compute across research tasks. Its role is to connect the computational epistemic capacity defined in Section 10.4 with the operational mechanisms that determine when and how such capacity becomes available. The objective is to distinguish possession of computational infrastructure from the allocation processes that convert infrastructure into usable research time. The discussion focuses on scheduling, prioritization, cost, and adaptive resource assignment.

Contemporary computational research commonly involves heterogeneous resources such as CPUs, GPUs, accelerators, memory, storage, network bandwidth, and specialized environments. Research tasks also differ in latency sensitivity, expected duration, uncertainty, and marginal value. An artificial coordinator can estimate these requirements, decompose projects into jobs, select appropriate hardware, schedule execution, and revise allocations as intermediate results arrive.

Definition 11.2 (Automated computational allocation)**.** Automated computational allocation is the machine-mediated assignment of computational resources to research tasks according to capacity constraints, priority rules, expected research value, cost, timing requirements, or other institutionally specified criteria.

Automation can reduce the coordinative labour involved in requesting clusters, comparing cloud options, managing queues, and rescheduling failed jobs. It can also increase the responsiveness of research systems because resource assignment can adapt continuously to changing experimental states. The political-economic significance lies in the criteria used by the allocator. A system that prioritizes expected publication impact, institutional status, projected commercial value, or previously accumulated credits can reproduce different patterns of access even when the scheduling process itself is technically efficient.

Proposition 11.3 (Allocation-rule dependence)**.** *The distributional effects of automated computational allocation depend on the rules by which requests are prioritized, priced, deferred, or denied, in addition to the total quantity of available compute.*

The proposition links coordination to governance. Increasing computational capacity can expand the feasible research space, while allocation rules continue to shape whose projects receive timely access and which trajectories remain practically realizable. Automated allocation therefore belongs to the generative conditions of scholarly production and carries consequences beyond a purely technical background.

11.2 Data Allocation

This subsection examines data acquisition as the coordinated search for, negotiation over, and lawful retrieval of information required for research. Its role is to extend the data-access analysis of Section 10.3 from possession and permission toward operational acquisition. The objective is to identify how artificial agents can assemble data resources across repositories, licences, institutional agreements, APIs, archives, and controlled-access environments. The discussion emphasizes provenance, authorization, compatibility, and acquisition cost.

A research project can require data distributed across many custodians and governed by different access regimes. Some datasets are open, some require registration, some depend on institutional subscriptions, and others require ethical approval, contractual agreement, or domain-specific authorization. Artificial agents can increasingly perform discovery, metadata comparison, format conversion, documentation checks, and submission of standardized access requests within authorized workflows.

Definition 11.4 (Automated data acquisition)**.** Automated data acquisition is the machine-mediated process of identifying, requesting, retrieving, validating, and preparing data resources for scholarly use under applicable technical, contractual, ethical, and institutional constraints.

DRAFT

The acquisition function can reduce repetitive search and administrative burdens while increasing the practical value of distributed data infrastructures. It can also make access disparities more visible. Agents operating for well-resourced institutions may inherit broader subscription rights, stronger credentials, or access to proprietary collections. The same automated search procedure can therefore produce very different feasible datasets depending on the institutional position from which it operates.

Remark 11.5 (Delegated acquisition and authorization)**.** Operational delegation can automate the execution of authorized acquisition procedures while leaving the underlying entitlement to access data determined by institutional, legal, ethical, or contractual rules.

This distinction becomes important when AI agents interact directly with repositories or other agents. The speed of acquisition can increase substantially, yet legitimacy continues to depend on provenance, consent, licensing, and accountability. Automated data acquisition therefore combines a potential reduction in academic administrative labour with continued dependence on the governance of access rights.

11.3 Experiment Allocation

This subsection analyzes experimental scheduling as the coordination of laboratories, instruments, field windows, participants, and other time-sensitive research resources. Its role is to connect the residual scarcity of experimental resources identified in Section 9.6 with concrete allocation procedures. The objective is to show how AI systems can coordinate resource use across multiple projects while preserving the analytical importance of priority rules and institutional authority. The discussion treats scheduling as a temporal form of access governance.

Many empirical resources cannot be duplicated on demand. A telescope can observe a limited number of targets during a given interval, a laboratory instrument can serve a finite queue, a clinical facility has constrained participant and staff capacity, and field research can depend on seasonal or regulatory windows. Scheduling determines how such resources are translated into actual experimental opportunity.

Definition 11.6 (Automated experimental scheduling)**.** Automated experimental scheduling is the machine-mediated coordination of time-sensitive empirical resources across research tasks, agents, or institutions under capacity, priority, safety, and procedural constraints.

An artificial scheduler can integrate expected experiment duration, equipment compatibility, maintenance periods, participant availability, travel windows, safety constraints, and the informational value of previous results. It can also reschedule dynamically when experiments fail or produce unexpected findings. These capabilities can reduce coordination costs and improve utilization of scarce infrastructure.

The allocation logic remains normatively consequential. Priority can be assigned by scientific urgency, prior reservation, grant status, institutional membership, expected information gain, public-interest criteria, or accumulated resource credits. Automated scheduling can implement any of these rules with high consistency. The political-economic question concerns the structure of entitlement and priority embedded in the scheduler.

Proposition 11.7 (Temporal access mediation)**.** *When scarce experimental resources are allocated through automated scheduling, control over scheduling rules becomes a form of control over the temporal distribution of empirical opportunity.*

Temporal access can shape which hypotheses are tested first, which projects retain momentum, and which agents can convert ideas into evidence. Scheduling therefore operates as part of the generative conditions of knowledge production.

11.4 Publication Allocation

This subsection examines publication coordination as the automation of submission preparation, venue matching, version management, compliance checking, dissemination, and post-publication routing. Its

DRAFT

role is to extend the circulation analysis of Sections 2 and 3 toward coordinated publication workflows. The objective is to distinguish scholarly judgment about where and how work should enter a community from the operational labour required to execute that decision. The discussion focuses on delegation, interoperability, and the institutional consequences of machine-mediated routing.

Publication involves many coordinative tasks that are adjacent to research content: formatting, metadata preparation, policy checks, repository deposits, version tracking, licence selection, disclosure forms, correspondence, and synchronization across preprint, journal, conference, and institutional systems. Artificial agents can increasingly perform these tasks once the relevant rules and permissions are specified.

Definition 11.8 (Automated publication coordination)**.** Automated publication coordination is the machine-mediated execution and synchronization of operational tasks required to submit, register, disseminate, update, and route scholarly outputs across publication and repository infrastructures.

This form of automation can reduce circulatory labour while preserving human or collective authority over substantive publication choices. It can also support machine-to-machine circulation. An AI agent could identify compatible venues, prepare compliant submissions, respond to routine metadata requests, deposit accepted versions, and update linked records without continuous human intervention.

Publication coordination also creates a potential concentration point. Recommendation systems, submission platforms, repository protocols, and automated compliance rules can influence where research is visible and which pathways are frictionless. A coordination layer that becomes widely shared can therefore acquire infrastructural power over scholarly circulation.

Claim 11.9 (Publication-routing influence)**.** A publication-coordination system acquires greater political-economic significance as its routing decisions affect access to scarce recognition, attention, or verification infrastructures.

The claim prepares the analysis of delegation in the next section. Operational convenience can coexist with substantial influence over the pathways through which knowledge receives evaluation and recognition.

11.5 Exchange Mechanism

This subsection analyzes exchange among artificial agents or AI-mediated institutions as a coordination mechanism for academic resources. Its role is to extend the concept of automated resource coordination beyond single-institution scheduling toward distributed environments in which agents negotiate access to heterogeneous resources. The objective is to identify the conditions under which compute, data, experimental capacity, verification services, or publication-related functions can be exchanged without direct human negotiation at each transaction. The discussion treats exchange as a protocol-level relation among authorized agents.

Research infrastructures are frequently distributed across organizations. One institution can possess compute, another a dataset, another an instrument, and another a verification capability. Human researchers currently coordinate many such exchanges through grants, collaborations, service contracts, reciprocal agreements, or informal networks. AI agents can mediate portions of these negotiations when authorization boundaries and settlement rules are sufficiently specified.

Definition 11.10 (Machine-mediated academic exchange)**.** Machine-mediated academic exchange is a resource-coordination relation in which artificial agents negotiate, allocate, or settle access to scholarly resources or services within institutionally authorized protocols.

Such exchange can occur through monetary payment, quotas, reciprocal access, service credits, contribution records, or priority adjustments. A laboratory agent could exchange unused instrument time for computational capacity; a repository agent could grant dataset access under a reciprocal validation agreement; a verification service could allocate capacity in return for institutional credits. These examples describe possible coordination architectures while remaining compatible with legal rights, liabilities, ownership interests, and beneficiary status being attributed to human or institutional principals.

DRAFT

Remark 11.11 (Operational agency and institutional attribution)**.** An artificial agent can perform negotiation and settlement functions while the legal rights, liabilities, ownership interests, and beneficiary status associated with the transaction remain attributable to human or institutional principals.

Machine-mediated exchange can reduce transaction labour and increase the utilization of distributed resources. It can also amplify differences in bargaining position when agents enter the exchange network with unequal endowments, permissions, reputation, or access to trusted infrastructures. The distribution of initial and recursively accumulated claims therefore remains relevant even when the exchange process itself is automated.

11.6 Settlement Mechanism

This subsection examines tokens and credits as accounting devices for coordinating heterogeneous academic resources. Its role is to identify a possible settlement layer for automated exchange and allocation without assuming that every academic resource must be priced through a general monetary system. The objective is to distinguish domain-specific allocation rights from transferable generalized claims. The discussion connects academic resource coordination with the broader political-economic question of how access rights become portable, accumulable, and potentially capital-like.

Academic institutions already use many non-monetary accounting devices: compute quotas, instrument hours, storage limits, participant allocations, internal service credits, priority points, travel budgets, and grant-specific spending categories. AI-mediated systems can make such units more granular and dynamically tradable within authorized domains.

Definition 11.12 (Academic resource token)**.** An academic resource token is a machine-readable claim that authorizes or records access to a specified quantity, duration, priority, or category of scholarly resource under defined institutional rules.

Definition 11.13 (Academic coordination credit)**.** An academic coordination credit is an accumulable accounting unit used to mediate allocation, exchange, reciprocity, or priority across one or more scholarly resource domains.

A token tied to one GPU-hour or one instrument reservation remains highly specific. A credit accepted across compute, data services, verification, publication support, and laboratory access has broader coordinating scope. Transferability and accumulation can further increase its economic significance.

Proposition 11.14 (Generalization of academic resource claims)**.** *As academic resource claims become more transferable, accumulable, interoperable, and accepted across heterogeneous resource domains, their function moves toward a generalized coordination medium within the scholarly system.*

The proposition identifies a continuum between resource tokens and money. Domain-specific tokens can remain administrative allocation devices, while broader credits can acquire money-like functions through portability and generalized acceptance. Their governance therefore matters for the distribution of future generative opportunities.

Automated resource coordination completes the operational layer developed across this section. Compute, data, experiments, publication processes, and distributed exchange can all be delegated to artificial systems while the deeper questions of entitlement, priority, accumulation, and rule formation remain institutionally consequential. The next section examines this boundary directly through delegation and generative sovereignty.

12 Generative Sovereignty

This section examines the boundary between productive delegation and the authority to shape scholarly generation. Its role is to connect the operational automation developed in Section 11 with the account

DRAFT

of self-directed scholarly generativity developed in Section 6. The objective is to distinguish delegation of routine coordination, evaluation, resource allocation, and research-agenda formation according to the degree to which each function shapes future generative possibilities. The discussion proceeds by functional decomposition. Each subsection identifies the delegated function, the authority embedded in that function, and the institutional conditions under which delegation can expand scholarly capacity while preserving meaningful participation in the formation of research purposes and rules.

Automation changes more than the quantity of labour attached to academic production. It can also relocate decision authority. A system that schedules compute executes a narrower function than a system that assigns verification priority; a system that summarizes reviews exercises a narrower role than a system that determines which questions merit future resources. The political-economic significance of delegation therefore depends on the depth at which the delegated function enters the formation of epistemic trajectories.

Definition 12.1 (Functional delegation)**.** Functional delegation is the transfer of execution responsibility for a bounded scholarly function to another agent or system under an authorization structure that specifies relevant goals, constraints, permissions, and conditions of revision.

Definition 12.2 (Generative sovereignty)**.** Generative sovereignty is the effective capacity of a scholarly agent or community to participate meaningfully in forming research purposes, revising evaluative standards, contesting resource allocations, redirecting research trajectories, and governing the conditions that shape future knowledge generation.

Generative sovereignty concerns effective participation and extends beyond isolated formal permission. A researcher can retain nominal authorship while lacking practical influence over the models, allocation rules, evaluation criteria, or agenda-selection systems that determine which projects remain feasible. Conversely, substantial operational automation can coexist with strong generative sovereignty when scholars retain credible capacities for initiation, interpretation, contestation, revision, and institutional rule change.

Proposition 12.3 (Delegation-depth gradient)**.** *The significance of delegation for generative sovereignty tends to increase as delegated functions move from routine execution toward evaluation, allocation, agenda formation, and governance of the rules that organize those functions.*

The proposition supplies the organizing principle for this section. Routine coordination can release time with limited influence over substantive direction. Evaluation and allocation shape recognition and opportunity. Agenda formation influences which possible questions enter sustained inquiry. Governance determines how all of these functions can be revised. The following subsections examine these layers in sequence.

12.1 Operational Delegation

This subsection analyzes the delegation of routine coordination as the lowest-depth case in the delegation gradient. Its role is to identify functions whose automation primarily changes the operational burden of scholarship while leaving research purposes and substantive judgments comparatively stable. The objective is to specify the conditions under which coordination delegation contributes to functional dereification and temporal recapture. The discussion connects the resource-coordination architecture of Section 11 with the account of released scholarly time in Section 5.

Routine coordination includes scheduling, metadata preparation, compliance checks, file routing, resource reservation, version synchronization, reminder management, routine correspondence, and other operational activities required to maintain a research process. These activities can be indispensable to institutional reproduction while remaining weakly connected to the intellectual reasons for pursuing a particular question. Their delegation can therefore reduce compulsory functionalization without requiring a transfer of research purpose.

DRAFT

Definition 12.4 (Routine coordination delegation)**.** Routine coordination delegation is the transfer of operational academic tasks whose outputs implement previously specified purposes, permissions, or schedules and whose execution has limited authority to redefine those purposes.

The quality of this delegation depends on the clarity of its authorization boundary. A scheduling agent may choose among available time slots, while the researcher retains authority to decide whether the experiment should occur. A publication agent may prepare metadata and route files, while the author retains authority over the substantive version and intended venue. A compute allocator may execute an approved resource plan, while the governing institution retains the criteria by which the plan was authorized.

Proposition 12.5 (Coordination-release effect)**.** *When routine coordination can be delegated with bounded discretion and reliable reversibility, automation can increase the time available for self-directed scholarly generativity while imposing limited change on substantive research direction.*

The proposition identifies the strongest case for liberation through delegation developed in this paper. The reduction of compulsory coordination labour can release time for exploratory inquiry, interpretation, conceptual development, and long-horizon research. This contribution remains conditional on the delegated infrastructure providing usable records, correction channels, and practical opportunities for intervention when operational decisions begin to affect substantive trajectories.

12.2 Evaluative Delegation

This subsection examines evaluative delegation as a deeper intervention into academic circulation. Its role is to identify how automated review, scoring, verification, ranking, and certification can influence recognition and the reuse of knowledge. The objective is to separate assistance in evaluative processing from authority over evaluative standards and final institutional consequences. The discussion builds on Sections 3, 4, and 9, which established the roles of peer review, evaluative compression, and verification scarcity.

Evaluation coordinates scarce attention and institutional trust. An artificial system that checks citations, executes code, detects inconsistencies, summarizes reviewer disagreement, or compares a manuscript with a benchmark can enlarge verification capacity. A system that assigns final scores, acceptance priorities, or trust labels exercises a more consequential form of authority because its outputs shape circulation, recognition, and future generative access.

Definition 12.6 (Evaluative delegation)**.** Evaluative delegation is the transfer of one or more scholarly assessment functions to an artificial or institutional system whose outputs influence verification, ranking, certification, recognition, or subsequent resource access.

Evaluative delegation therefore has at least two dimensions. The first concerns execution: who performs checking, comparison, synthesis, or scoring. The second concerns standard formation: who defines the criteria, thresholds, weighting rules, escalation procedures, and acceptable evidence. These dimensions can be institutionally separated.

Definition 12.7 (Evaluative delegation boundary)**.** The evaluative delegation boundary is the division between assessment functions delegated for execution and evaluative authorities retained for the formation, interpretation, revision, and contestation of standards.

A robust boundary can combine machine-scale verification with plural scholarly judgment. Automated systems can triage routine checks, surface anomalies, or synthesize large review corpora, while communities preserve channels for contextual interpretation, methodological dissent, and revision of criteria. This arrangement treats evaluation as a generative condition because standards influence which forms of work receive recognition and become inputs to later inquiry.

DRAFT

Proposition 12.8 (Evaluative authority effect)**.** *Delegated evaluation becomes increasingly consequential for generative sovereignty as its outputs acquire stronger influence over recognition, credibility, visibility, and access to subsequent research opportunities.*

The proposition links evaluation to the scarcity migration identified in Section 9. When production becomes abundant, control over verification and trusted recognition can become a primary bottleneck. Delegating evaluative labour can therefore support scholarly liberation while delegation of unreviewable evaluative authority can concentrate influence over the field's future generative possibilities.

12.3 Allocative Delegation

This subsection analyzes the delegation of resource allocation as authority over material and institutional conditions of knowledge production. Its role is to connect automated coordination with the distribution of compute, data, laboratory time, verification capacity, publication support, and other scarce inputs. The objective is to clarify why efficient allocation and generative sovereignty remain distinct analytical dimensions. The discussion uses the scarcity and epistemic-capital framework developed in Sections 9 and 10.

Resource allocation shapes which research trajectories can be materially realized. An automated system may assign compute by expected information gain, distribute laboratory access according to urgency, route verification resources toward uncertain claims, or exchange credits across institutions. These operations can increase utilization and reduce transaction labour. They also encode priorities that affect the feasible research space of scholars and institutions.

Definition 12.9 (Allocative delegation)**.** Allocative delegation is the transfer of decision authority over the distribution, timing, priority, or exchange of scholarly resources within a specified institutional domain.

Allocative delegation can be narrow or extensive. A narrow system implements a budget, quota, or reservation policy established elsewhere. An extensive system interprets competing goals, updates priorities, accumulates performance signals, and changes access dynamically. The second configuration participates more directly in shaping generative conditions.

Definition 12.10 (Generative allocation authority)**.** Generative allocation authority is the capacity to alter an agent's effective research possibilities through decisions governing access to scarce scholarly resources or infrastructures.

This authority can exist even when the allocated resource remains formally owned by an institution. Access to compute, instruments, datasets, trusted repositories, or experimental populations can determine whether a project reaches verification and circulation. Resource allocation therefore belongs to the political economy of generative capacity alongside its administrative functions.

Proposition 12.11 (Allocation-sovereignty coupling)**.** *The effect of allocative delegation on generative sovereignty increases with the extent to which allocation decisions determine feasible research trajectories and with the difficulty of contesting, revising, or bypassing those decisions.*

This proposition highlights contestability and plurality as institutional design variables. Automated allocation can support liberation when it reduces coordination labour and broadens reliable access. Generative sovereignty is strengthened when researchers can understand the relevant allocation logic, challenge consequential decisions, seek alternative infrastructures, and participate in revising the rules governing scarce resources.

12.4 Agenda Delegation

This subsection examines research-agenda formation as a high-depth form of delegation. Its role is to identify how artificial systems can influence which problems receive sustained attention, which hypotheses become institutionally legible, and which research trajectories attract resources. The objective is to

DRAFT

distinguish automated problem generation from authority over collective research priorities. The discussion connects the AI–AI knowledge-production circuit in Section 7 with the analysis of scholarly attention and visibility in Sections 9 and 10.

Artificial systems can propose questions, identify gaps, rank anomalies, forecast tractability, estimate expected information gain, and generate portfolios of candidate projects. These capabilities can expand the set of research possibilities visible to scholars. Agenda formation becomes institutionally consequential when such systems also determine which proposals enter funding, verification, publication, or infrastructural pipelines.

Definition 12.12 (Research-agenda delegation)**.** Research-agenda delegation is the transfer of authority to identify, rank, prioritize, or sustain candidate research directions in ways that influence collective attention, resource commitment, or institutional recognition.

Agenda formation is generative because it shapes the space of questions from which later knowledge emerges. The relevant issue extends beyond the accuracy of a ranking system. A system can favor questions with measurable outcomes, short feedback cycles, established datasets, high citation potential, or compatibility with available tools. These criteria can be useful while also directing attention toward particular epistemic forms.

Definition 12.13 (Agenda-formative power)**.** Agenda-formative power is the capacity to shape which research possibilities receive sustained collective attention, resources, and institutional continuation.

A scholarly community can employ artificial systems as sources of candidate problems while retaining plural pathways for human-originated questions, minority programmes, aesthetic judgments, exploratory work, and long-duration inquiry. Such plurality preserves the possibility that valuable research emerges from criteria unavailable to the current optimization system.

Proposition 12.14 (Agenda-depth principle)**.** *Delegation reaches a deeper level of generative governance when an automated system can shape the set of research questions that receive durable attention and resources, because this influence acts upstream of later production and evaluation.*

The principle clarifies the relation between automation and liberation. A researcher liberated from routine review labour may gain time for personal inquiry, while an agenda-allocation infrastructure can simultaneously narrow the feasible space in which that inquiry can receive material support. The evaluation of post-labour scholarly freedom therefore requires attention to both released time and agenda-formative power.

DRAFT

12.5 Human Agency

This subsection develops a positive account of human generative agency within highly automated academic systems. Its role is to specify the forms of scholarly participation that remain central when substantial operational, evaluative, and coordinative labour can be delegated. The objective is to connect research autonomy, voluntary intellectual labour, judgment, and long-horizon inquiry with the broader concept of generative sovereignty. The discussion synthesizes Sections 6, 7, and the preceding delegation analysis.

Human generative agency includes the capacities to initiate inquiry, articulate purposes, interpret unexpected results, reformulate questions, exercise epistemic and aesthetic judgment, sustain commitments across uncertain periods, contest inherited standards, and create new evaluative vocabularies. These capacities can be exercised with extensive artificial assistance. Their political-economic significance lies in whether scholars retain effective opportunities to direct and reshape the systems that mediate their research.

Definition 12.15 (Human generative agency)**.** Human generative agency is the effective capacity of human participants to initiate, interpret, redirect, contest, and sustain knowledge-generative activity in relation to both research objects and the institutional systems that condition inquiry.

Human generative agency is compatible with substantial machine participation. An artificial agent can search literature, run experiments, manage resources, or propose hypotheses while a human researcher contributes purposes, judgments, interpretation, revision, and commitments. Other configurations can distribute agency across teams of humans and artificial agents. The analytical focus therefore rests on the capacities that participants can exercise within the relation.

Definition 12.16 (Generative participation)**.** Generative participation is meaningful involvement in the formation, interpretation, revision, or governance of processes that influence future knowledge production.

This definition extends participation beyond authorship attribution. A scholar who can modify a model's objectives, challenge an allocation rule, redirect a project after an anomalous result, or revise a community's evaluative criteria participates in the formation of generative conditions. These forms of participation become especially important as routine academic labour becomes increasingly machine-mediated.

Proposition 12.17 (Liberation-agency condition)**.** *Automation has stronger emancipatory significance when the reduction of compulsory functional labour is accompanied by expanded effective opportunities for self-directed generative agency and generative participation.*

The proposition connects the paper's two central strands. Functional de-reification concerns release from roles required for system maintenance. Generative sovereignty concerns the capacity to participate in shaping what the system produces, values, and enables. A post-labour academic order can therefore be evaluated through the joint distribution of temporal freedom and generative agency.

12.6 Delegation Governance

This subsection consolidates the section by examining governance arrangements for increasingly delegated academic systems. Its role is to specify institutional properties that can preserve generative sovereignty across routine coordination, evaluation, allocation, and agenda formation. The objective is to identify governance dimensions that support delegation while retaining meaningful capacities for understanding, contestation, revision, exit, and collective rule formation. The discussion treats governance as an ongoing process of institutional design extending beyond a one-time authorization decision.

Delegated systems can acquire durable influence through cumulative integration. A resource allocator can feed evaluation data into publication routing; a review system can influence reputation; reputation can affect resource credits; resource access can shape which research programmes accumulate further evidence. Governance therefore concerns the relations among delegated subsystems as well as the behavior of each component individually.

Definition 12.18 (Governance of delegated academic systems)**.** Governance of delegated academic systems is the institutional process through which authorization, transparency, contestability, revision, interoperability, accountability, and participation are organized across machine-mediated scholarly functions.

Several governance dimensions are especially relevant to generative sovereignty. Traceability supports reconstruction of consequential decisions. Contestability provides procedures through which affected participants can challenge outputs or rules. Revisability allows criteria and system objectives to change with new evidence or normative commitments. Interoperability and plural infrastructures can preserve alternative routes to resources and recognition. Periodic reauthorization can reconnect operational systems with collective purposes as conditions evolve.

Definition 12.19 (Sovereignty-preserving delegation)**.** Sovereignty-preserving delegation is an institutional arrangement in which automated execution expands productive or coordinative capacity while affected participants retain meaningful capacities to understand consequential rules, contest decisions, revise governing criteria, pursue alternative pathways, and participate in the evolution of the delegated system.

DRAFT

Proposition 12.20 (Governed delegation principle)**.** *The emancipatory potential of academic automation increases when delegated systems reduce compulsory functional labour while governance institutions preserve credible participation in the formation and revision of generative conditions.*

This principle provides the bridge to the broader post-labour analysis developed in the remainder of the paper. Delegation can release scholars from circulation, evaluation, and coordination burdens while preserving a rich field of voluntary generative activity. The political-economic problem shifts toward the governance of the systems that allocate opportunities, stabilize standards, and shape research trajectories. Generative sovereignty therefore supplies a criterion for distinguishing labour-saving automation from a more comprehensive redistribution of scholarly agency.

13 Labour Generalization

This section generalizes the preceding analysis from academic work to labour in broader economic systems. Its role is to identify which features of academic automation are domain-specific and which express a more general political economy of production, circulation, coordination, and functionalization. The objective is to use academic labour as a structurally compact case through which the relations among productive activity, circulatory activity, compulsory function, and generative agency can be examined across other domains. The section proceeds in five stages. It first consolidates the productive and circulatory components of academic work, then develops corresponding categories for general labour, and finally examines how functionalization can arise across heterogeneous economic domains.

Academic work provides an analytically useful case because production and circulation are institutionally visible within the same professional field. Research can generate knowledge, while review, publication, grant administration, scheduling, indexing, reputation formation, and resource coordination support the movement and reproduction of that knowledge. Advanced automation can enter each function with different consequences for labour time, agency, recognition, and access. Similar distinctions can be made in domains such as manufacturing, logistics, care, finance, administration, and professional services, even though the concrete forms of production and circulation differ substantially.

Definition 13.1 (Labour-function decomposition)**.** Labour-function decomposition is the analytical separation of economically organized activity according to the function it performs in generating outputs, circulating outputs and claims, coordinating resources, maintaining institutional continuity, and shaping future generative conditions.

Proposition 13.2 (Cross-domain extension principle)**.** *A labour category developed in the academic case supports broader political-economic analysis when its defining relation can be specified independently of the particular scholarly artifact, institution, or profession through which that relation first becomes visible.*

The proposition sets the methodological constraint for this section. The aim is to generalize relations, with vocabulary serving that relational abstraction. Academic peer review, for example, has domain-specific content, while the conversion of situated judgment into an institutional signal has analogues in certification, quality assurance, credit assessment, hiring, procurement, compliance, and platform ranking. The wider analytical value therefore lies in the function performed within a generative and circulatory system.

13.1 Academic Production

This subsection consolidates academic production as the generative component of the scholarly system. Its role is to specify the activities through which new epistemic objects, interpretations, methods, datasets, experimental results, and conceptual structures enter collective circulation. The objective is to separate productive contribution from the institutional functions that evaluate, route, certify, and allocate access

DRAFT

to those contributions. The discussion synthesizes the account of knowledge generation in Section 2 with the later analysis of self-directed scholarly generativity in Section 6.

Academic production includes activities that alter the available epistemic field. These activities can include formulating a problem, developing a concept, constructing a model, collecting evidence, designing an experiment, interpreting an anomaly, synthesizing literatures, or producing a new methodological instrument. The relevant commonality is generative contribution: the activity creates, transforms, or reorganizes objects that can subsequently enter scholarly interpretation and circulation.

Definition 13.3 (Academic productive labour)**.** Academic productive labour is organized scholarly activity whose primary function is the generation, transformation, or evidential development of epistemic objects that can contribute to subsequent inquiry.

This definition allows both human and artificial participation. A human researcher can formulate a problem and interpret results; an artificial system can generate candidate hypotheses, perform analysis, or produce experimental artifacts. A research team can distribute these functions across multiple participants. Productive labour therefore identifies a functional relation within a knowledge-generating process and leaves the identity of the productive carrier analytically open.

Academic production also has a temporal dimension. Some productive acts generate immediately visible outputs, while others prepare conditions for later discovery. Maintaining a long-duration dataset, constructing an instrument, developing a theoretical vocabulary, or preserving an archive can expand future epistemic capacity even when immediate publication output remains limited. A political economy of academic production therefore benefits from distinguishing visible output production from the reproduction of knowledge-generative capacity.

Definition 13.4 (Epistemic productive contribution)**.** An epistemic productive contribution is an activity that enlarges, reorganizes, validates, or sustains the set of epistemic possibilities available to later inquiry.

Proposition 13.5 (Productive plurality)**.** *Academic production can be distributed across heterogeneous activities and agents while remaining unified by its contribution to the formation or transformation of epistemic possibilities.*

The proposition matters for automation because output counts alone provide a narrow representation of productive participation. Systems that reduce the cost of manuscript generation can increase visible production while leaving conceptual judgment, empirical access, long-horizon interpretation, and infrastructure formation unequally distributed. The analysis of academic production therefore requires attention to the relations through which distinct contributions enter the generative process.

13.2 Academic Circulation

This subsection consolidates academic circulation as the set of activities through which scholarly outputs, evaluations, resources, recognition, and access claims move across an institutional field. Its role is to connect the analysis of peer review and epistemic credit in Section 3 with the automation of publication, resource allocation, and machine-mediated exchange developed in Section 11. The objective is to clarify how circulation can consume substantial labour while its primary system function concerns institutional movement, evaluation, and allocation of epistemic objects.

Academic systems require movement across multiple interfaces. Manuscripts move toward venues; reviews move toward editors and authors; funding claims move toward committees; datasets move across repositories; attention moves through recommendation systems; reputational signals move across hiring and promotion processes; and resource entitlements move across institutional accounts. These movements transform the practical availability and institutional status of scholarly work.

Definition 13.6 (Academic circulatory labour)**.** Academic circulatory labour is organized scholarly activity whose primary function is to move, route, evaluate, certify, allocate, or translate epistemic objects and associated claims across institutional positions.

DRAFT

Circulatory labour can be intellectually demanding. Reviewing a manuscript, editing a volume, evaluating a grant proposal, or assessing a dataset can require substantial expertise. The distinction from academic productive labour concerns system function: circulatory labour contributes to selection, recognition, routing, and institutional reproduction, while productive labour contributes directly to the formation or transformation of epistemic objects. A single activity can combine both functions.

Definition 13.7 (Circulatory coupling)**.** Circulatory coupling is the dependence of productive access, recognition, or continuation on successful passage through institutional processes of evaluation, routing, certification, allocation, or visibility.

Academic careers often exhibit strong circulatory coupling. Access to future research time, equipment, employment, visibility, and collaboration can depend on publication and evaluation outcomes. Circulation therefore shapes future production by altering the resources and recognition available to researchers. The two functions form a recursive relation even when they remain analytically distinguishable.

Automation can reduce the labour cost of circulation by handling routine screening, matching, scheduling, formatting, routing, and settlement. It can also deepen circulatory coupling when automated ranking or allocation systems acquire greater influence over access to future generative conditions. The political-economic evaluation of automation therefore requires both labour accounting and governance analysis.

Proposition 13.8 (Circulation-production recursion)**.** *When circulatory outcomes influence access to future research resources, recognition, or institutional continuation, academic circulation becomes a generative condition for subsequent academic production.*

This recursion explains why reducing circulatory labour can have emancipatory significance while leaving circulation itself institutionally consequential. Automation can transfer execution away from scholars while the rules governing circulation continue to shape who can generate, what can be sustained, and which trajectories receive institutional support.

13.3 Productive Labour Generalization

This subsection extends the productive category beyond academia. Its role is to identify a domain-general form of labour concerned with the creation, transformation, maintenance, or restoration of outputs and capacities that enter social reproduction. The objective is to connect the academic case with broader labour processes while retaining sensitivity to material, informational, care-oriented, organizational, and ecological forms of production. The discussion proceeds through functional abstraction and remains independent of commitment to a single theory of value.

General productive labour can include manufacturing goods, cultivating food, maintaining infrastructure, providing care, developing software, repairing equipment, producing knowledge, restoring ecosystems, or constructing organizational capacities. These activities differ in material form and institutional setting. Their shared analytical feature is participation in the generation or maintenance of outputs and capacities that other activities can subsequently use.

Definition 13.9 (General productive labour)**.** General productive labour is organized activity whose primary function is to create, transform, maintain, restore, or expand outputs and generative capacities that contribute to ongoing social or economic reproduction.

The definition includes maintenance because many systems reproduce themselves through continuous preservation. A bridge, hospital, software system, archive, energy grid, agricultural landscape, or caregiving relation can lose productive capacity when maintenance ceases. Production therefore includes activities that sustain the conditions under which future outputs remain possible.

DRAFT

Artificial systems can increasingly participate in general productive labour. Robotics can perform material tasks; software agents can produce code and analysis; autonomous systems can monitor infrastructure; artificial assistants can perform portions of administrative and care-related work. Productive-carrier substitution can therefore occur across heterogeneous domains. The structural question concerns how access to the resulting generative capacity is organized.

Definition 13.10 (Productive-carrier substitution in general labour)**.** Productive-carrier substitution in general labour is the transfer of productive functions among human, artificial, organizational, or hybrid agents while the surrounding relations of access, ownership, coordination, and governance may retain continuity or undergo transformation.

Proposition 13.11 (Carrier-function distinction)**.** *Changes in the agent performing productive labour and changes in the institutional relations governing productive capacity are analytically separable dimensions of economic transformation.*

This distinction extends the core insight developed in the universal-AI thought experiment of the wider four-paper project. Automation can alter who performs productive functions while leaving claims, dependencies, resource bottlenecks, and control relations structurally significant. Labour reduction therefore supplies one dimension of transformation within a larger generative-relational architecture.

13.4 Circulatory Labour Generalization

This subsection extends the circulatory category beyond academic systems. Its role is to identify labour devoted to moving goods, claims, information, permissions, evaluations, and resource entitlements across an economy. The objective is to show how circulation, coordination, certification, and allocation can form a substantial field of labour whose automation has consequences distinct from the automation of production itself. The discussion abstracts from the academic case while retaining the recursive relation between circulation and future generative access.

General circulatory labour includes logistics, scheduling, brokerage, accounting, payment processing, credential verification, procurement, claims administration, compliance processing, matching, inventory coordination, platform moderation, and portions of managerial coordination. Some of these functions move material goods; others move information, rights, permissions, or institutional signals. Their shared feature is organization of relations among agents, outputs, and resources.

Definition 13.12 (General circulatory labour)**.** General circulatory labour is organized activity whose primary function is to route, match, certify, account for, allocate, schedule, exchange, or settle outputs and claims across economic positions.

Circulatory labour can become highly automated because many of its operations are rule-governed, data-intensive, and repetitive. Machine systems can route orders, match supply and demand, allocate compute, execute payments, verify credentials, schedule transport, assign tasks, and settle claims. AI-agent interaction can further shift circulation toward machine-mediated coordination in which artificial agents negotiate access to resources on behalf of human or organizational principals.

Definition 13.13 (Machine-mediated general circulation)**.** Machine-mediated general circulation is the execution of routing, allocation, exchange, scheduling, certification, or settlement functions through interacting artificial systems operating under institutional permissions and constraints.

The reduction of human circulatory labour can release time from coordination burdens. At the same time, the rules embedded in circulation continue to influence access to productive conditions. A logistics platform can determine delivery priority; a credit system can shape financing access; a procurement system can determine market entry; an automated benefits system can affect household resources; an AI allocation layer can shape compute or energy access. Circulation therefore remains a site of power even when execution becomes highly automated.

DRAFT

Proposition 13.14 (Circulatory-governance persistence)**.** *Automation can reduce the human labour required for circulation while preserving or intensifying the political-economic significance of the rules governing circulation.*

The proposition generalizes the academic case. Replacing reviewers, schedulers, brokers, clerks, or coordinators with automated systems changes labour demand while leaving questions of entitlement, prioritization, contestability, and rule formation active. These questions become central to the political economy of post-labour coordination.

13.5 Cross-Domain Functionalization

This subsection synthesizes the section by examining functionalization across heterogeneous forms of labour. Its role is to connect the academic analysis of reviewer functionalization and functional de-reification with broader labour relations in which persons can become institutionally represented through the functions they are expected to perform. The objective is to develop a cross-domain account of compulsory functionalization and to identify the condition under which automation can support a wider form of generative freedom. The discussion compares productive and circulatory roles while preserving differences among occupations, institutions, and forms of dependence.

Economic systems coordinate activity by assigning functions. A worker can be represented as production capacity, a reviewer as evaluative capacity, a driver as transport capacity, a caregiver as care capacity, a clerk as administrative capacity, or a researcher as publication capacity. Functional representation can support coordination and division of labour. It becomes politically significant when access to livelihood, recognition, or future generative opportunities depends strongly on continued performance of a prescribed function.

Definition 13.15 (Compulsory economic functionalization)**.** Compulsory economic functionalization is a relation in which an agent's access to essential resources, recognition, or future generative opportunities depends substantially on performing institutionally prescribed functions under limited effective exit conditions.

This definition places dependence at the center of the analysis. The same task can have different political-economic meanings under different conditions. Teaching, caregiving, research, craft, or programming can be experienced as self-directed generative activity when participants possess meaningful control over purposes, conditions, and exit. Similar activities can become compulsory functions when livelihood and institutional survival depend on externally structured performance with narrow scope for redirection.

Definition 13.16 (Cross-domain functional de-reification)**.** Cross-domain functional de-reification is the reduction of institutional dependence on a person's compulsory performance of a prescribed economic function while preserving or expanding that person's effective access to resources and self-directed generative activity.

Advanced automation can contribute to this process when machines assume burdensome productive or circulatory functions and access to livelihood becomes less dependent on human execution of those tasks. The same automation can produce a different relation when control over automated systems concentrates and access to their outputs depends on opaque allocation mechanisms. Functional de-reification therefore depends on the surrounding organization of generative conditions.

Proposition 13.17 (Liberation through functional reorganization)**.** *The emancipatory significance of labour automation increases when reduced compulsory functionalization is accompanied by secure access to material and generative conditions, meaningful opportunities for voluntary activity, and participation in the governance of automated systems.*

DRAFT

This proposition generalizes the paper's academic argument. The reviewer released from routine evaluation can redirect time toward self-directed research. A worker released from repetitive production can redirect time toward care, learning, creation, community activity, or other chosen forms of generation. The political-economic issue concerns the institutional relations that determine whether released time becomes genuine temporal and generative freedom.

The academic case therefore functions as a small-scale model of a broader transition. Automation can move labour away from compulsory productive and circulatory functions while preserving a rich field of human activity. The deeper transformation concerns the relation between persons and the systems that organize access, coordination, and future generative possibility. This broader framing prepares the analysis of labour liberation under advanced automation in the following section.

14 Labour Liberation

This section develops the paper's account of labour liberation after the preceding extension from academic labour to general labour. Its role is to distinguish reductions in necessary labour from broader changes in compulsory functionalization, voluntary activity, self-directed generativity, and collective participation in the governance of shared generative systems. The objective is to specify the conditions under which advanced automation can enlarge human freedom while preserving meaningful participation in social and epistemic generation. The section proceeds through five analytical layers. It first clarifies necessary labour and compulsory functionalization, then examines voluntary generative activity and self-directed generativity, and finally places individual freedom within collective generative participation.

The discussion treats labour liberation as a multidimensional transformation. Reduced labour time can matter materially, yet the political-economic significance of automation depends on how released time, access to resources, institutional standing, and participation in generative governance are reorganized. The analytical emphasis therefore falls on the relation between automation and the conditions under which persons can direct, sustain, and revise their own forms of activity.

Definition 14.1 (Labour liberation)**.** Labour liberation is the expansion of effective freedom produced when socially necessary or institutionally compulsory functions require less human performance while access to material security, generative resources, voluntary activity, and collective participation remains sufficiently supported.

Proposition 14.2 (Multidimensional liberation principle)**.** *The liberating significance of automation depends jointly on reductions in necessary labour, reductions in compulsory functionalization, expansion of self-directed generativity, and preservation of meaningful participation in the governance of shared generative conditions.*

The proposition provides the organizing logic for this section. A post-labour condition can therefore be examined through several distinct dimensions whose trajectories may diverge. Automation can reduce task burdens while resource access remains concentrated; it can release time while agenda formation remains externally structured; it can expand voluntary activity while collective governance becomes more opaque. Labour liberation requires attention to the configuration of these dimensions together.

14.1 Necessity Burden

This subsection establishes necessary labour as the first dimension of labour liberation. Its role is to identify activities whose performance is tied to the material and institutional reproduction of life under a given technological and social arrangement. The objective is to separate reductions in required human labour from the wider question of how social access to generated goods and services is organized. The discussion uses the distinction between productive function and access developed in Section 13.

Necessary labour can be understood relationally. A society requires food production, shelter maintenance, energy provision, care, repair, sanitation, logistics, administration, and many other forms of

DRAFT

recurrent activity. The quantity of human effort required for these functions varies with technology, infrastructure, organization, ecological conditions, and institutional design. Advanced automation can transfer portions of these recurrent functions to artificial systems and thereby reduce the human labour required for social reproduction.

Definition 14.3 (Necessary human labour)**.** Necessary human labour is the human activity required, under a given socio-technical arrangement, to reproduce material and institutional conditions whose continued provision is treated as essential to the functioning of persons and collective systems.

The definition makes necessity conditional on institutional and technical arrangements. A task can move out of the domain of necessary human labour when its required function is reliably supplied through automation, infrastructure, or alternative forms of organization. The underlying social need may continue while the human labour requirement declines.

Proposition 14.4 (Automation of necessary functions)**.** *When artificial systems can reliably perform socially necessary functions, the quantity of necessary human labour can decline even while the corresponding material and institutional needs remain active.*

This proposition clarifies why post-labour analysis concerns more than the disappearance of useful activity. Food, care, maintenance, verification, coordination, and infrastructure remain necessary functions even when human execution becomes less necessary. The central political-economic issue concerns the organization of access to the outputs and infrastructures through which those functions are supplied.

Reduced necessary labour can therefore create temporal capacity without determining its distribution. Some agents may gain extensive discretionary time while others retain high burdens because automation is unevenly accessible, because residual tasks remain concentrated, or because institutional arrangements continue to tie livelihood to labour performance. The distribution of released time becomes part of the political economy of automation.

Definition 14.5 (Released temporal capacity)**.** Released temporal capacity is the discretionary time created when necessary human labour declines while material access and institutional security remain sufficiently stable for that time to become practically usable.

Released temporal capacity provides one material basis for labour liberation. Its significance depends on whether persons can convert released time into rest, care, learning, inquiry, creation, civic activity, or other forms of chosen participation.

14.2 Functionalization Burden

This subsection examines the second dimension of labour liberation: the relation between persons and institutionally prescribed functions. Its role is to extend the concept of compulsory economic functionalization developed in Section 13.5. The objective is to clarify how automation can alter dependence on prescribed roles and how liberation can be evaluated through effective exit, redirection, and re-entry into different forms of activity. The discussion centers on institutional dependence, while the subjective experience of particular occupations remains outside the present analytical scope.

Compulsory functionalization arises when continued access to livelihood, recognition, institutional membership, or future opportunity depends strongly on performing a prescribed function. The function can be productive, circulatory, evaluative, administrative, or coordinative. A researcher can become tied to publication and review functions; a worker to production targets; a caregiver to continuous service provision; a clerk to administrative processing; a driver to transport capacity. The relevant relation is the coupling between survival or opportunity and prescribed functional performance.

Automation can weaken this coupling when automated systems assume the required function and institutions maintain secure access to material and social conditions for the affected persons. The same technical substitution can preserve compulsory dependence when access to basic resources continues to require participation in newly created functions. Functional de-reification therefore concerns the reorganization of dependence together with the technical replacement of task performers.

DRAFT

Definition 14.6 (Functional exit capacity)**.** Functional exit capacity is an agent's effective ability to leave, reduce, or redirect an institutionally prescribed function while retaining sufficient access to material security, recognition, and future generative opportunity.

Proposition 14.7 (Functional exit criterion)**.** *Reductions in compulsory functionalization become more substantial as functional exit capacity increases across material, institutional, and generative dimensions.*

Functional exit capacity adds precision to the idea of liberation from work. A person with nominal freedom to leave a role may possess little effective exit when livelihood, healthcare, housing, legal status, or future opportunity depends on continued participation. Advanced automation can expand effective exit when the social organization of automated productivity supports continuity of access beyond prescribed labour performance.

This perspective also clarifies the relation between automation and dignity. The issue concerns whether a person is institutionally reduced to the function through which access is secured. Greater functional exit allows productive, intellectual, caring, or creative activity to persist while weakening the coercive coupling between prescribed performance and basic access.

14.3 Voluntary Generation

This subsection develops voluntary generative activity as a positive dimension of labour liberation. Its role is to identify forms of activity that continue after compulsory labour burdens decline because persons value the activity, its products, its relations, or its contribution to shared worlds. The objective is to distinguish the reduction of compulsory labour from the reduction of human generation. The discussion extends the account of voluntary intellectual labour in Section 6.2 to broader domains of social activity.

Human activity can remain intensive under conditions of extensive automation. People may choose to research, teach, build, repair, cultivate, compose, care, organize, deliberate, explore, or create even when artificial systems can perform similar functions. The generative significance of these activities can derive from curiosity, attachment, craft, recognition, public contribution, aesthetic judgment, solidarity, or the intrinsic value attached to participation in a process.

Definition 14.8 (Voluntary generative activity)**.** Voluntary generative activity is sustained activity through which an agent contributes to material, epistemic, social, aesthetic, or institutional generation under conditions of meaningful choice regarding participation, direction, intensity, and continuation.

The concept places effective choice at the center while preserving the social character of generation. Voluntary activity can be collaborative, disciplined, demanding, and institutionally organized. Its voluntariness concerns the relation between the participant and the activity, including the ability to redirect or discontinue participation without severe loss of basic access.

Proposition 14.9 (Activity persistence under labour reduction)**.** *A decline in compulsory labour can coexist with extensive human activity when access to generative conditions supports voluntary participation across diverse forms of creation, care, inquiry, and collective contribution.*

This proposition is central to the paper's conception of a post-labour society. Automation can reduce the necessity of labour while leaving human generativity active. The resulting social field may contain extensive activity whose value is weakly connected to wage necessity and more strongly connected to chosen purposes, relationships, and forms of collective life.

The distinction also matters for academic work. A scholar released from routine review, administrative coordination, or metric production can still pursue difficult research for long periods. The relevant transformation concerns the source and governance of the activity. Similar patterns can appear outside academia when persons continue to engage in craft, care, engineering, cultivation, or community organization after their livelihood depends less directly on performing those functions.

DRAFT

14.4 Self-Direction

This subsection develops self-directed generativity as a deeper dimension of labour liberation. Its role is to move beyond the availability of voluntary activity toward the capacity to shape purposes, methods, temporal horizons, collaborators, and conditions of generation. The objective is to connect released time with effective generative agency. The discussion generalizes the account of self-directed scholarly generativity developed in Section 6.

Voluntary participation can remain highly structured by external agendas. Platforms can determine visibility, institutions can define recognized outputs, automated systems can preselect options, and resource architectures can constrain feasible trajectories. Self-directed generativity therefore depends on effective influence over the direction and conditions of activity in addition to the freedom to participate.

Definition 14.10 (Self-directed generativity)**.** Self-directed generativity is the effective capacity of an agent to initiate, sustain, revise, and redirect generative activity through meaningful influence over its purposes, methods, temporal horizons, resource use, and relational configuration.

This capacity has both individual and relational dimensions. An individual may choose a research problem or artistic project, while access to laboratories, shared spaces, collaborators, datasets, energy, compute, or public institutions can shape the range of feasible directions. Self-direction therefore depends partly on the architecture of generative conditions.

Proposition 14.11 (Generative-agency condition)**.** *Labour automation contributes more strongly to self-directed generativity when released temporal capacity is accompanied by access to generative resources, plurality of feasible trajectories, and effective authority to revise goals and methods.*

The proposition links temporal freedom to the wider political economy developed across the four-paper project. Released time can support generative freedom when persons possess meaningful access to the conditions required for chosen activity. Concentrated control over models, infrastructure, land, energy, institutions, or recognition can narrow practical generative possibility even in a society with low necessary labour.

Self-directed generativity therefore provides a more demanding measure of post-labour freedom than leisure time alone. The relevant question concerns whether persons can participate in shaping what becomes possible, valuable, and sustainable within their own trajectories of activity.

14.5 Collective Participation

This subsection places individual labour liberation within collective generative systems. Its role is to connect necessary-labour reduction, functional exit, voluntary activity, and self-directed generativity with participation in the governance of shared infrastructures and institutions. The objective is to specify why labour liberation includes a collective dimension when automated systems increasingly coordinate production, circulation, allocation, and evaluation. The discussion integrates the concept of generative sovereignty from Section 12 with the broader general-labour analysis.

Advanced automation can make collective systems increasingly capable of operating with limited direct human execution. Energy grids, logistics networks, knowledge infrastructures, administrative systems, production facilities, and allocation platforms can become highly autonomous. Human freedom within such systems depends partly on whether people retain meaningful channels for contesting rules, revising priorities, forming shared purposes, and influencing the evolution of automated coordination.

Definition 14.12 (Collective generative participation)**.** Collective generative participation is the effective capacity of members of a shared social system to contribute to the formation, revision, and governance of the generative conditions that shape common resources, institutional priorities, and future possibilities.

Collective participation differs from compulsory execution of system functions. A person can participate in decisions about research infrastructure without performing routine review, contribute to gov-

DRAFT

ernance of energy allocation without operating the grid, or deliberate about care institutions without supplying every care task directly. Automation can therefore reduce functional burdens while preserving or expanding participation at the level of collective purpose and governance.

Proposition 14.13 (Collective liberation condition)**.** *Labour liberation becomes more robust when reductions in compulsory execution are accompanied by meaningful participation in the governance of shared generative conditions.*

This proposition connects labour liberation to political-economic agency. A highly automated society can provide material abundance while governance remains concentrated within opaque technical or institutional systems. Another arrangement can combine extensive automation with distributed forms of contestation, deliberation, revision, and shared institutional authorship. The distinction concerns collective generative participation.

The five dimensions developed in this section together provide a structured account of labour liberation under advanced automation. Necessary human labour can decline; compulsory functionalization can weaken; voluntary generative activity can expand; self-directed generativity can become more feasible; and collective generative participation can preserve agency over shared conditions. These dimensions can reinforce one another when institutions convert automated productive capacity into secure access, temporal freedom, plurality of generative trajectories, and meaningful participation in governance.

The framework also clarifies the next analytical task. Once liberation is understood through the organization of functional burdens and generative agency, attention turns to the systems that govern automated coordination itself. The following section therefore examines governance under automated coordination, including dependence on artificial systems, allocation rules, institutional opacity, epistemic agency, and concentration of generative control.

15 Coordination Governance

This section examines the governance problems that emerge once production, circulation, allocation, and evaluation are increasingly coordinated by artificial systems. Its role is to extend the labour-liberation analysis in Section 14 toward the institutional conditions that shape automated coordination itself. The objective is to distinguish reductions in human execution from the distribution of authority over automated systems, with particular attention to dependence, allocation, opacity, epistemic agency, and concentration of generative control. The section proceeds through five analytical dimensions. It first specifies AI-mediated dependence, then examines automated allocation and institutional opacity, before turning to epistemic agency and the concentration of generative control.

The discussion treats automated coordination as an institutional relation whose technical capability forms one component of a wider governance structure. Artificial systems can schedule resources, rank requests, route information, evaluate submissions, and mediate exchange at high speed. The political-economic significance of these functions depends on the rules through which systems are configured, the agents who can revise those rules, the information available to affected participants, and the distribution of effective contestation rights. Automation therefore changes the site of coordination while leaving questions of authority and dependence active.

Definition 15.1 (Automated coordination governance)**.** Automated coordination governance is the institutional organization of authority, accountability, contestation, revision, and access surrounding artificial systems that allocate resources, mediate exchange, evaluate claims, or structure generative opportunities.

Proposition 15.2 (Governance persistence under coordination automation)**.** *As coordination functions become increasingly automated, political-economic governance shifts toward the rules, infrastructures, permissions, and revision mechanisms that structure automated decisions.*

The proposition identifies the central transition developed in this section. Reduced human handling of coordination can lower administrative and circulatory burdens while increasing the significance of system design, infrastructure ownership, model access, institutional oversight, and procedural recourse. The

resulting governance field is therefore compatible with low human labour and high political-economic consequence.

15.1 Coordination Dependence

This subsection develops AI-mediated dependence as the first governance dimension of automated coordination. Its role is to identify the relations through which persons and institutions rely on artificial systems for access to resources, information, evaluation, and opportunities. The objective is to distinguish dependence on human intermediaries from dependence on technical and institutional infrastructures. The discussion builds on the accounts of automated resource coordination in Section 11 and functional exit capacity in Section 14.2.

Academic and general economic coordination increasingly can occur through systems that route requests, allocate compute, prioritize applications, rank outputs, recommend information, or negotiate machine-mediated exchanges. Dependence emerges when continued participation in a generative field requires access to these systems and when alternative pathways carry substantial cost. The relevant relation therefore concerns effective access to coordination infrastructure as well as the quality of service provided by a particular model or agent.

Definition 15.3 (AI-mediated dependence)**.** AI-mediated dependence is a relation in which an agent's effective access to resources, recognition, information, coordination, or future generative opportunities depends substantially on artificial systems and the institutional infrastructures that authorize, configure, and sustain them.

The definition emphasizes the combined technical and institutional character of dependence. A scholar can depend on an automated allocation platform even when the software is technically replaceable if institutional participation is tied to that platform. A worker can depend on a scheduling system when assignments, income, or access to future work flow through its classifications. A research group can depend on model-mediated literature discovery when visibility and retrieval increasingly determine which bodies of knowledge enter practical consideration.

Proposition 15.4 (Dependence relocation)**.** *Automation can reduce dependence on specific human intermediaries while increasing dependence on coordination infrastructures whose rules and access conditions are institutionally structured.*

This proposition links automated coordination to the paper's broader account of functional dereification. Human reviewers, administrators, schedulers, or brokers can be released from routine intermediary roles while users become more dependent on technical infrastructures. The resulting transformation can enlarge freedom when access is secure, alternatives are available, and governance remains contestable. It can narrow effective freedom when participation becomes strongly coupled to opaque or concentrated coordination systems.

AI-mediated dependence also has a temporal dimension. Short interruptions can be manageable when alternative systems exist, while long-term dependence can shape accumulated reputation, resource histories, recommendation profiles, and future eligibility. The continuity of access therefore matters alongside immediate system performance. A highly capable system can become a central institutional gateway when prior interactions influence later opportunities.

Definition 15.5 (Coordination dependency intensity)**.** Coordination dependency intensity is the degree to which an agent's current and future generative opportunities are contingent on continued access to a particular automated coordination system or tightly integrated class of systems.

Dependency intensity provides a useful link to governance analysis. High dependency increases the importance of exit possibilities, interoperability, procedural recourse, data portability, alternative channels, and institutional transparency. These features shape whether automated coordination functions as enabling infrastructure or as a concentrated gatekeeping relation.

DRAFT

15.2 Allocation Regime

This subsection examines automated allocation as the second governance dimension. Its role is to identify how artificial systems distribute scarce resources, temporal priority, visibility, verification effort, and access to generative infrastructures. The objective is to separate the efficiency of allocation from the authority to define allocation criteria. The discussion connects the resource-coordination framework in Section 11 with the scarcity-migration analysis in Section 9.

Automated systems can allocate compute, laboratory access, review capacity, publication attention, funding recommendations, workflow priority, or access tokens. These systems can process large volumes of requests and update allocations dynamically. Their political-economic significance depends on the criteria encoded into allocation procedures, the data used to evaluate claims, and the institutional authority governing overrides and appeals.

Definition 15.6 (Automated allocation regime)**.** An automated allocation regime is a rule-governed system in which artificial agents or models assign scarce resources, access rights, temporal priority, or visibility among competing requests under institutionally specified objectives and constraints.

Allocation regimes can differ along several dimensions: universality of access, priority rules, transferability of claims, accumulation of credits, treatment of historical usage, recognition of exceptional cases, and availability of human or collective review. These dimensions influence both immediate allocation outcomes and the reproduction of future generative capacity.

Proposition 15.7 (Allocation-governance distinction)**.** *The automation of allocation reduces the labour required to execute allocation decisions while leaving the selection and revision of allocation criteria as a distinct governance function.*

This distinction is central to the paper's account of delegation. A system may efficiently schedule compute or rank requests once objectives and constraints have been specified. The normative and political-economic content enters through the specification of objectives, acceptable trade-offs, protected claims, priority categories, and procedures for revision. Automated execution can therefore coexist with substantial human, institutional, or collective responsibility for the allocation architecture.

Automated allocation can also produce cumulative effects. Access to compute can improve research outputs; improved outputs can increase recognition; recognition can influence later priority; later priority can expand access again. Similar recursive processes can operate through funding, laboratory access, visibility, or recommendation systems. Allocation rules therefore participate in the formation of future opportunity distributions.

Definition 15.8 (Recursive allocation effect)**.** A recursive allocation effect occurs when an allocation decision alters an agent's future eligibility, priority, recognition, or resource access in ways that influence subsequent allocation rounds.

Recursive effects make temporal analysis important. A locally reasonable allocation rule can generate persistent concentration when advantages compound across repeated cycles. Governance therefore includes monitoring the long-term distributional and generative consequences of automated allocation, alongside evaluation of individual decisions.

The allocation problem also intersects with resource tokens and credits introduced in Section 11.6. When allocation claims become transferable, accumulable, or broadly exchangeable, governance must address the relation between operational coordination and the emergence of generalized claims. The architecture of automated allocation can thereby influence the future form of economic exchange within highly automated systems.

15.3 Governance Opacity

This subsection develops institutional opacity as the third governance dimension. Its role is to examine the informational conditions under which participants can understand, contest, and revise automated coordination. The objective is to distinguish technical complexity from institutional opacity and to identify

DRAFT

the governance consequences of limited interpretability at the level of rules, data, authority, and recourse. The discussion places opacity within the broader framework of generative sovereignty developed in Section 12.

Automated coordination systems can be difficult to understand for multiple reasons. Models may be technically complex, institutional criteria may be dispersed across documents and interfaces, data provenance may be inaccessible, decision authority may be distributed across organizations, and appeal mechanisms may be poorly specified. These sources of opacity can accumulate even when individual components operate as designed.

Definition 15.9 (Institutional opacity)**.** Institutional opacity is the condition in which agents affected by an automated coordination system have limited effective access to the rules, data dependencies, authority structures, decision pathways, or revision mechanisms that shape consequential outcomes.

Institutional opacity therefore extends beyond model interpretability. A technically interpretable model can participate in an opaque institution when users cannot identify who selected the model, which criteria govern its deployment, how data are weighted, or which authority can revise the process. Conversely, a technically complex system can operate within a comparatively transparent institution when governance responsibilities, decision criteria, auditing procedures, and recourse pathways are accessible and meaningful.

Proposition 15.10 (Opacity-governance relation)**.** *As institutional opacity increases, effective contestation and informed participation require stronger mechanisms for disclosure, explanation, audit, representation, and procedural recourse.*

The proposition identifies opacity as a governance variable whose level can vary across institutional arrangements using advanced technology. Institutions can reduce effective opacity through documentation, public criteria, accessible interfaces, independent auditing, traceable decision histories, and representative oversight. The relevant standard concerns whether affected agents can form sufficiently reliable models of the systems shaping their opportunities and can act upon that understanding.

Opacity can also redistribute expertise. When only a narrow group can interpret system behaviour, institutional influence may shift toward technical specialists, infrastructure owners, or organizations with privileged data access. Expertise itself then becomes part of the political economy of automated coordination. Broader participation can require translation institutions, public-interest technical capacity, and shared forms of oversight that connect specialized knowledge with collective decision-making.

Definition 15.11 (Governance legibility)**.** Governance legibility is the practical degree to which affected participants can identify consequential rules, responsible authorities, relevant evidence, and available mechanisms for contestation or revision within an automated coordination system.

Governance legibility provides a positive counterpart to opacity. Participants can retain governance legibility under conditions of incomplete technical understanding when sufficient institutional visibility supports participation, accountability, and informed challenge.

15.4 Epistemic Agency

This subsection examines epistemic agency as the fourth governance dimension. Its role is to connect automated coordination with the capacity of persons and communities to form judgments about the systems that organize knowledge, resources, and opportunities. The objective is to specify how automation can support human inquiry while preserving capacities for interpretation, critique, disagreement, and revision. The discussion connects the earlier analysis of voluntary epistemic participation in Section 5.5 with the account of generative sovereignty in Section 12.

Automated systems can summarize evidence, rank alternatives, generate explanations, and recommend decisions. These capacities can expand practical access to information and reduce cognitive burdens. They can also shape which evidence becomes salient, which categories appear natural, and which

DRAFT

options enter the decision space. Epistemic agency therefore concerns the relation between assistance and the continued ability to form, revise, and contest judgments.

Definition 15.12 (Epistemic agency)**.** Epistemic agency is the effective capacity of an agent or community to form, examine, revise, and contest judgments concerning claims, evidence, classifications, priorities, and the systems that mediate access to them.

Epistemic agency has several dimensions. Interpretive capacity concerns understanding claims and evidence. Critical capacity concerns identifying assumptions, exclusions, and alternative explanations. Revision capacity concerns changing judgments in light of new information. Contestatory capacity concerns challenging institutional classifications or automated decisions. Collective epistemic agency concerns the ability of communities to deliberate about standards, categories, and shared knowledge infrastructures.

Proposition 15.13 (Assistance-agency compatibility)**.** *Extensive AI assistance can coexist with strong epistemic agency when users retain meaningful capacities to access evidence, compare alternatives, challenge system outputs, and participate in revising the standards that organize evaluation and coordination.*

This proposition avoids treating automation and epistemic agency as inherently opposed. Artificial systems can extend search, synthesis, translation, verification support, and modelling capacity. Their liberating potential is greater when these functions enlarge the space of inquiry available to users and when institutional arrangements preserve access to evidence and alternative pathways of judgment.

Epistemic agency becomes especially important in recursive AI-mediated knowledge systems. If AI systems generate claims, evaluate outputs, recommend literature, and update future models, participants need capacities to inspect the feedback structures that reproduce epistemic priorities. Human and collective judgment can then operate at multiple levels: within individual research tasks, across evaluation criteria, and within governance of the infrastructure itself.

Definition 15.14 (Epistemic governance participation)**.** Epistemic governance participation is the effective capacity to contribute to the formation and revision of standards, classifications, evidence practices, and coordination rules that shape collective knowledge production.

This concept connects epistemic agency to the wider political economy of liberation. A person can possess extensive access to AI-generated knowledge while having little influence over the standards through which that knowledge is selected, ranked, or institutionally recognized. Stronger epistemic governance participation links individual inquiry with collective authorship of the systems that structure knowledge circulation.

15.5 Control Concentration

This subsection develops concentration of generative control as the fifth governance dimension. Its role is to integrate dependence, allocation, opacity, and epistemic agency into an account of structural power under automated coordination. The objective is to identify how control over models, compute, data, infrastructure, standards, and institutional gateways can become concentrated even as direct human labour requirements decline. The discussion connects the academic case to the wider analysis of generative control developed across the four-paper project.

Automated coordination can centralize control through several pathways. Model providers can mediate access to reasoning and generation. Infrastructure owners can control compute, storage, or network capacity. Institutions can centralize certification and recognition. Platforms can shape visibility and recommendation. Data holders can influence training, verification, and model updating. Governance bodies can define allocation rules and appeal procedures. These forms of control can overlap within a small number of organizations or remain distributed across multiple institutions.

DRAFT

Definition 15.15 (Generative control concentration)**.** Generative control concentration is the accumulation of effective authority over multiple conditions of generation—including infrastructure, models, data, allocation, recognition, and governance—within a limited set of agents or institutions.

Concentration matters because control across several layers can become mutually reinforcing. Model access can improve output quality; high-quality outputs can expand recognition; recognition can improve resource access; resource access can support stronger infrastructure; infrastructure can increase influence over future standards. The political-economic significance therefore lies in the coupling among control domains.

Proposition 15.16 (Coupled control accumulation)**.** *When control over models, infrastructure, allocation, recognition, and governance is mutually reinforcing, automated coordination can produce recursive concentration of generative control even under conditions of declining necessary human labour.*

This proposition connects post-labour abundance with the persistence of political economy. A society can experience extensive automation and material productivity while generative conditions become increasingly concentrated. Reduced labour necessity therefore leaves active questions concerning access, contestation, institutional pluralism, interoperability, public capacity, and participation in governance.

Concentration can also affect the meaning of exit. A user may be formally free to leave one platform while practical alternatives remain limited because models, data histories, reputational signals, institutional credentials, or coordination standards are tightly integrated. Effective plurality depends on more than the number of nominal providers. It depends on the presence of viable alternative pathways through which agents can sustain generative activity and preserve accumulated capabilities.

Definition 15.17 (Effective generative plurality)**.** Effective generative plurality is the existence of multiple viable and institutionally recognized pathways through which agents can access generative resources, maintain continuity of activity, contest coordination rules, and participate in the evolution of shared infrastructures.

Effective plurality provides one institutional counterweight to concentrated generative control. Its forms can include interoperable systems, public infrastructures, cooperative institutions, decentralized governance arrangements, open standards, plural verification systems, and meaningful portability of data or credentials. The specific institutional design remains an empirical and normative question, while the analytical criterion concerns the availability of viable alternative generative pathways.

The five dimensions developed in this section together clarify the governance problem of advanced automation. AI-mediated dependence concerns reliance on coordination infrastructures; automated allocation concerns the distribution of scarce opportunities; institutional opacity concerns the visibility of rules and authority; epistemic agency concerns the capacity to interpret and contest mediated judgments; and concentration of generative control concerns the recursive accumulation of authority over the conditions of future generation. These dimensions show why labour liberation and automated coordination require joint analysis.

The next section turns from governance risks to a broader account of generative freedom and political-economic governance. It integrates outcome distribution, access to generative capacities, governance of generative conditions, functional entry and exit, and participation in system governance into a common framework for evaluating post-labour arrangements.

16 Generative Freedom

This section integrates the paper's preceding analyses into a common framework for generative freedom under advanced automation. Its role is to connect labour liberation in Section 14 with the governance problems identified in Section 15. The objective is to specify the institutional dimensions through which reduced labour necessity can become a durable expansion of human generative agency. The section proceeds through six dimensions: distribution of generated outcomes, access to generative capacities, governance of generative conditions, entry into functional roles, exit from functional roles, and participation

DRAFT

in system governance. The discussion treats these dimensions as mutually conditioning components of a political-economic arrangement whose quality depends on their joint configuration.

Automation can increase the quantity of generated goods, services, knowledge, and coordination capacity while leaving access and governance unevenly distributed. It can also reduce compulsory functions while preserving strong dependence on systems that allocate opportunities or define admissible pathways. Generative freedom therefore concerns the practical relation between persons and the social, technical, and institutional conditions through which they can initiate, sustain, redirect, and discontinue meaningful activity.

Definition 16.1 (Generative freedom)**.** Generative freedom is the effective capacity of agents to access sufficient generated outcomes and generative resources, initiate and redirect meaningful activity, enter and leave functional roles under viable conditions, and participate in shaping the systems that structure future generative opportunities.

Proposition 16.2 (Integrated generative-freedom principle)**.** *The expansion of generative freedom depends jointly on outcome security, access to generative capacities, contestable governance of generative conditions, functional mobility, and meaningful participation in system governance.*

The proposition supplies the organizing logic for this section. A high level of material abundance can coexist with low functional mobility. Broad access to tools can coexist with concentrated rule-setting authority. Formal participation can coexist with weak access to the information or resources needed for effective influence. The analysis therefore evaluates political-economic freedom through a configuration of relations whose joint structure provides more information than isolated indicators such as labour time, income, automation intensity, or nominal access.

16.1 Outcome Security

This subsection establishes distribution of generated outcomes as the first dimension of generative freedom. Its role is to specify the material and institutional basis that allows reduced labour necessity to become practically usable freedom. The objective is to connect automated production with the distribution of goods, services, care, knowledge, income-equivalent claims, and other outputs required for secure participation in social life. The discussion builds on the distinction between necessary labour and released temporal capacity developed in Section 14.1.

Advanced automation can increase the volume and variety of generated outcomes while altering the relation between contribution and access. A society can possess extensive productive capacity while access remains strongly tied to employment, ownership, platform membership, institutional credentials, or token holdings. Under such conditions, reduced demand for human labour can create a gap between productive abundance and individual security. The distributional dimension therefore concerns the rules through which generated outcomes become available to persons whose labour contribution may be declining in economic necessity.

Definition 16.3 (Outcome security)**.** Outcome security is the durable and practically reliable access of an agent to generated goods, services, care, knowledge, and institutional provisions sufficient to sustain participation in social and generative life.

Outcome security has both quantitative and relational components. The quantity and quality of available outputs matter, while the conditions of access also shape freedom. Access that is highly discretionary, revocable, opaque, or dependent on a narrow set of gatekeepers can provide material provision with limited security. More stable arrangements can increase the practical value of released time because persons can plan activities whose benefits emerge over long horizons.

Proposition 16.4 (Outcome-security condition)**.** *Reductions in necessary labour contribute more strongly to generative freedom when access to essential generated outcomes remains sufficiently secure across changes in employment, occupational role, and institutional participation.*

This condition is especially important in a post-labour setting. Research, caregiving, artistic practice, civic participation, learning, and exploratory activity often require sustained periods during which immediate market returns are uncertain or absent. Outcome security can therefore operate as a condition of generative diversity by allowing a wider range of trajectories to remain viable.

Distribution also shapes bargaining relations. Agents with secure access to essential outcomes possess greater capacity to decline undesirable roles, contest institutional demands, or redirect their activity. The distributional layer therefore interacts directly with functional exit and with the capacity to exercise meaningful choice over future generative trajectories.

16.2 Capacity Access

This subsection examines access to generative capacities as the second dimension of generative freedom. Its role is to move beyond the receipt of finished outcomes toward the resources and infrastructures through which agents can produce, investigate, create, care, organize, and collaborate. The objective is to distinguish consumption security from effective participation in generation. The discussion draws on the analysis of model access, data access, computational resources, verification infrastructure, and automated resource coordination in Sections 10 and 11.

Generative capacities include skills, time, models, compute, data, laboratories, tools, networks, institutional standing, verification pathways, and access to artificial agents capable of performing productive or coordinative functions. Their distribution influences which persons can transform intentions into sustained activities. A post-labour society with broad material provision can still exhibit narrow generative participation if high-capacity tools and infrastructures remain concentrated.

Definition 16.5 (Generative-capacity access)**.** Generative-capacity access is the effective ability of an agent to mobilize the technical, material, epistemic, institutional, and relational resources required to initiate and sustain a chosen generative activity.

Effective access requires more than nominal availability. A model can be publicly visible while high-quality use depends on expensive compute. A laboratory can be formally open while scheduling priority strongly favors established institutions. A publication venue can accept submissions while verification costs remain beyond the reach of many researchers. The relevant measure is therefore the practical ability to mobilize a capacity under the conditions that govern its use.

Definition 16.6 (Generative access depth)**.** Generative access depth is the degree to which an agent can employ, adapt, combine, and sustain generative capacities across a meaningful range of activities and time horizons.

Access depth becomes increasingly important as artificial systems assume wider productive functions. A person with a general-purpose artificial agent can possess substantial generative leverage when that agent can acquire resources, coordinate workflows, and interact with infrastructures. The political-economic significance of such leverage depends on permissions, rate limits, model modification rights, resource entitlements, and the surrounding institutional architecture.

Proposition 16.7 (Capacity-access condition)**.** *Generative freedom expands more substantially when reductions in compulsory labour are accompanied by broad and durable access to the capacities required for self-directed and collectively directed generation.*

This proposition connects labour liberation with the migration of scarcity discussed in Section 9. As production becomes easier, bottlenecks can migrate toward verification, compute, attention, trusted infrastructure, or physical experimentation. Generative freedom therefore depends on access to the capacities located at the current bottlenecks of a field.

DRAFT

16.3 Condition Governance

This subsection develops governance of generative conditions as the third dimension of generative freedom. Its role is to identify the upstream institutional rules that shape which capacities exist, who can access them, and which trajectories remain viable. The objective is to connect generative sovereignty in Section 12 with the governance analysis of automated coordination in Section 15. The discussion focuses on rule formation, revision, contestation, infrastructure design, and the distribution of authority over systems that condition future activity.

Generative conditions include allocation rules, technical standards, model permissions, ownership structures, data governance, interoperability requirements, verification procedures, legal classifications, institutional recognition, and the architecture of shared infrastructures. These conditions influence the feasible space within which agents exercise generative capacity. Their significance grows when automated systems integrate multiple functions and become durable gateways to resources, information, recognition, or coordination.

Definition 16.8 (Generative-condition governance)**.** Generative-condition governance is the process through which rules, infrastructures, permissions, standards, and institutional arrangements that structure future generative possibilities are formed, interpreted, contested, and revised.

The concept extends governance beyond direct allocation decisions. A rule governing interoperability can influence future exit options. A model-modification policy can shape who can adapt artificial systems to local purposes. A verification standard can determine which forms of evidence become institutionally legible. A data-retention rule can influence cumulative access and learning. These decisions shape the field in which later choices occur.

Proposition 16.9 (Upstream governance principle)**.** *Authority over generative conditions has amplified political-economic significance because it can influence multiple downstream distributions of capacity, recognition, functional opportunity, and future access.*

Upstream governance is therefore closely related to generative control concentration. A system can distribute immediate outcomes broadly while retaining centralized authority over the conditions that determine later participation. Conversely, plural and contestable governance can preserve multiple pathways for experimentation, institutional innovation, and collective revision even when operational execution is highly automated.

Generative freedom at this layer concerns the availability of meaningful routes through which affected participants can influence governing conditions. Such routes can include public rulemaking, cooperative governance, institutional representation, open standards, appeals, portability, audit, collective bargaining, community oversight, and plural infrastructures. Their design varies across domains, while their common function is to connect those affected by generative conditions with processes capable of revising them.

16.4 Entry Capacity

This subsection examines entry into functional roles as the fourth dimension of generative freedom. Its role is to clarify why a post-labour society can preserve rich forms of work, service, scholarship, care, and collective contribution even as compulsory dependence on these functions declines. The objective is to distinguish freedom from compulsory functionalization from the capacity to enter valued functions under meaningful conditions. The discussion extends the concepts of voluntary generative activity and self-directed generativity developed in Section 14.

Functional roles can remain attractive because they provide skill development, social recognition, relational participation, collective purpose, intellectual challenge, aesthetic value, or opportunities to contribute to shared institutions. Advanced automation can reduce the amount of human labour required for a function while leaving room for human participation at different levels of intensity. The relevant

DRAFT

freedom therefore includes access to roles that persons value, even when society can satisfy the corresponding functional need through artificial systems.

Definition 16.10 (Functional entry capacity)**.** Functional entry capacity is an agent's effective ability to enter, learn, practice, and sustain a valued social or productive function under conditions that provide meaningful access to the resources, recognition, and relations associated with that role.

Functional entry can be constrained when automated systems monopolize practical opportunities, when institutional credentials remain scarce, when training pathways disappear, or when human participation is treated as inefficient despite its social or developmental value. A society with abundant automated capacity can therefore face a distinct design question concerning how people retain opportunities to participate in medicine, research, education, craft, engineering, public administration, or other functions they find meaningful.

Proposition 16.11 (Voluntary functional participation principle)**.** *Labour liberation is compatible with continued human participation in productive and social functions when entry is sufficiently voluntary and access to valued roles remains practically available.*

The principle clarifies the distinction between automation and exclusion. Removing the requirement that a person perform a function for survival can enlarge freedom, while removing all viable pathways into the function can reduce a different dimension of agency. Generative freedom therefore includes opportunities for voluntary participation alongside protection from compulsory functional dependence.

Functional entry also has a collective dimension. Communities may value maintaining human competence in fields where automation performs most routine work. Retained competence can support institutional resilience, cultural continuity, plural judgment, emergency capacity, and the ability to contest machine-mediated decisions. Entry pathways can therefore contribute both to personal generative freedom and to collective generative plurality.

16.5 Exit Capacity

This subsection examines exit from functional roles as the fifth dimension of generative freedom. Its role is to extend the concept of functional exit capacity introduced in Section 14.2 into the integrated governance framework. The objective is to specify the material, institutional, and generative conditions that make exit credible. The discussion focuses on continuity of access, portability, reputation, retraining, and the preservation of future opportunity after role transition.

A formal right to leave a role has limited practical significance when exit entails loss of livelihood, healthcare, housing, legal status, accumulated credentials, data histories, social recognition, or access to future generative resources. Automated production can increase exit capacity when essential outcomes become less dependent on current employment and when artificial systems lower the cost of learning, retraining, coordination, or independent production. The same automation can reduce exit capacity when resource access becomes tightly coupled to a platform, reputation system, proprietary model, or institutional identity.

Definition 16.12 (Generative exit security)**.** Generative exit security is the degree to which an agent can leave or reduce a functional role while preserving sufficient outcome security, transferable capabilities, institutional continuity, and access to future generative opportunities.

Generative exit security expands the earlier concept of functional exit capacity by emphasizing continuity across trajectories. A person may leave a role and retain basic material security while losing access to the tools, credentials, or networks required to pursue alternative forms of activity. A stronger form of exit preserves the possibility of redirection and future re-entry into meaningful generative domains.

Proposition 16.13 (Functional mobility principle)**.** *Generative freedom increases when agents possess both credible entry into valued functions and credible exit when they choose to redirect their activity.*

DRAFT

This proposition identifies functional mobility as a joint condition. Weak exit capacity can produce dependency, while weak entry capacity can produce disengagement or exclusion. A post-labour political economy can support a wider range of life trajectories when persons can move among research, care, craft, learning, civic work, entrepreneurship, rest, artistic practice, and other activities while preserving material and generative standing across transitions.

Automation can support such mobility through individualized learning, portable digital tools, automated coordination, accessible production systems, and reduced dependence on continuous employment. Institutional design remains consequential because portability of credentials, data, reputation, benefits, and resource rights determines whether technical possibilities become effective mobility.

16.6 Governance Participation

This subsection develops participation in system governance as the sixth and integrative dimension of generative freedom. Its role is to connect individual functional mobility with collective authority over the infrastructures that coordinate post-labour life. The objective is to specify how persons can remain participants in the formation of common rules even when artificial systems perform extensive productive, evaluative, allocative, and coordinative functions. The discussion synthesizes generative participation from Section 12.5, collective generative participation from Section 14.5, and governance legibility from Section 15.3.

System governance includes the formation and revision of objectives, allocation criteria, access rules, interoperability standards, verification procedures, model constraints, public-service obligations, data governance, accountability mechanisms, and institutional boundaries. Participation can occur through direct deliberation, representative institutions, professional bodies, cooperative structures, public oversight, participatory technical design, or other arrangements suited to the scale and function of a system.

Definition 16.14 (System-governance participation)**.** System-governance participation is the effective capacity of affected agents to contribute to the interpretation, contestation, revision, and authorization of rules and infrastructures that shape shared generative conditions.

Effective participation depends on more than formal inclusion. Participants require information, time, interpretive capacity, access to relevant evidence, viable channels of contestation, and institutions capable of translating participation into consequential revision. Automated systems can assist these processes by summarizing proposals, simulating consequences, translating technical material, and coordinating large-scale deliberation. Their use can expand participation when governance remains legible and revisable.

Definition 16.15 (Participatory generative governance)**.** Participatory generative governance is an institutional arrangement in which those affected by shared generative conditions possess meaningful and recurring opportunities to shape the rules, infrastructures, and priorities through which those conditions evolve.

Proposition 16.16 (Post-labour governance condition)**.** *A post-labour arrangement has stronger generative-freedom characteristics when reductions in compulsory labour and coordination burdens are accompanied by durable participation in the governance of shared generative conditions.*

This condition completes the section's integrated framework. Outcome security provides the material basis of usable freedom. Access to generative capacities enables participation in creation and inquiry. Governance of generative conditions concerns authority over the upstream rules that structure possibility. Functional entry and exit create mobility across social roles. System-governance participation connects individual freedom with collective self-direction.

The six dimensions together provide a political-economic account of generative freedom suited to advanced automation. They also clarify the relation between liberation and delegation. Artificial systems can assume extensive productive, evaluative, and coordinative functions while persons retain rich forms of voluntary generation and collective participation. The decisive institutional issue concerns how access, mobility, authority, and governance are organized around the resulting infrastructures. The next section synthesizes the paper's argument and develops its implications for post-labour political economy.

DRAFT

17 Post-Labour Synthesis

This section integrates the paper's empirical entry point, functional decomposition of academic labour, analysis of epistemic circulation, and account of generative freedom into a common political-economic interpretation of advanced automation. Its role is to consolidate the mechanisms developed in Sections 1–16 and to clarify their implications beyond academic work. The objective is to identify which dimensions of liberation are plausibly advanced by automation, which forms of dependence migrate into new infrastructures, and which governance problems become more consequential when productive and circulatory functions are extensively delegated. The section proceeds through six components: analytical integration of academic automation, labour functionalization and generative agency, scarcity migration and epistemic capital, delegation and generative sovereignty, institutional architecture of post-labour society, and a broader research programme for the political economy of liberation. The discussion uses the academic case as a structurally concentrated setting in which production, circulation, evaluation, allocation, recognition, and governance can be observed within a single institutional field.

The paper's central analytical movement begins with a distinction between activity and compulsory function. Academic automation can reduce the amount of human effort required for literature processing, review, coordination, writing, and other recurrent tasks while preserving substantial space for curiosity, judgment, research, artistic creation, teaching, care, and collective inquiry. The resulting political-economic question therefore concerns the organization of human generativity after routine functional requirements weaken. The same movement also reveals that automation redistributes dependence: the scholar released from review labour may become more dependent on model access, compute, data, recommendation systems, verification infrastructures, and automated allocation mechanisms. Liberation and dependence can consequently develop through different channels within the same technical transformation.

Definition 17.1 (Post-labour generative arrangement)**.** A post-labour generative arrangement is an institutional configuration in which artificial systems perform a substantial share of socially necessary productive, circulatory, evaluative, or coordinative functions while human agents retain meaningful access to generated outcomes, generative capacities, functional mobility, and participation in the governance of shared generative conditions.

The definition treats post-labour transformation as a reorganization of functions and relations. It therefore provides a wider analytical object than a reduction in hours worked. The remaining subsections specify the components of this reorganization and the conditions under which automation can support a stronger form of generative freedom.

17.1 Analytical Integration

This subsection consolidates the academic case into a single political-economic sequence. Its role is to connect the empirical developments identified in Section 1 with the functional architecture developed in Section 2. The objective is to show how automation enters academic systems at multiple points and progressively changes the relation among knowledge generation, circulation, evaluation, institutional reproduction, and resource coordination. The discussion follows the movement of a scholarly object through the system and identifies where human functional obligations can be reduced, displaced, or reconstituted.

Academic work historically combines activities with different institutional roles. A researcher may formulate questions, conduct experiments, interpret evidence, write manuscripts, review other manuscripts, apply for resources, coordinate data access, maintain institutional credentials, and contribute to professional governance. Sections 3 and 4 showed that several of these functions also produce portable institutional objects such as scores, decisions, rankings, credits, and recognition signals. These objects help circulate knowledge and allocate scarce opportunities, while simultaneously narrowing complex scholarly activity into administratively usable representations.

DRAFT

AI-mediated automation changes this architecture because productive and circulatory functions can increasingly be separated from the human persons historically required to perform them. Automated systems can ingest literature, generate candidate hypotheses, assist experimentation, draft representations, perform routine evaluation, coordinate computational resources, acquire data, schedule facilities, and manage publication workflows. Section 7 further showed how these capacities can form connected AI–AI circuits, while Section 8 established the recursive character of such systems: generated knowledge becomes input to later generation, evaluation becomes feedback, and model updates incorporate previous outputs into future productive capacity.

Proposition 17.2 (Academic automation integration principle)**.** *As automation expands across productive, circulatory, evaluative, and coordinative functions, the political-economic significance of academic work increasingly depends on how access, verification, recognition, allocation, and governance are organized around the resulting artificial infrastructures.*

The proposition places the main analytical emphasis on the institutional environment surrounding automation. A highly capable AI system can reduce review time, coordination costs, or writing burdens while the distribution of compute, data, experimental access, visibility, and institutional recognition remains strongly differentiated. Academic automation therefore provides a compact example of a broader pattern: technical substitution can remove particular human functions while leaving the relations that govern access and future opportunity active.

The academic case is especially informative because knowledge is simultaneously an output, a productive input, an object of evaluation, and a basis for future recognition. Recursive automation can consequently intensify both abundance and bottlenecks. The volume of generated claims can grow rapidly while verification, attention, trusted recognition, and empirical access remain scarce. This tension provides the bridge to the wider analysis of scarcity migration and epistemic capital later in this section.

17.2 Agency Synthesis

This subsection synthesizes the paper's account of labour liberation. Its role is to connect functional dereification in Section 5, self-directed scholarly generativity in Section 6, and the general labour framework in Section 13. The objective is to specify the relation between reduced compulsory function and expanded generative agency. The discussion distinguishes required system maintenance from voluntary activity and then extends the distinction beyond academic work.

Academic review provides a particularly clear example. A scholar can contribute valuable judgment through peer review while simultaneously experiencing review as a compulsory function required to reproduce an institutional system. Automation can assume portions of routine checking, consistency assessment, formatting, triage, or coordination. The resulting release of human time has emancipatory significance when scholars gain greater practical capacity to pursue research questions, intellectual interests, care activities, artistic work, public engagement, or rest according to self-directed priorities.

Section 14 generalized this distinction through necessary labour, compulsory functionalization, voluntary generative activity, self-directed generativity, and collective generative participation. These categories allow labour liberation to be described through changes in the relation between persons and socially necessary functions. A society may remain highly active while reducing the extent to which access to basic outcomes depends on performing externally assigned functions. Human activity can then become more heterogeneous in purpose and temporal organization.

Definition 17.3 (Functional liberation)**.** Functional liberation is the expansion of agents' effective capacity to decline, leave, reduce, or redirect socially assigned functions while preserving sufficient outcome security and access to future generative opportunities.

Proposition 17.4 (Generative-agency conversion condition)**.** *Reductions in compulsory labour contribute more strongly to liberation when released time, resources, and institutional standing can be converted into self-directed and collectively meaningful generative activity.*

DRAFT

The conversion condition explains why labour reduction and generative freedom require separate measurement. A reduction in working hours can coexist with insecure access to resources, weak opportunities for self-directed activity, concentrated platform dependence, or limited participation in common institutions. Conversely, persons may choose intensive activity when they possess meaningful control over its direction, duration, collaborators, and purposes. The political-economic object is therefore the structure through which time and capacity become available for self-directed generation.

The same structure extends beyond scholarship. Care workers, teachers, programmers, designers, translators, administrators, and many other actors perform mixtures of intrinsically valued activity and institutionally required function. Automation can change the ratio between these components. A post-labour political economy can therefore be evaluated partly by the extent to which people gain credible opportunities to participate in valued activities while retaining viable exit from functions they wish to leave.

17.3 Scarcity Synthesis

This subsection integrates the scarcity and capital analyses developed in Sections 9 and 10. Its role is to explain why abundant automated production can shift the location of political-economic advantage. The objective is to identify the resources that become relatively more consequential when the marginal cost of producing scholarly artifacts declines. The discussion follows the movement of scarcity from production toward verification, attention, trust, recognition, data, computation, and empirical infrastructure.

AI-mediated production can increase the number of manuscripts, hypotheses, analyses, summaries, and other epistemic artifacts available to a research community. Such abundance changes the value of complementary capacities. Verification becomes more important when claims multiply faster than reliable checking. Attention becomes more consequential when readers and evaluators face a growing volume of candidate outputs. Institutional trust and recognition become scarce coordination resources when communities require mechanisms for selecting among abundant artifacts. Experimental access, proprietary data, compute, model capability, and high-quality feedback can become increasingly decisive for producing results that exceed inexpensive textual recombination.

This migration also changes the structure of epistemic capital. Section 10 showed that possession of information can lose relative importance when powerful models provide broad access to codified knowledge. Advantage can then migrate toward control over model capability, data, compute, verification systems, experimental infrastructure, and visibility channels. These resources affect both present output and future opportunity.

Definition 17.5 (Post-abundance epistemic capital)**.** Post-abundance epistemic capital is an accumulated capacity to secure preferential access to scarce verification, attention, recognition, computational, empirical, or visibility resources under conditions of abundant knowledge production.

Proposition 17.6 (Scarcity-capital migration principle)**.** *When automation reduces scarcity in one stage of a generative process, political-economic advantage can migrate toward complementary stages whose capacities remain limited, institutionally governed, or costly to reproduce.*

This principle links the academic case to broader economic systems. Automated production of software, design, media, or services can reduce scarcity in direct output while increasing the strategic importance of energy, compute, trusted identity, distribution channels, physical infrastructure, rights, standards, or access to scarce environments. The location of capital can therefore change together with the technical organization of production.

The analytical implication is significant for liberation. Reducing compulsory productive labour can expand human freedom while concentrated control over newly scarce complements can recreate dependency through different channels. A political economy of advanced automation therefore requires attention to scarcity migration alongside labour displacement. The relevant question concerns the evolving distribution of effective access to the resources that condition future generation.

DRAFT

17.4 Delegation Synthesis

This subsection consolidates the paper's account of delegation and governance. Its role is to integrate automated resource coordination from Section 11, generative sovereignty from Section 12, and governance under automated coordination from Section 15. The objective is to specify the boundary between labour-saving delegation and the transfer of authority over future generative conditions. The discussion proceeds through operational delegation, evaluative authority, allocation authority, agenda formation, and system governance.

Delegation can reduce burdens that people regard as routine or externally imposed. An AI system can search literature, coordinate resources, schedule experiments, draft routine reports, or administer transactions while a human researcher retains authority over research purposes and interpretation. Such delegation can strengthen generative freedom by lowering transaction and coordination costs. The political-economic character changes when the delegated system gains durable authority over which goals are admissible, which outputs count as credible, which actors receive resources, or which trajectories receive continued support.

Section 12 described generative sovereignty through retained capacity to formulate purposes, contest standards, redirect activity, and participate in governing the conditions of future generation. Section 15 added the problems of institutional opacity, automated allocation, epistemic agency, and concentration of generative control. Together, these analyses imply that delegation has depth. Operational tasks can be delegated while authority remains distributed and contestable; deeper delegation can reorganize the locus of effective governance.

Definition 17.7 (Delegation depth)**.** Delegation depth is the extent to which an automated system exercises authority across operational coordination, evaluation, allocation, agenda formation, and governance of the conditions that shape future generative possibilities.

Proposition 17.8 (Sovereignty-preserving automation condition)**.** *Automation supports generative sovereignty more strongly when increases in delegation depth are accompanied by sufficient legibility, contestability, reversibility, plural access, and effective participation in rule formation.*

The condition provides a framework for evaluating autonomous coordination through institutional as well as technical performance. A system can allocate resources efficiently while participants possess weak understanding of its criteria or limited ability to challenge its decisions. Another system can automate extensive operational work while retaining transparent rules, alternative access pathways, and strong procedures for revision. These configurations differ substantially in their implications for generative agency.

The same logic extends to AI–AI exchange. Artificial agents may autonomously acquire compute, data, energy, publication services, or other inputs through tokenized coordination. Human users can experience substantial relief from transaction labour while the background protocols governing those exchanges become increasingly consequential. The disappearance of visible human exchange therefore increases the importance of protocol governance, entitlement design, interoperability, and oversight.

17.5 Institutional Synthesis

This subsection develops the institutional implications of the preceding synthesis. Its role is to combine the six dimensions of generative freedom specified in Section 16 into a broader account of post-labour institutional architecture. The objective is to identify the conditions through which reduced labour necessity can coexist with security, mobility, generative plurality, and collective self-direction. The discussion organizes these conditions around outcomes, capacities, functional mobility, common infrastructures, and governance.

A post-labour society can possess extensive automated productive capacity while maintaining very different institutional arrangements. Access to generated outcomes may be broadly guaranteed or tightly linked to asset ownership. Generative capacities may be widely available or concentrated through proprietary models and infrastructure. Functional roles may remain open to voluntary human participation

DRAFT

or become institutionally inaccessible once automation dominates performance. Exit from employment may be secure or may entail loss of housing, healthcare, status, data, credentials, or future opportunity. Governance may be participatory and legible or highly centralized and opaque.

Section 16 organized these differences through outcome security, generative-capacity access, governance of generative conditions, functional entry, functional exit, and system-governance participation. These dimensions can now be interpreted as components of post-labour institutional architecture.

Definition 17.9 (Post-labour institutional architecture)**.** Post-labour institutional architecture is the configuration of distribution, access, mobility, recognition, infrastructure, and governance arrangements through which extensively automated societies organize human security and generative participation.

Proposition 17.10 (Post-labour plurality principle)**.** *Post-labour institutional arrangements support broader generative plurality when agents possess secure access to essential outcomes, multiple pathways to generative capacities, credible functional mobility, and meaningful influence over shared generative conditions.*

The plurality principle emphasizes the coexistence of different ways of living and generating. Advanced automation can support research-intensive lives, artistic lives, care-centred lives, entrepreneurial activity, community work, craft, education, exploration, rest, and combinations that shift over time. Institutional architecture determines whether such heterogeneity becomes practically available across social groups.

The academic case clarifies this point. A researcher released from routine review labour benefits from automation most fully when research resources, model access, data, experimental infrastructure, publication channels, and institutional recognition remain sufficiently accessible. Similar conditions apply across other domains. Liberation therefore involves both the removal of compulsory functions and the maintenance of conditions that support diverse future trajectories.

17.6 Research Programme

This subsection identifies the broader research implications of the paper. Its role is to convert the preceding synthesis into a programme for comparative and empirical political economy. The objective is to specify variables and institutional relations that deserve measurement as automation advances. The discussion focuses on labour decomposition, scarcity migration, generative access, delegation depth, functional mobility, and governance participation.

The first research implication concerns measurement of labour. Aggregate employment and hours worked provide limited information about the composition of remaining activity. Research can distinguish productive, circulatory, evaluative, administrative, coordinative, and self-directed generative components. Such decomposition can reveal whether automation reduces burdens experienced as compulsory while expanding opportunities for voluntary generation.

The second implication concerns scarcity migration. Empirical work can track changes in the relative scarcity of production, verification, attention, compute, data, energy, experimental access, recognition, and trusted distribution channels. These measurements can identify where new dependencies and concentrations form after automation lowers costs elsewhere in the system.

The third implication concerns generative access. Studies can examine access depth, effective model capability, data quality, computational resources, interoperability, portability, and opportunities for independent production. Formal availability can then be distinguished from the effective capacity to initiate and sustain meaningful projects.

The fourth implication concerns delegation and governance. Comparative analysis can measure delegation depth, system legibility, appeal mechanisms, allocation transparency, alternative access pathways, and the distribution of authority over agenda formation and rule revision. These variables provide empirical indicators of generative sovereignty under automated coordination.

The fifth implication concerns functional mobility. Research can examine entry pathways, exit security, credential portability, benefit portability, retraining access, reputation portability, and the continuity

DRAFT

of generative opportunity across transitions. Such measures can clarify whether reduced labour necessity translates into a wider feasible set of life trajectories.

Definition 17.11 (Liberation-sensitive automation analysis)**.** Liberation-sensitive automation analysis evaluates technical change through its effects on compulsory function, generative access, scarcity distribution, functional mobility, delegation depth, and participation in the governance of shared generative conditions.

The academic case offers an empirically accessible setting for developing these measures because automation is already entering multiple stages of research production and circulation. The wider relevance of the framework lies in its capacity to study other domains while treating labour reduction as one component of a wider political-economic transformation. Automation reorganizes relations among agents, capacities, infrastructures, claims, and governing institutions.

The synthesis therefore supports a broader interpretation of post-labour liberation. Advanced AI can release persons from substantial portions of necessary and circulatory labour, create new space for self-directed generation, and expand the technical possibility of material abundance. At the same time, scarcity can migrate, epistemic and economic capital can reorganize, and control over generative conditions can become more concentrated or more plural. The political economy of liberation consequently concerns the institutional conversion of automation into durable generative freedom. A formal conclusion can now state the manuscript's central result, delimit its scope, and identify the conceptual contribution of the academic case to the study of post-labour society.

18 Conclusion

This conclusion closes the paper by consolidating the analytical result of the academic case and specifying its implications for the wider political economy of automation. Its role is narrower than the theoretical synthesis in Section 17. The synthesis integrated the paper's mechanisms across production, circulation, evaluation, scarcity, capital, delegation, governance, and post-labour institutional design. The present section performs four final tasks. Subsection 18.1 states the central analytical result; Subsection 18.2 specifies the scope conditions and analytical boundaries of the argument; Subsection 18.3 identifies the implications for post-labour political economy; and Subsection 18.4 closes with the paper's conception of generative freedom. The method is synthetic and restrictive: the conclusion restates only those claims supported by the academic case and the structural analysis developed throughout the manuscript.

18.1 Core Result

The paper began with a concrete transformation in academic work. Artificial systems increasingly mediate literature processing, problem formulation, experimentation, writing, evaluation, publication coordination, and resource allocation. These developments make academic labour a useful concentrated setting for examining a broader political-economic question: what kind of liberation becomes possible when functions required for the reproduction of a social system can be delegated to artificial agents?

The central result is a distinction among automation, functional liberation, and generative freedom. Automation concerns the transfer of tasks from human to artificial agents. Functional liberation concerns the reduction of compulsory roles through which persons are required to sustain production, circulation, evaluation, coordination, or institutional reproduction. Generative freedom concerns the effective capacity to direct one's own generative activity, access relevant capacities, enter and leave social functions, and participate in governing the conditions that shape future possibilities. These dimensions can develop together, yet each requires separate analysis.

The academic case illustrates this distinction clearly. Automated peer review can reduce compulsory evaluative labour while scholars continue to participate in research, judgment, and criticism. Automated resource coordination can reduce administrative burdens while leaving consequential questions about

DRAFT

allocation authority, access, and governance intact. AI-mediated knowledge circuits can expand productive capacity while shifting scarcity toward verification, attention, trust, recognition, experimental resources, and visibility. The political-economic significance of automation therefore lies partly in the redistribution of functional obligations and partly in the reorganization of the conditions under which generative agency can be exercised.

This result gives functional de-reification a limited but important meaning. A scholar released from recurrent institutional functions can redirect time and attention toward self-directed inquiry, teaching, artistic work, care, or other forms of activity. Liberation in this sense concerns release from compulsory functionalization together with preserved or expanded generative agency. The same technical transformation can produce different institutional outcomes depending on the organization of access, recognition, allocation, and governance.

18.2 Scope Limits

The argument rests on an analytical use of academic automation. Contemporary academic AI remains heterogeneous across tasks, institutions, and fields, and the paper limits its inference to transformations already observable in partial form. Present developments therefore serve as an empirical entry point and a structural analogue for selected dimensions of wider automation, while comprehensive post-labour social organization remains a separate object of inquiry.

The analysis also distinguishes functional delegation from normative authorization. Operational performance in review, ranking, resource allocation, or publication coordination and legitimate authority over epistemic standards, distributive priorities, or research agendas occupy distinct institutional dimensions. The paper consequently separates operational competence, institutional delegation, and governance authority. Future work requires domain-specific accounts of responsibility, contestability, representation, and accountability for automated academic systems.

A further boundary concerns the meaning of liberation. Reduced labour time alone provides an incomplete measure. Expanded leisure can coexist with concentrated control over generative infrastructure, weak access to research resources, opaque allocation, constrained exit, or limited participation in governance. Conversely, continued intensive activity can coexist with substantial generative freedom when participation is voluntary, materially supported, self-directed, and embedded in institutions that preserve access and collective governance. The paper therefore treats labour liberation as relational and institutional, with reductions in required human activity forming one component of a wider transformation.

The concepts developed here also require empirical specification. Verification capacity, epistemic capital, functional exit, generative sovereignty, and governance participation must be linked to observable institutions, resources, permissions, interfaces, and decision procedures. Their operational forms will differ across universities, laboratories, publishing systems, professional fields, and broader economic sectors. The present manuscript provides an analytical architecture and a research programme; domain-specific work can develop appropriate metrics for particular institutional settings.

18.3 Post-Labour Implications

The academic case supports a wider interpretation of post-labour political economy. Advanced automation can reduce the need for human participation in functions required to keep production and circulation operating. The resulting society can still contain allocation systems, exchange media, scarce resources, infrastructural dependence, institutional authority, and asymmetric control over generative conditions. The decline of necessary human labour therefore shifts the location of political-economic questions toward access, governance, functional mobility, and control over the infrastructures through which artificial and human generativity are coordinated.

This shift is visible in the paper's treatment of scarcity migration. When manuscript production becomes inexpensive, verification, attention, trusted recognition, experimental resources, and visibility can become more consequential. Epistemic capital can consequently migrate toward control over models,

DRAFT

data, compute, verification systems, publication infrastructure, and recommendation mechanisms. Similar processes can occur outside academia when productive abundance increases faster than the capacity to verify, allocate, govern, or distribute access to the systems that generate valuable outputs.

The delegation analysis adds a second implication. Shallow delegation can remove routine burdens while preserving human direction over purposes, standards, and institutional rules. Deeper delegation can extend into evaluation, allocation, agenda formation, and system governance. The political significance of automation therefore depends partly on delegation depth and on whether institutions preserve generative sovereignty through contestability, participation, transparency, credible exit, and plural access to generative capacities.

The resulting post-labour research agenda concerns more than the disappearance of work. It concerns the institutional organization of released time, the distribution of generative capacities, the ability to refuse compulsory functions, the allocation of scarce inputs, and participation in shaping shared generative conditions. Academic automation offers an early and analytically concentrated case through which these broader transformations can be studied.

18.4 Closing Synthesis

The paper's conception of generative freedom begins with a simple distinction. Human activity can remain extensive even when labour necessity declines. Research, teaching, art, care, experimentation, association, and collective inquiry can continue because agents value these activities and the worlds they help to create. Advanced automation can therefore change the institutional reasons for activity while leaving extensive human activity possible.

This perspective reframes liberation. A liberated post-labour arrangement would reduce the extent to which persons must occupy system-required functions in order to secure the material and institutional conditions of life. It would also support meaningful access to generative capacities, credible entry and exit across functions, and participation in governing shared infrastructures and allocation systems. These dimensions connect freedom from compulsory functionalization with freedom to participate in generation.

The academic case makes the distinction especially visible. A reviewer released from routine evaluative obligations can remain a scholar. A researcher released from administrative coordination can remain an active participant in knowledge production. A person released from labour necessity can remain generatively engaged in scientific, artistic, social, and relational life. Automation acquires liberatory significance when it expands this capacity for self-directed and collectively governed generation.

The broader political-economic implication is that post-labour society remains a field of institutional design and relational struggle. Artificial systems can assume substantial productive and circulatory functions, while questions of access, recognition, allocation, delegation, governance, and generative sovereignty remain historically consequential. The political economy of liberation therefore concerns the conditions under which reduced compulsory labour can be converted into durable generative freedom.

References

[1] Association for the Advancement of Artificial Intelligence. *AAAI-26 Review Process Update: Scale, Integrity Measures, and Pathways to Sustainability*. 2025. URL: `https://aaai.org/conference/aaai/aaai-26/review-process-update/` (visited on 09/20/2026).

[2] Joydeep Biswas, Sheila Schoepp, Gautham Vasan, Anthony Opipari, Arthur Zhang, Zichao Hu, Sebastian Joseph, Matthew Lease, Junyi Jessy Li, Peter Stone, Kiri L. Wagstaff, Matthew E. Taylor, and Odest Chadwicke Jenkins. "AI-Assisted Peer Review at Scale: The AAAI-26 AI Review Pilot". In: *arXiv preprint arXiv:2604.13940* (2026). URL: `https://arxiv.org/abs/2604.13940`.

DRAFT

[3] NeurIPS Position Paper Track Chairs. *AI-Generated Papers in the NeurIPS 2026 Position Paper Track*. June 2, 2026. URL: https://blog.neurips.cc/2026/06/02/ai-generated-papers-in-the-neurips-2026-position-paper-track/ (visited on 09/20/2026).

[4] Yutaro Yamada, Robert Tjarko Lange, Cong Lu, Chris Lu, Shengran Hu, Jakob Foerster, David Ha, and Jeff Clune. "Towards end-to-end automation of AI research". In: *Nature* (2026). DOI: 10.1038/s41586-026-10265-5. URL: https://doi.org/10.1038/s41586-026-10265-5.

DRAFT