

Article

Dynamic Complexity and Institutional Decision-Making in UK Higher Education: A Multimethod Systemic Assessment

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Highlights

Please indicate how your work links to systems science via your contributions to systems practice, theory, and/or methodology.

- Demonstrates a sequential multimethod systems assessment combining Systemigram, causal loop diagramming, the Viable System Model, and Ideal Final Result to connect problem structuring, causal analysis, organisational diagnosis, and design-oriented intervention.

What are the main findings and/or the implications of the main findings?

- Learning and teaching decision-making is influenced by reinforcing quality-performance-revenue mechanisms alongside balancing capacity constraints involving workload, staff–student ratios, marking pressure and delayed performance indicators.
- Sustainable improvement requires recruitment and resource decisions to be linked to staffing and facilities capacity, workload models to reflect actual teaching demands, and institutions to use stronger leading indicators, coordination, and forward-looking intelligence.

Abstract

UK higher education institutions operate under performance, resource, and stakeholder pressures whose effects are mediated by feedback, delays and competing constraints. This study examines how such dynamic complexity influences learning and teaching decision-making and evaluates a multimethod systems design combining a Systemigram, interview-informed causal loop diagram (CLD), Viable System Model (VSM) and Ideal Final Result (IFR). The CLD was developed from two rounds of semi-structured interviews comprising 24 interviews, analysed through thematic and open coding and subsequently validated with participants. The analysis identifies reinforcing mechanisms linking learning and teaching quality, National Student Survey (NSS)/Postgraduate Taught Experience Survey (PTES) outcomes, institutional attractiveness, enrolment, revenue and reinvestment, alongside balancing constraints through which enrolment increases staff–student ratios and marking pressure, reducing teaching and assessment/feedback quality. The VSM identifies coordination, resource control and intelligence requirements, while the IFR translates the identified tensions into design principles. The methods help explain why apparently rational local interventions can generate delayed or counterproductive effects and identify workload, staffing capacity, leading indicator and coordination interventions for UK Higher Education Institutions (HEIs).



Academic Editor: Timothy Ferris

Received: 30 July 2026

Revised: 4 September 2026

Accepted: 8 September 2026

Published: 10 September 2026

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Keywords: systems thinking; higher education; policy making; dynamic complexity; system dynamics; ideal final result; viable systems model; systemigram

1. Introduction

Over the past 40 years, UK government policy has increasingly embraced marketisation in higher education, driven by neo-liberal ideologies and new public management principles [1–3]. This shift introduced reforms focused on efficiency, accountability, and value for money, leading to the adoption of performance indicators, competitive funding models, and managerial practices across the sector [4,5]. The Jarratt Report [6] marked a turning point, recommending the use of key performance indicators (KPIs) to improve institutional management, which were later formalised by the Higher Education Funding Council for England (HEFCE) in 1999 [7,8].

The introduction of market-driven government policies in higher education has significantly complicated decision-making for higher education institutions (HEIs) in the UK [9]. UK HEIs are now expected to operate in a competitive environment, where strategic decisions need to examine and address issues such as market positioning, funding, and performance outcomes [10]. These decisions are high stakes, as they directly impact institutional reputation, student recruitment, and financial sustainability. The pressure to respond to external demands while maintaining academic integrity has shifted governance models, requiring HEIs to balance managerial efficiency with traditional collegial values.

Decision-making is further complicated by the need to satisfy a wide range of internal and external stakeholders, each with distinct priorities and expectations [10,11]. Internally, the HEI executive team, faculties, schools, staff, and students may themselves have competing priorities, where a balance needs to be found between spending on delivery and prioritising educational quality, versus saving to reinvest in facilities and ensure the financial sustainability of the HEI. Meanwhile, externally, government bodies, employers, and prospective students demand accountability which is measured by the performance evaluation frameworks (PEFs), as well as value for money. This diversity creates tension and complexity, as decisions are often required to be negotiated across competing interests, and in instances without clear consensus. Decision-making in higher education is an intricate activity because the HEI is an example of a complex social system with many levels and sources of complexity present in both the environment in which the HEI operates and within the HEI itself [12]. This complexity creates difficulties in the management and decision-making that need to occur for an HEI to be successful in achieving their desired performance outcomes.

Resources are a key component in attaining success in an HEI, and they take the form of human resources (management, research, teaching, and support staff), facilities (buildings, classrooms, and technology) and financial (necessary for investment and sustainability). Operational decision-making, particularly around resource allocation, adds another layer of difficulty. Scarcity of resources, conflicting goals, and environmental uncertainty make it challenging to align day-to-day decisions with strategic objectives [13,14]. Academic work itself is multifaceted, involving teaching, research, and administration, which further complicates resource planning [15].

In the UK, the external performance evaluation of HEIs has evolved which has culminated in the creation of a series of external PEFs, an umbrella term for the external frameworks, surveys and outcome measures through which aspects of HEI performance are evaluated. These include the Research Excellence Framework (REF), the Graduate Outcomes Survey (GOS), the National Student Survey (NSS), the Postgraduate Taught

Experience Survey (PTES), Postgraduate Research Experience Survey (PRES), the Teaching Excellence Framework (TEF) and more recently, the Knowledge Exchange Framework (KEF). HEIs are now expected to demonstrate value for money, meet diverse stakeholder expectations, and also perform well in these PEFs. This has created a high-stakes environment where performance outcomes directly influence funding, reputation, and student recruitment, compelling universities to rethink their strategic priorities and operational practices [3,10].

To be successful and sustainable, HEIs have had to develop new strategies that align institutional goals with measurable outcomes. This includes adopting strategic planning processes, implementing KPIs, and integrating performance measurement systems (PMS) that track progress against both internal objectives and external benchmarks [8,16]. These strategies must also account for the complexity of academic work, resource constraints, and the decentralised nature of university structures, which can hinder coordination and strategic alignment [13,17].

HEIs are increasingly conceptualised as dynamically complex systems due to their structural and operational characteristics. These institutions consist of numerous interconnected components, e.g., students, staff, departments, governance bodies, and external stakeholders, that interact in non-linear ways and are influenced by feedback loops and time delays [18,19]. As systems, HEIs receive inputs such as funding, labour, and expertise, which are transformed through processes like teaching, research, and administration into outputs including graduates, research outcomes, and performance metrics. The complexity arises not just from the number of components. There are numerous unpredictable and evolving relationships between them that adds to this complexity.

Another key contributor to complexity is the feedback inherent in the system, which can produce unintended and counterintuitive consequences when decisions are made without a holistic understanding of the system's structure and behaviour [20,21]. For example, cost-saving measures like staff reductions may lead to decreased morale and performance, which will ultimately undermine the intended financial benefits. Without adopting a holistic systems thinking approach, decision-makers risk implementing policies that fail to account for these interdependencies, resulting in inefficiencies and resistance [12,22]. Recognising HEIs as dynamically complex systems and adopting an appropriate methodology to manage this complexity are essential for developing more effective, adaptive strategies that align institutional goals with long-term sustainability.

Assidmi [22] recommends adopting a systems thinking approach to address the inherent complexity within the system. This systems perspective shifts attention away from traditional managerial thinking, i.e., often reductionist and focused on linear cause and effect relationships, towards understanding how individual components operate within and influence the wider system [23]. Systems thinking draws on a range of interdisciplinary fields, allowing researchers to select appropriate methods and theories to gain stakeholder insights and examine the system as a whole [24].

Although System Dynamics and related systems approaches have been applied to higher education, previous studies have largely focused on individual modelling approaches or particular performance problems. Less attention has been given to combining contextual problem structuring, participant elicited causal mapping, organisational viability diagnosis and design-oriented reflection within a single UK higher education decision context. This study examines this methodological gap by examining learning and teaching decision-making through a sequential multimethod systems assessment.

The aim of the study is to examine how dynamic complexity shapes learning and teaching decision-making in a UK HEI and to determine what additional explanatory and practical insight is obtained by combining complementary systems methods. The

overarching research question is: How can a multimethod systems assessment reveal the feedback structures, organisational viability conditions and policy tensions that shape learning and teaching decision-making in a UK HEI? The empirical causal analysis draws on two rounds of semi-structured interviews involving 24 interviews in total; the resulting CLD was subsequently subjected to participant validation.

This study utilises a number of qualitative systems thinking approaches, namely causal loop diagram (CLD), Systemigram, Viable System Model (VSM), and Ideal Final Result (IFR), to examine the complexities, feedback loops, non-linearities, viability, and the ideal learning and teaching ecosystem that supports efficient decision-making within the UK HEI context. No stock-flow model or numerical simulation was developed in this study; consequently, the CLD is used for qualitative structural explanation rather than prediction or scenario simulation. Recent qualitative-SD research supports this explanatory use of non-simulated causal structures, while emphasising traceability from qualitative evidence to causal links and transparent model reporting [25,26].

The rest of the paper is organised as follows: Section 2 reviews the higher education and systems literature and identifies recurring constructs and domains relevant to the systemic assessment. Section 3 outlines the study methodology and explains how the empirical CLD variables and causal relationships were derived from the interview data, informed by these sensitising domains. Section 4 presents the results, followed by the discussion in Section 5 and conclusions in Section 6.

2. Literature Review

Higher education is a system, and this concept of higher education as a system is not new; in 2011 the white paper “Higher Education: Students at the Heart of the System” discussed the changes being made to higher education funding that aimed “to make the English higher education system more responsive to students and employers” [27] (page 27). But what is a system? Daellenbach et al. [18] defined a system as an entity that comprises components that are interacting and interdependent and form a unified whole, receiving inputs from and transferring outputs to the environment. There are financial, social, political, production, and educational systems and each of these systems consists of components interconnected in such a way that they have a purpose and a form and produce their own pattern of behaviour over time [28,29].

The way that a system behaves is fundamental because it is the behaviour of the system that transfers the inputs into the outputs. Typically, the inputs present in a system are the raw materials and resources (typically funds, labour, and expertise); these are transferred via a series of processes into the outputs (typically goods, services, and information) [18]. The entire education sector can be considered to be a system; the sector has inputs (learners, teachers, funding) which are transformed via processes into outputs (qualifications, economic productivity, research, and innovation).

There are multiple levels within the education sector. Higher education is one of these levels and is a subsystem within the education system, with its own inputs and outputs. Within the higher education system sits the higher education institution, which is itself a system [30]. In an HEI, the inputs (which include students, staff, and facilities) are transformed by the processes (which include teaching, timetabling, staff allocation, and student support services) to produce outputs (which include graduates, student experience, and research). In the UK context, these outputs are then measured by external performance evaluation frameworks such as the NSS, PTES, TEF and the REF, which are run by bodies such as the Office for Students (OfS), Advance HE, and Research England.

The circular interactions between system components are known as feedback and a lack of understanding about the feedback in the system is what leads policymakers to

make decisions that have unintended and unforeseen consequences [20]. For example, the introduction of salary savings measures to reduce costs can lead to staff attrition and a need for further spending in recruitment and training, which offsets any cost savings [12].

In addition to the feedback that is present in the system, HEIs also experience non-linear relationships [20]. The first form of non-linearity occurs when the cause-and-effect interactions between the variables are not proportional; for example, a minor change to assessment policy can have a significant impact on student attainment [29,31]. Non-linearity refers here to situations in which the magnitude of an outcome does not vary proportionately with the magnitude of its cause. This should be distinguished from multiple causation, where an outcome is simultaneously influenced by several variables. Student attainment being influenced by tutor experience, entry qualifications and engagement is therefore treated as multiple causation rather than, by itself, evidence of non-linearity.

Finally, alongside the feedback and non-linear relationships that are present, HEIs also experience time delays which occur for two reasons; firstly, in the time taken to measure and report the information needed to make decisions, and, secondly for the decisions to impact the state of a system [20]. Delays can exist in both material and resource flows (for example staff recruitment and student enrolment) and information flows (for example NSS results; students complete the NSS between January and April, but the results are not published until August) [32]. These delays often result in policies that can have counter-intuitive outcomes, but which may not be realised for several years. For example, a policy to drive up student enrolment may be to reduce entry tariffs; this is likely to affect students' graduation results and employability rates, which impact the NSS and thus the HEI's league table (LT) position and attractiveness to future potential students, but only after a period of several years has occurred [12].

The complexity present in systems such as an HEI exceeds human cognitive capabilities as decision-makers are overwhelmed by the complexity of the system in which they are present and the number of options available at any one time [20]. Simon [33] (page 501) originally founded the theory of bounded rationality when he noted that the capacity of the human mind for formulating and solving complex problems was exceedingly small compared to the size of the problem. The presence of bounded rationality leads decision-makers to view the complex system as a series of parts, which they then treat as separate entities [22]. Decision-makers' thinking becomes short-term and linear and they are unable to adopt a dynamic system perspective as they struggle to incorporate time delays and feedback into their decision-making process [34]. This is known as reductionism and it leads decision-makers to ignore the fundamental dynamic interactions that exist between the various parts of the system, which leads to unsuccessful decision-making [35].

There are therefore many variables and decisions or policies within the HEI system and the relationships between the variables and the decisions are dynamic as they change over time and are influenced by the interactions occurring within the system [29]. When the variables present in the system change significantly over time, this causes dynamic problems to occur and dynamic complexity arises from the connections and interdependencies that exist between the variables present in the system [29]. Even a simple system can display dynamic complexity as the circular interactions (feedback) between the variables change over time [20].

The inherent complexity of HEIs makes decision- and policy-making difficult, and one way to overcome the issues associated with the presence of dynamic complexity is the adoption of a systems thinking approach. The adoption of a systems thinking perspective is important as it draws on a collection of interdisciplinary fields and proposes a selection of methods, theories, and concepts from these fields to help structure and map problem situations [24,36–38]. The adoption of the approach can help the user understand the

complex system in which they operate, make informed decisions and understand the implications of any policy proposed, and enhance communication by bringing stakeholders together [24,30,39,40]. The pertinent literature informing the development of the CLD, alongside the primary data collection, is summarised in Table 1.

Table 1. Previous higher education systems studies informing the analysis (authors' own work).

Author(s) and Year	Main Findings
Kennedy [41]	Developed a System Dynamics model that led to understanding the key drivers of quality in higher education as staff performance, student performance, research, teaching and learning, administrative support, and funding.
Galbraith [12]	Produced a systems model to generate behaviours that a typical university exhibits over time; his basic generic model of the HEI management considered the inputs and outputs.
Barlas and Diker [42]	Constructed an interactive dynamic simulation model that showed the long-term, strategic problems that needed to be addressed by high-level strategic policy-making mechanisms within an HEI in Turkey.
Oyo et al. [43]	Developed a model to review policies on funding and quality in HE but concluded that HEIs accepted large student enrolment to compensate for inadequate funding and that this short-term decision undermined the HEI's long-term capacity to maintain quality.
Hussein and El-Nasr [39]	Produced a System Dynamics model of the factors affecting student satisfaction and the optimal allocation of budget over a three-year period that provided an indication of spending to better utilise resources and provide the best affordable quality of education.
Merkulov et al. [44]	Developed a model to study the relationship between enrolment and rankings, which showed rankings were impacted by student attainment, progression and continuation, quality of students enrolled, staff–student ratio, class–faculty ratio, employability, and alumni reputation. They determined that the most valuable lever to improve rankings was admissions policy.
Zaini et al. [32]	Showed that as student satisfaction increased so did reputation, and therefore the volume of UG students; however, as the volume of UG students increased, the impact on faculty and facility load led to a decrease in student satisfaction.
Al Hallak et al. [45]	Developed a series of simulation models to examine the relationship between student flows, staff ratios and investment in plant and facilities.
Ismail et al. [30]	Developed a System Dynamics model for investigating the critical success factors of a total quality management process that affected students' satisfaction. Their findings suggested that student satisfaction was impacted by quality of teaching, quality of student learning, cost, and the percentage of trained students.
Kim and Rehg [40]	Produced a causal loop diagram of faculty workload and morale that showed faculty workload being impacted by faculty turnover, faculty hiring, student enrolment, class size, the quality of student–faculty interactions and faculty burnout. They determined that it is critical to maintain a sufficient size of competent faculty workforce to support quality teaching, research, and high morale.
Heathcote et al. [9]	Applied systems thinking to understand student behaviour and established that the probability of a student applying to an HEI was impacted by the appeal of the HEI, course suitability, locality, fear of debt, financial relief, flexibility of programme and reputation.
Pavlov and Katsamakas [46]	Applied systems thinking to develop a System Dynamics module that considered whether US colleges would survive the declining student enrolment. Their analysis suggested that solutions such as cutting cost (by, for example, reducing faculty) or seeking to increase revenue (by, for example, improving campus facilities) to attract students may only improve the college's short-term financial position.

3. Materials and Methods

Within the broader field of systems thinking, System Dynamics (SD) is a methodological tradition developed to understand and manage complex systems by modelling the interactions, feedback loops, and time delays that influence system behaviour over time. Originally developed in the field of industrial management, System Dynamics has since been widely adopted across disciplines, including education, due to its ability to simulate real-world dynamics and support strategic decision-making [39]. Unlike traditional linear models, System Dynamics captures the non-linear and adaptive nature of systems, allowing decision-makers to explore how changes in structure or policy can lead to outcomes. This is particularly valuable in higher education, where institutions operate as complex systems with multiple interdependent components and stakeholders.

The potential of System Dynamics to address dynamic complexity lies in its ability to model both quantitative and qualitative aspects of the structure as well as the decision-making that occurs. Through causal loop diagrams and simulation models, System Dynamics entails both qualitative and quantitative modelling approaches. CLDs can be used to represent feedback structures, delays and potential unintended consequences, whereas quantified stock-flow models enable simulation and the systematic testing of policy scenarios [29,47]. Moreover, using CLD provides users with a better understanding of their position in the system, as this is achieved through the identification of the underlying feedback structures [48–50]. Barlas and Diker [42] also support the application of System Dynamics and state that it is particularly applicable to higher education decision-making because of the dynamic and perennial nature of performance measurement problems in HEIs.

System Dynamics offers a powerful methodology for addressing the dynamic complexity inherent in HEI management. With institutions facing increasing demands for quality standards and diminishing resources [50], System Dynamics enables decision-makers to explore how structural relationships and feedback loops influence outcomes over time. System Dynamics helps uncover the systemic causes of performance issues and supports the development of more adaptive and resilient strategies by modelling non-linear interactions and time delays [39]. Its ability to simulate real-world behaviour makes it particularly valuable in environments resistant to policy change, where traditional approaches may fail to capture the full scope of institutional dynamics [29,51]. In higher education, where performance is influenced by factors such as staff competence, student engagement, and resource allocation, SD enables institutions to better understand the systemic impact of their decisions. SD enhances traditional performance measurement approaches and supports more adaptive, informed, and resilient strategic planning by incorporating feedback and behavioural elements [52,53].

Despite its potential, the application of System Dynamics in higher education remains limited. Most existing research has focused on modelling specific subsystems, e.g., enrolment, faculty morale, or quality control, instead of the institution as a whole [12,30,40]. Attempts to model entire HEIs have typically relied on high-level variable aggregation, which can obscure important nuances [41,46]. Furthermore, the majority of studies have used quantitative simulation models, with only one identified example of qualitative System Dynamics modelling [9]. This highlights a gap in the literature and an opportunity to expand the use of System Dynamics, particularly qualitative approaches like causal loop diagramming, to better capture stakeholder perspectives, share mental models, and support collaborative decision-making in complex educational environments. Within System Dynamics Diagramming, qualitative CLD provides a language to communicate and understand the dynamic, interconnected, fundamental feedback structure of the system of interest [22,54]. These CLDs can be applied to solve problems that include time delays [55].

This paper adopts a multimethod systems approach, and in particular CLD, to provide a quick and powerful means of gaining an overview of the many challenges facing organisations and offers a range of concepts and a series of practical methodologies that can assist in tackling real-world problems and can be applied within any discipline [36,56]. CLD represents causal relationships between variables using signed links. A positive (+) link indicates that, all else being equal, a change in one variable produces a change in the same direction in the connected variable, whereas a negative (−) link indicates a change in the opposite direction. Reinforcing feedback loops amplify change, whereas balancing loops counteract change or move the system towards a constraint or goal. The literature in Section 2, and in particular constructs within the literature cited in Table 1, were used to sensitise the analysis to relevant domains of dynamic complexity and higher education performance, while the variables and signed causal relationships in the empirical CLD were derived principally from coded interview data and subsequently validated with participants.

Although CLD forms the main part of the study, featuring primary data collection and analysis, this study adopts a multimethod systemic design instead of a single-method SD approach. The rationale for this choice is methodological complementarity, enabling a conceptual examination of the UK HE sector from different perspectives. Complex organisational problem situations are often not fully captured through one representational form, since causal explanation, contextual interpretation, organisational diagnosis, and design-oriented reflection each emphasise different aspects of the system. Multimethod systems thinking therefore enabled the study to combine methods that are analytically mutually reinforcing but are also distinct in nature [38,57,58]. Moreover, the multimethod design is pluralist rather than an attempt to merge the underlying traditions into a single methodology. The methods are selected because they perform different analytical functions: the Systemigram structures and bounds the problem situation; qualitative causal loop diagramming identifies feedback structure; VSM examines organisational viability and coordination; and IFR reframes the resulting constraints as design requirements. Their distinct theoretical origins are therefore retained while their outputs are used sequentially (Table 2). The methods also originate in different systems traditions: qualitative causal loop diagramming is rooted in System Dynamics, the VSM in organisational cybernetics, and IFR in TRIZ, while the Systemigram is used here as a systems problem structuring and narrative-mapping technique. Their combination is thus functional and pluralist and not necessarily an attempt to reconcile their underlying theoretical traditions.

Table 2. Methods, input, output, and applications (authors’ own work).

Method	Primary Input	Output	How Output Is Used Next
Systemigram	HE literature and institutional context	Bounded narrative/problem map	Identifies actors, pressures, and domains requiring causal examination
Interview-informed CLD	Coded interview variable pairs and validated causal links	Signed causal structure and R/B feedback loops	Identifies dynamic constraints and recurrent decision tensions
VSM	CLD activities, and organisational decision/control arrangements	Diagnosis of Systems 1–5 and 3*	Identifies coordination, control, and intelligence weaknesses
IFR	CLD trade-offs and VSM constraints	Ideal functional statements/design principles	Generates practical intervention principles

Prior to the application of CLD, the Systemigram is first used as a problem structuring and narrative-mapping method [59]. Its role is to represent the wider problem situation surrounding learning and teaching decision-making, including external performance evaluation frameworks, stakeholder expectations, resource constraints, policy levers, and delayed performance outcomes. This is consistent with the systems tradition of structuring complex organisational situations before selecting or applying more formal analytical representations [60]. Unlike a causal loop diagram, which focuses on feedback and polarity, the Systemigram provides a narrative and visual account of how actors, processes and environmental pressures are connected within the problem situation. It can therefore support establishing the boundary and context of the study before more detailed causal analysis is undertaken. The Systemigram is thus used as a problem structuring and narrative mapping technique. Relevant actors, processes, external pressures, decisions and outcomes are identified from the problem context and connected to show the principal narrative relationships and establish the system boundary before more detailed causal analysis.

The Viable System Model is then applied as an organisational diagnostic framework [61]. Following Beer's VSM, organisational viability is examined through the interaction of operational, coordination, control, intelligence and policy functions [62,63]. VSM is particularly suitable for this study because HEIs operate through semi-autonomous operational units, such as faculties, schools, programmes and modules, while also requiring coordination, control, intelligence and policy coherence at the institutional level. VSM therefore enables the analysis to move beyond causal feedback and to consider whether the organisation has the structural and communicative capacity to remain viable in a changing higher education environment. In this study, VSM is used to examine whether learning and teaching decision-making is supported by adequate operational autonomy, coordination mechanisms, resource control functions, monitoring processes, environmental intelligence, and strategic policy coherence. The allocation of case activities to the VSM was undertaken functionally rather than through a second coding exercise. Activities and decision arrangements identified through the CLD and case context were classified according to their organisational function within Beer's VSM: activities directly producing learning and teaching value were allocated to System 1; mechanisms coordinating those operational activities to System 2; internal resource allocation and performance-control activities to System 3; monitoring and audit activities to System 3; environmental scanning and adaptation to System 4; and institutional policy, identity and strategic balancing to System 5. The resulting VSM is therefore an author-derived organisational interpretation of the empirical CLD and case context rather than an independently coded empirical model.

The other adopted approach, Ideal Final Result, is used as a design-oriented heuristic. Originating in TRIZ, IFR encourages analysts to define the desired function of a system while reducing harmful effects, unnecessary cost, or unintended consequences [64]. Previous applications of TRIZ to service design have used contradiction analysis together with the Ideal Final Result to translate identified service tensions into potential redesign solutions [65]. Within this study, IFR is applied as a way of framing institutional contradictions. For example, HEIs seek to improve student experience while controlling workload, grow enrolment while maintaining teaching quality, and respond to performance frameworks while preserving academic values. IFR therefore complements Qualitative System Dynamics (QSD)—implemented using CLDs in this study—and VSM by helping to translate systemic diagnosis into design principles for more adaptive and sustainable learning and teaching policy.

The four methods do not have identical empirical status within this study. The CLD is the principal empirically derived model and was constructed from coded interview data and participant validation. The Systemigram, VSM and IFR are subsequent conceptual

interpretations undertaken by the authors using the empirical CLD, the case context and the relevant systems literature. They are therefore used for complementary analytical purposes rather than presented as additional independently validated empirical models.

In sum, the Systemigram supports contextualisation, the CLD supports causal explanation, and the VSM supports organisational diagnosis. These systemic methods provide a richer account of how institutional decision-making is informed by feedback structures and delays, as well as by the organisational capacity of the institution to coordinate local teaching activities, respond to performance signals, and align short-term operational decisions with longer-term institutional sustainability (Figure 1).

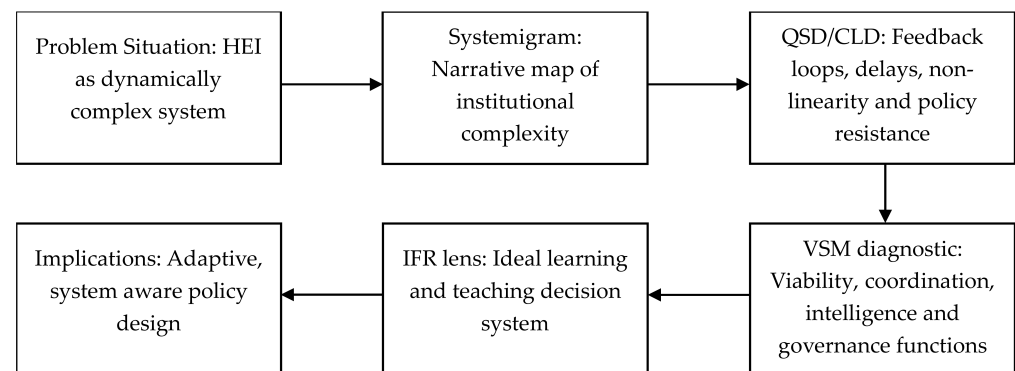


Figure 1. Sequence of the application of systemic methods (authors' own work).

Materials for Causal Loop Diagramming

For the application of QSD using CLD, the first stage of the study was to determine the boundary; the decision was to investigate one of the schools within the HEI as a case study. It is standard practice to adopt a case study approach in System Dynamics as System Dynamics models are built to represent a specific context [66]. The use of a single case study is particularly appropriate in this study as it enables the researcher to undertake the context-rich exploration needed to uncover the feedback structures, mental models, and dynamic interactions operating within the complex system being investigated [67]. This research develops a systemic explanation of dynamics, rich in context, influencing decision-making within the bounded HEI case, and evaluates the analytical contribution of combining complementary systems methods. [68].

The data required was gathered from interviews as this provided opportunities for interaction between the researcher and participants, allowing for clarification, elaboration, and the collection of responses in the participants' own words [69]. To understand the causal structures, there needed to be close engagement with the participants, and this is more feasible within a single, bounded system.

The case study approach was considered to be appropriate for two reasons: firstly because locating the study within the school provided access to participants to enable data collection (which was based upon interviews), and secondly because the school provided a clearly identifiable boundary (the schools and the HEI are bounded systems) [70].

The study required qualitative data to develop the causal loop diagram; this is appropriate as qualitative data and judgments are used by management when developing strategy as well as during the decision-making processes [71]. Participant involvement was necessary to elicit the required knowledge from the participants' mental models, to increase the chances of implementation, and to foster opportunities for participant learning to occur as participants gained an understanding of the impact of their decisions on future performance [72,73]. This study received ethical approval from the appropriate institutional review board, and all procedures undertaken followed the approved ethical guidelines.

The sample of participants was purposeful and included a selection of all members of academic staff from across a school which included representation from visiting lecturers, lecturers, senior lecturers with admin roles and/or research allowances, principal lecturers with admin roles and/or research allowances, readers, professors, and academic managers. There were two rounds of interviews: in round 1 (the pilot interviews) there were 13 participants, and in round 2 there were 11 participants, totalling 24 interviews. The interviews lasted between 45 min and 1 h in duration and were either held in-person or online depending upon participant availability. The researchers used a list of semi-structured questions, each interview was recorded, and notes were also taken at the time. After each interview, the interview transcripts were typed up and shared with the participant.

After the interviews were completed, thematic analysis was undertaken using the framework proposed by Braun and Clarke [74]. The coding process was largely informed by grounded analysis and data-coding techniques associated with grounded theory, as suggested by Kim and Andersen [75]. Their approach begins with open coding (to discover the themes in the data and identify the variables and causal relationships). This is then followed by a process similar to axial coding, in which variables and causal relationships are consolidated to generate a causal map [75].

Open coding identified the themes and pairs of relationships that would be used in the creation of the CLD. The approach adopted was to first analyse the contents of the transcripts, the themes were identified and colour coded, and then a list of the main themes arising was produced. After the themes had been established, the transcripts were reviewed to establish the variable pairings that were mentioned in the context of each theme. During the coding phase the transcripts were also carefully reviewed to establish variable pairings and the two key themes related to the variable pairings were noted; a notation was added on the transcripts displaying where the evidence could be found. The data was inputted into Microsoft Excel, and this enhanced analysis, together with the use of the filter function, made it easier to establish the causal links.

This data was then used to create the CLD. Once the CLD was created, the next stage was to hold validation meetings with participants to provide them with an opportunity to comment on the CLD which included confirmation of variable names, relationship directions, the feedback loops, and policy levers. There were 12 participants in the validation meetings, and the participants included a lecturer, programme leaders, and members of the senior management team.

This exercise ensured that the CLD was a true representative of what was said in the interviews and was occurring in the real system [20,21]. The final CLD that represented the learning and teaching sector within the school is presented in Section 4.

4. Results

4.1. Representation of the Problem Situation

The Systemigram (Figure 2) provides a high-level narrative representation of the problem situation. It outlines that the institution's learning and teaching decisions are embedded within a wider marketised higher education environment and are not isolated constructs. External performance evaluation frameworks intensify stakeholder expectations and increase the variety of demands placed on institutional decision-makers. As this variety exceeds the cognitive and organisational capacity of individual decision-makers, the presence of bounded rationality leads to simplified mental models and short-term policy responses. These responses are enacted through local policy levers such as workload allocation, staffing decisions, facilities investment, module (or programme) leadership arrangements, assessment design, and student support mechanisms. The effects of these decisions are then realised through the quality of classroom activity and assessment/feedback

processes, which influence module ratings, NSS/PTES outcomes, league table position, institutional attractiveness, enrolment, revenue, and ultimately the surplus available for reinvestment. The Systemigram therefore provides a contextual bridge between the literature on dynamic complexity and the more detailed causal loop diagram presented later within the paper.

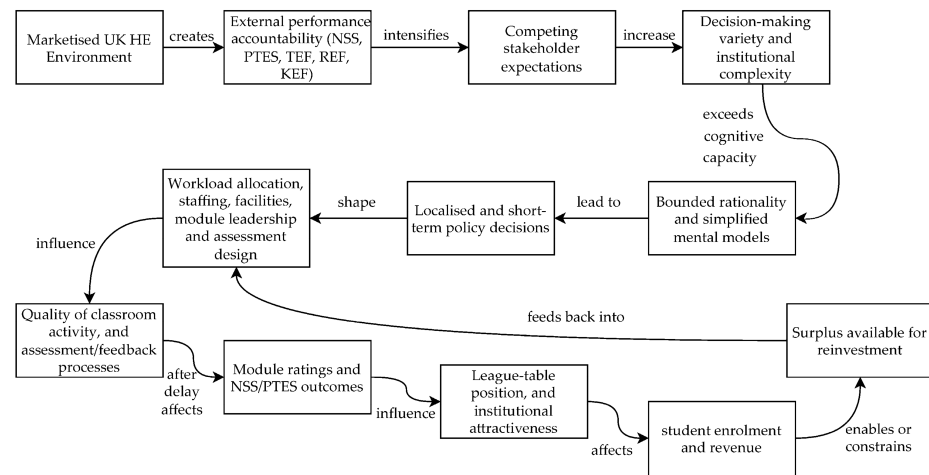


Figure 2. Systemigram outlining problem situation within the UK HE context (authors' own work).

The Systemigram is not intended to duplicate the causal analysis subsequently provided by the CLD. Its contribution is to establish the system boundary and preserve the institutional narrative linking external pressures, decision-makers, resource choices and delayed outcomes before signed feedback relationships are examined.

4.2. CLD: Interactions, Polarities, and Feedback Loops

Before presenting the CLD, Table 3 summarises illustrative coding results showing how interview-derived themes and causal statements were consolidated into the variables and signed relationships represented in Figure 3. Themes did not become CLD variables directly. Themes were used as organising categories. Within each theme, repeated causal statements were coded as variable pairs, together with their direction of influence. These variable pairs were consolidated into the variables and signed causal relationships used to construct the CLD (Table 3).

Table 3. Coding results (authors' own work).

Coding Theme	Example Coded Relationship	Polarity	Figure 3 Variable/Structure
Workload/time	Staff time on module preparation → teaching quality	+	Workload → preparation time → classroom quality
Staff capability	Staff T&D/support → appropriate assessment	+	CPD/T&D → capability → A&F quality
Cohort/capacity	Number of students → individual student support	–	Student numbers/capacity pressure
Cohort/capacity	Cohort size → personalisation	–	Enrolment/SSR quality constraint
Assessment	Appropriate assessment → assessment/feedback fairness	+	Quality of A&F processes
Student experience	Enthusiastic teaching → student satisfaction	+	Staff enthusiasm → classroom quality/NSS
Finance	Number of students → revenue	+	Enrolment → revenue
Workload	Investment in workload → personalised teaching/curriculum	+	Surplus/investment → workload → quality

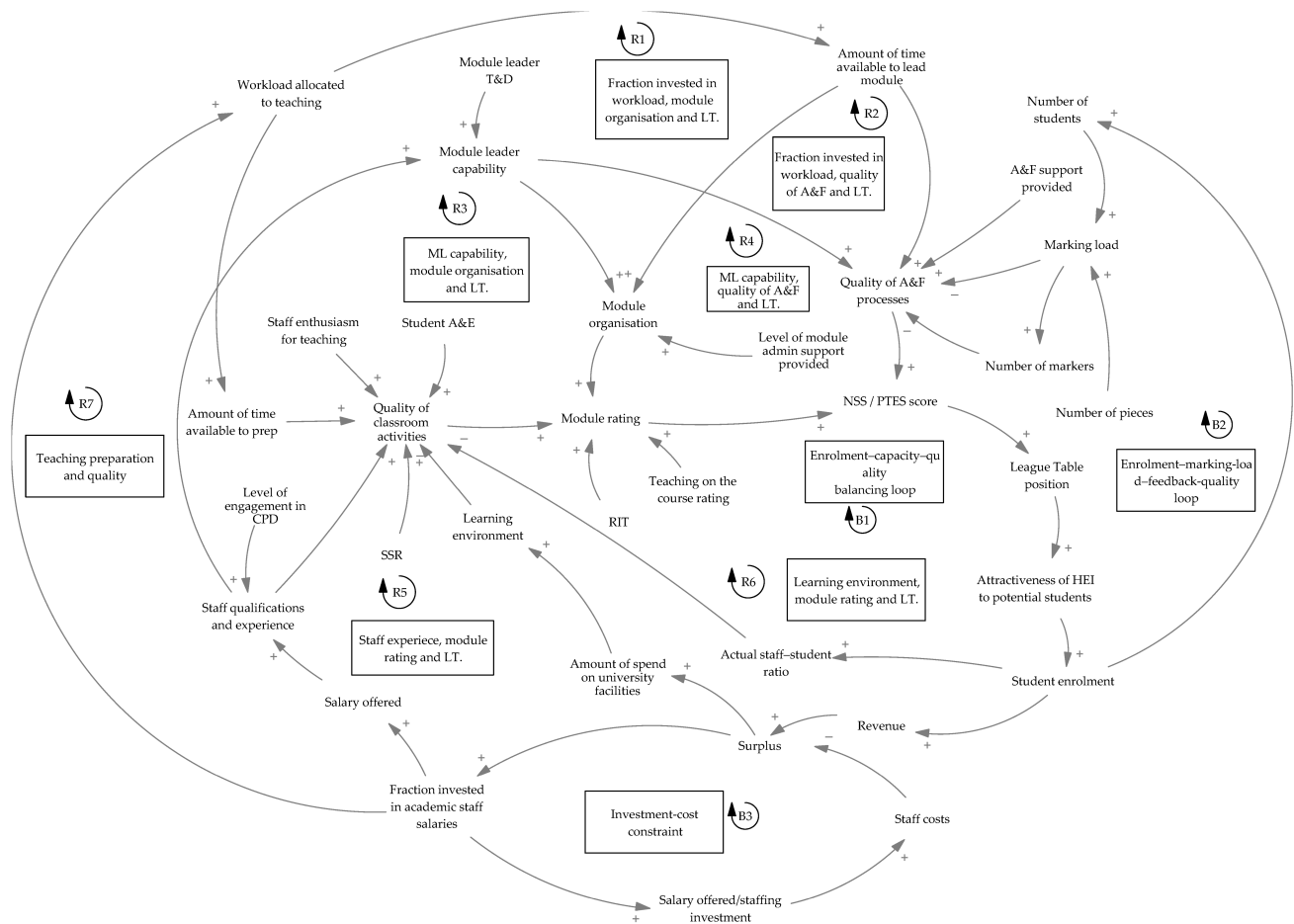


Figure 3. Causal loop diagram representing causal relationships and feedback loops (authors' own work).

The CLD for the learning and teaching sector has two main components: the quality of the classroom activities and the quality of assessment and feedback processes.

The first component, the quality of the classroom activities, is positively impacted by staff qualifications and experience, the amount of time available to prepare (which includes the ability to offer flexible learning, addressing different learning styles, etc.), staff enthusiasm for teaching, student attendance and engagement (A&E), and the learning environment (for example learning resources centre, classroom attributes, physical resources, environmental, technology, facilities, availability of resources) and is negatively impacted by the staff–student ratio (SSR). The quality of the classroom activities positively impacts the module rating, and this variable is also positively impacted by the module organisation rating, the amount of research-informed teaching (RIT) included and the teaching on the course rating (which includes appropriateness of module content in terms of levelness, currency, and amount). The module organisation rating is impacted by module leader (ML) capability (which is impacted by staff qualifications and experience and module leader training and development (T&D)), the amount of time made available to lead the module and the level of module administration support provided. The module rating is an important variable that will directly impact NSS/PTES scores which in turn feed into the league table position obtained by the HEI and thus impact future student enrolment and revenue. Within the first component, the decisions that need to be made that impact the quality of classroom activities relate to workload allocated to teaching, the volume of research informed teaching incorporated, the module leader training and development, staffing (which includes salary offered and the staff–student ratio as this relates to the capacity

available), spend on facilities and the level of module administrative support provided. Interview evidence supported the relationship between staff experience and preparation demands. For example, one teaching-focused participant explained that preparing new teaching required substantial time and observed that “newer (less experienced) people need longer”. This informed the representation of staff qualifications and experience, preparation time and classroom activity within the causal structure.

The second component relates to the quality of the assessment and feedback (A&F) processes which is an umbrella term that refers to the quality of the assessment itself and also all of the administration of the assessment and this impacts the NSS/PTES scores. This variable is positively impacted by the module leader capability, the amount of time made available to lead the module and the amount of support provided to the students regarding their assessment and feedback. It is negatively impacted by the marking load (which is impacted by the number of students and the number of assessment pieces) and the number of markers on the module (also impacted by the marking load). The decisions that are made within the second component which impact the quality of the assessment and feedback processes relate to the module leader workload allocated, module leader training and development and the decisions about the assessment strategy. Participants also described workload as a finite capacity that generated trade-offs between activities. One participant reported that periods of intensive teaching involved “18/19 h per week” and had “squashed out PL work”. The CLD therefore treats workload allocation as a constraint on the time available for teaching preparation and leadership rather than simply as an independent input. The negative relationship between student numbers, marking pressure and the capacity to sustain feedback was also visible in the interview data. One participant reflected that “marking online went well for 40 students (wouldn’t want to do for 200)”. This illustrates the capacity mechanism represented in the CLD: increases in assessment volume can place pressure on the time and resources available for assessment and feedback.

CLD contains both reinforcing and balancing feedback structures. Seven reinforcing loops (R1–R7) describe mechanisms through which investment, capability and learning and teaching quality can become self-reinforcing, while two balancing loops (B1–B2) represent capacity constraints associated with enrolment growth. A further financial balancing loop (B3) is shown where the expenditure consequence of staff investment is explicitly represented. These loops are described below (Table 4).

The first feedback loop, labelled R1 on the CLD, is a reinforcing feedback loop that shows that the amount of time available to lead the module will have a positive impact on the module organisation (as the academic has more time to spend on module leadership); this positively impacts the module rating and thus the NSS/PTES scores which feed directly into the league table position and impacts attractiveness to students, therefore increasing enrolment and revenue and thereby the subsequent surplus that can be reinvested in the form of workload allocation.

The second feedback loop, labelled R2 on the CLD, is another reinforcing feedback loop that shows that the workload allocated to teaching, and in particular to the amount of time available to lead the module, will have a positive impact on the quality of the assessment and feedback processes and thus the NSS/PTES scores which feed directly into the league table position and impact attractiveness to students, therefore increasing enrolment, revenue and the subsequent surplus that can be reinvested in the form of workload allocation.

The third feedback loop, labelled R3 on the CLD, is again a reinforcing feedback loop and this loop shows that the module leader capability will have a positive impact on the module organisation which positively impacts the module rating and thus the NSS/PTES

scores which feed directly into the league table position and impacts attractiveness to students therefore increasing enrolment, revenue and thereby the subsequent surplus that can be reinvested in staff salaries thereby enabling the HEI to recruit more qualified and experienced staff who are likely to have more capability in the role as module leader.

Table 4. Feedback loops in the simplified CLD (authors' own work).

Loop	Sequence	Type
R1	ML time → organisation → module rating → NSS/PTES → attractiveness → enrolment → revenue → surplus → workload	Reinforcing
R2	ML/workload time → A&F quality → NSS/PTES → attractiveness → enrolment → revenue → surplus → workload	Reinforcing
R3	ML capability → organisation → module rating → ... → salary investment → capability	Reinforcing
R4	ML capability → A&F quality → ... → salary investment → capability	Reinforcing
R5	Staff capability → classroom quality → module rating → ... → salary investment → capability	Reinforcing
R6	Learning environment → classroom quality → module rating → ... → facilities investment	Reinforcing
R7	Teaching workload → preparation time → classroom quality → module rating → ... → teaching investment	Reinforcing
B1	Enrolment → SSR → classroom quality → module rating → NSS/PTES → attractiveness → enrolment	Balancing
B2	Enrolment/student numbers → marking load → A&F quality → NSS/PTES → attractiveness → enrolment	Balancing
B3	Surplus → staff investment/expenditure → staff cost → surplus	Balancing

The fourth feedback loop, labelled R4 on the CLD, is a reinforcing feedback loop that shows that the module leader capability will have a positive impact on the quality of the assessment and feedback processes and thus the NSS/PTES scores which feed directly into the league table position and impact attractiveness to students, therefore increasing enrolment and revenue and thereby the subsequent surplus that can be reinvested in staff salaries, thereby enabling the HEI to recruit more qualified and experienced staff who are likely to have more capability in the role as module leader.

The fifth feedback loop, labelled R5 on the CLD, is a reinforcing feedback loop that shows that the quality of classroom activity will have a positive impact on the module rating and thus the NSS/PTES scores which feed directly into the league table position and impact attractiveness to students, therefore increasing enrolment and revenue and thereby the subsequent surplus that can be reinvested in staff salaries, thereby enabling the HEI to recruit more qualified and experience.

The sixth feedback loop, labelled R6 on the CLD, is the last reinforcing feedback loop and it shows that the learning environment will enhance the quality of classroom activity which has a positive impact on the module rating and thus the NSS/PTES scores results which feed directly into the league table position and impact attractiveness to students, therefore increasing enrolment and revenue and thereby the subsequent surplus that can be reinvested into HEI facilities.

The seventh feedback loop is a reinforcing loop linking teaching workload allocation to preparation time and classroom quality. Greater investment in academic staffing increases the workload capacity available for teaching, which increases the amount of time available to prepare classroom activities. Greater preparation time contributes positively to the quality of classroom activities, which improves the module rating and subsequently

NSS/PTES performance. Improved performance supports league-table position and institutional attractiveness, which influence student enrolment and revenue. Increased revenue can generate additional surplus for reinvestment in academic staffing, thereby increasing the teaching workload capacity available and completing the reinforcing loop.

There are also three balancing loops as identified below: B1 represents a capacity constraint associated with student growth. An increase in institutional attractiveness can increase student enrolment. Unless staffing capacity increases proportionately, higher enrolment increases the actual staff–student ratio. A higher staff–student ratio negatively affects the quality of classroom activities, reducing the module rating and subsequently NSS/PTES performance. Lower performance weakens league-table position and institutional attractiveness, thereby constraining subsequent enrolment growth. The loop therefore counteracts unconstrained growth and represents a balancing mechanism within the system. B2 represents a second capacity constraint operating through assessment. Higher student enrolment increases the number of students requiring assessment. Holding the assessment design constant, an increase in student numbers increases marking load. Higher marking load negatively affects the quality and/or timeliness of assessment and feedback processes, thereby reducing NSS/PTES performance. Lower NSS/PTES performance can weaken league table position and institutional attractiveness, constraining future student enrolment. This forms a balancing loop in which growth creates additional assessment pressure that can subsequently limit the conditions supporting further growth. B3 represents the immediate financial constraint on reinvestment. A larger surplus enables a greater fraction of resources to be invested in academic staffing. Increased staffing expenditure, however, increases institutional staff costs and therefore reduces the surplus remaining for further investment. The loop is balancing because the financial consequence of additional staffing limits the extent to which reinvestment can continue indefinitely.

This CLD shows that the NSS/PTES scores are impacted by the following KPIs: module rating (which is impacted by the module organisation and teaching on the course ratings) and the quality of assessment and feedback processes. The policy levers that influence these KPIs and subsequently the NSS/PTES scores are: workload allocated to teaching, amount of time available to prepare the classroom activities, staff qualifications and experience (impacted by salary offered), the staff–student ratio, the learning environment, module leader training and development, amount of time available to lead the module, level of module administrative support provided, the assessment and feedback support provided and the number of markers on the module. Administrative support was similarly identified as enabling effective delivery; a participant described it simply as “essential to have had the admin support.” This supports its inclusion as a policy lever affecting module organisation and the assessment/feedback process. Thus, there are a considerable number of decisions that can be made to enhance the NSS/PTES scores, but whichever policy levers are used they all fundamentally depend upon financial investment to provide the time and support necessary.

4.3. Higher Education Components and Activities

The VSM interpretation (Figure 4) reframes the learning and teaching sector as a viable organisational system. System 1 consists of the primary operational activities through which value is produced. This includes activities such as teaching/delivery, assessment and feedback, and student support. System 2 represents the coordination mechanisms that prevent operational conflict, such as timetabling, assessment calendars, quality assurance cycles, and module and/or programme level processes. System 3 represents the internal control function through which resources are allocated, and operational performance is managed, including workload models, staffing decisions, facilities investment, and module

leadership support. System 3* provides monitoring and audit through module evaluations, NSS/PTES data, workload monitoring, and quality reviews. System 4 represents the intelligence and adaptation function, scanning the external environment and interpreting changes in policy, student expectations, competitor behaviour, and pedagogic practice. System 5 provides policy, identity, and strategic coherence by balancing the immediate operational demands of System 3 with the future-oriented intelligence of System 4.

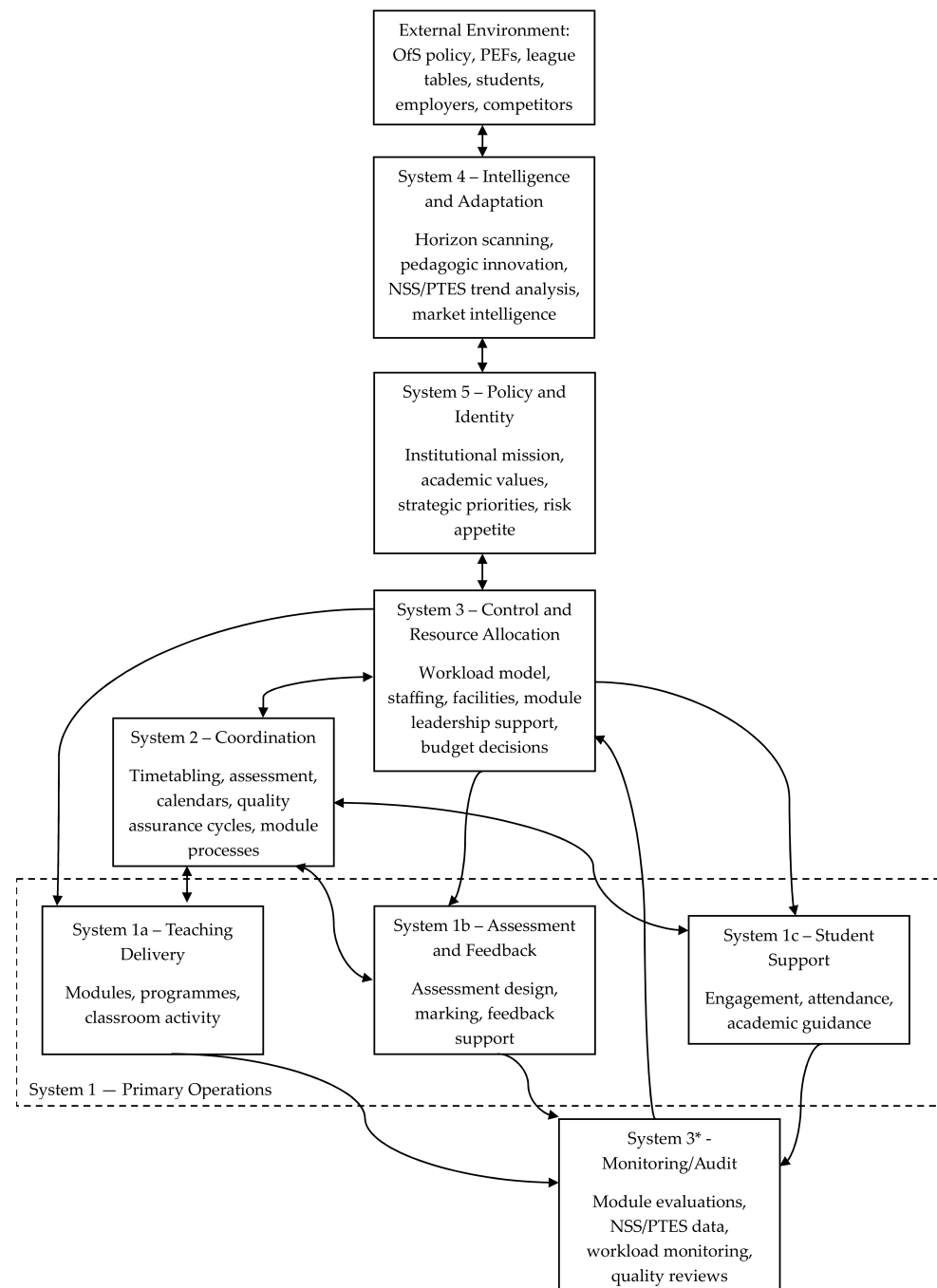


Figure 4. Viable system model diagnosis (authors' own work). System 3* denotes the supplementary monitoring/audit channel associated with System 3; it is not an additional numbered system.

This VSM diagnosis complements the CLD by showing that although policy resistance may arise from feedback loops and delays, weaknesses in organisational viability could also contribute to such resistance. For instance, if System 4 intelligence is weak, the institution may respond reactively to NSS/PTES outcomes rather than proactively redesigning

learning and teaching practices. If System 2 coordination is weak, module-level decisions may create inconsistency across programmes. If System 3 resource allocation is overly short-term, workload, staffing, and facilities decisions may undermine the very quality indicators they are intended to improve. The VSM therefore supports the evaluation of organisational capacity to absorb external complexity and translate it into coherent, adaptive decision-making.

In practical use, the VSM can be applied as a diagnostic checklist to recurring institutional decisions such as enrolment target-setting and workload allocation. For each decision, the HEI can identify the relevant System 1 operational units, the System 2 coordination mechanisms, the System 3 resource decision, the System 3* monitoring evidence, the System 4 forward-looking intelligence and the System 5 policy criterion. Missing or weak connections then become explicit redesign requirements rather than remaining general statements about organisational complexity. For the case institution, the diagnosis directs particular attention to the interface between System 3 resource allocation and System 4 intelligence: enrolment growth and performance ambitions need to be incorporated into workforce and workload planning before capacity problems appear in lagged NSS/PTES indicators.

4.4. Higher Education Decision System and IFR

The IFR provides a useful design heuristic for interpreting the implications of the analysis. Rather than asking only how existing policy levers can be adjusted, IFR encourages consideration of what the learning and teaching decision system would ideally achieve if core benefits could be delivered with minimal unintended negative consequences or additional cost. In this study, the ideal decision system would maintain or improve the quality of classroom activity and assessment/feedback, while avoiding unsustainable increases in workload, erosion of staff morale, or delayed reactive responses to external performance indicators. This does not imply that constraints can be eliminated. Instead, it provides a structured pathway for identifying contradictions within the current system. The need to increase quality while reducing cost, to grow enrolment while maintaining staff–student interactions, and to respond to external performance frameworks while preserving academic values are a few instances of such tensions. IFR therefore extends the QSD findings by supporting the identification of design principles for more adaptive and sustainable learning and teaching policy. The tensions used in the IFR analysis were not treated as additional interview themes. They were derived from trade-offs visible in the CLD and constraints identified through the VSM interpretation. For example, the CLD shows that enrolment can increase revenue while simultaneously increasing staff–student ratios and marking pressure; workload allocation constrains the time available for preparation, module leadership and assessment/feedback; and lagged NSS/PTES outcomes create a tension between retrospective performance information and the need for timely intervention. Each identified tension was then reformulated as an ideal functional statement and translated into a possible intervention implication, as shown in Table 5.

In the case studied, this IFR framing translates into a specific decision requirement around enrolment and workload. The CLD indicates that increases in student numbers raise staff–student ratios and marking pressure, while participants also identified limits to the time available for teaching preparation, module leadership and assessment activity. Accordingly, enrolment growth decisions should not be considered solely in relation to projected revenue but should be accompanied by an explicit assessment of staffing capacity, marking workload, module leadership time and administrative support. This provides a case-specific application instance of the IFR principle of pursuing growth while avoiding deterioration in classroom and assessment/feedback quality.

Table 5. IFR framing for UK HEIs (authors' own work).

Current Tension in the System	IFR Framing	Possible Implication
Improving NSS/PTES often requires more staff time, yet staff time is constrained.	High-quality feedback and support are achieved without unsustainable workload increases.	Redesign assessment, feedback timing, use of feedback, feedforward, and administrative support.
Module leaders need capability; however, training and workload support are uneven.	Module leadership quality improves without relying only on individual goodwill.	Embed module leadership development into workload and quality processes.
Student enrolment increases revenue yet also increases staff–student ratio pressure.	Growth occurs without degrading classroom quality or assessment feedback.	Link recruitment targets staffing, facilities, and learning support capacity.
PEF results are delayed, encouraging reactive decisions.	Performance intelligence is available early enough to support timely intervention.	Develop leading indicators before NSS/PTES publication.
Resource allocation is financially driven.	Investment decisions account for long-term teaching quality, reputation, enrolment, and sustainability.	Use CLD/VSM outputs to assess systemic consequences of savings decisions.

5. Discussion

The findings suggest that learning and teaching decision-making in HEIs is influenced by more than isolated managerial choices. Decisions are embedded in a dynamically complex environment in which market pressures, performance evaluation frameworks, stakeholder expectations, resource constraints and delayed outcome measures interact over time [18–21,32]. This supports the argument that HEIs should not be treated as simple administrative systems where policy inputs produce direct and predictable outcomes. The Systemigram demonstrates that learning and teaching outcomes are produced through chains of interaction entailing institutional attractiveness, enrolment, income, workload, staff capacity, classroom quality, assessment and feedback, with delayed external indicators. This clarifies why interventions that may seem rational locally generate unintended consequences at the system level [12,20,21]. The causal interpretation developed through CLD corroborates this. This finding is consistent with previous System Dynamics research in higher education, which has similarly shown that institutional performance emerges from interacting resource, staffing, student and performance relationships rather than isolated policy variables [40,42,47,50]. Decisions such as reducing staff costs, increasing student recruitment, changing assessment practices or investing in facilities may have delayed and non-linear effects. These decisions can temporarily improve one performance concern, while weakening another part of the system [20,42]. For instance, short-term financial savings may reduce staff capacity and morale, which later affects teaching quality, feedback timeliness, student satisfaction, and institutional reputation [40]. The utility of the CLD is therefore that it makes visible the feedback structures through which policy resistance may emerge [20,29]. This is important since performance frameworks can encourage institutions to respond to measured outcomes after delays have already occurred, rather than addressing leading indicators and structural causes [7].

However, the analysis also indicates that dynamic complexity alone does not fully explain institutional policy resistance. The VSM assessment can suggest that organisational viability is also of importance. Issues in coordination, intelligence or policy coherence may amplify the effects of feedback delays. For instance, if System 2 coordination is weak, local module or programme decisions may create inconsistency in assessment, feedback or student support. If System 3 resource allocation is dominated by short-term financial control, operational decisions may undermine the learning and teaching quality they are intended

to protect. If System 4 intelligence is underdeveloped, the institution may react to external performance results instead of approximating changes in student expectations, competitor behaviour, regulatory priorities, or learning and teaching practices. Therefore, improving decision-making requires both more improved appreciation of feedback structures and stronger organisational capacity to absorb and respond to complexity.

The IFR analysis shows that many learning and teaching problems are suffering from institutional tensions. HEIs are expected to improve quality, and at the same time reduce cost and increase responsiveness, yet avoid workload expansion. These tensions cannot be resolved by performance monitoring alone. They need design thinking about how benefits can be achieved with fewer negative side effects. As an example, improving feedback quality may require redesigning assessment and feedforward processes instead of asking staff to provide more individualised feedback. Similarly, improving student outcomes may need earlier leading indicators rather than waiting for delayed external survey or league-table results.

The enrolment–capacity relationship identified in the case is consistent with earlier System Dynamics work in higher education showing that student growth can place pressure on staffing and infrastructure [32,40]. The present study extends that reasoning by tracing the pressure through staff–student ratios, classroom quality and assessment/feedback processes to NSS/PTES and subsequent institutional attractiveness.

The workload and staff-capacity mechanisms also align with prior work linking workload, morale, performance and staff retention [40,46]. In the present case, these mechanisms are connected explicitly to learning and teaching performance and to the financial reinvestment structure, demonstrating why apparently efficient resource reductions can generate delayed adverse performance effects.

The additional contribution of the multimethod design is to distinguish three analytically different sources of difficulty; the CLD exposes dynamic causal structure, the VSM identifies organisational capacity and coordination weaknesses, and IFR translates these findings into design requirements. The methods therefore provide complementary rather than interchangeable explanations, consistent with systems-methodological pluralism in which different approaches highlight different dimensions of complexity [38,57,58].

Overall, the contribution of the study lies in demonstrating how a multimethod systems approach can provide a richer understanding of HEI learning and teaching decision-making than a single method alone. The Systemigram contextualises the problem situation, CLD explains the feedback structure, VSM diagnoses organisational viability, and IFR supports design-oriented reflection on institutional contradictions. This multimethod systemic assessment highlights that sustainable improvement in learning and teaching requires attention to performance outcomes, as well as the feedback, delays, resource dependencies and organisational functions that produce those outcomes over time.

Study Limitations

A limitation of the study is that the models are conceptual and qualitative. The study provides a structured systemic interpretation as opposed to a statistically validated or simulated model. This is appropriate for surfacing feedback, delays, contradictions and organisational pathologies, particularly where data are incomplete or where the purpose is problem structuring. Nevertheless, the findings should not be interpreted as proving causal strength or predicting the magnitude of effects. Further work could validate the causal loop diagram with a wider group of stakeholders, compare interpretations across different types of HEIs, and develop selected stock-flow diagrams (SFDs) where appropriate data are available. A further limitation is that the models simplify institutional reality. Although

this is unavoidable in systems modelling, the diagrams should be treated as learning and decision-support systems, instead of complete representations of the HEI system.

6. Conclusions

This paper has examined learning and teaching decision-making in UK higher education as a dynamically complex organisational problem. The study shows that HEI performance outcomes are influenced by interacting feedback loops, delays, resource constraints, stakeholder pressures, and organisational viability conditions. The analysis suggests that policy resistance can occur when institutions respond to symptoms, such as declining satisfaction or performance indicators, without addressing the underlying feedback structures and organisational capacities that generate those outcomes.

For UK HE practice, four implications follow. First, workload models should incorporate the actual drivers of learning and teaching demand, including cohort size, assessment design, module leadership, administrative support and pedagogic complexity, rather than relying primarily on coarse workload units. Second, student-recruitment targets should be approved alongside explicit staffing, facilities and learning-support capacity assessments. Third, HEIs should supplement lagged NSS/PTES and league-table outcomes with leading indicators that permit intervention before external results are published. Fourth, recurring resource and policy decisions should be reviewed using an explicit systemic decision framework that tests their consequences across teaching quality, workload, staffing capacity, financial sustainability and future performance.

The study demonstrates the value of a multimethod systems approach in examining complex higher education systems. The Systemigram provides a narrative representation of the problem context, QSD identifies causal relationships and feedback loops, VSM highlights the organisational functions required for viability, and IFR frames the contradictions that have to be examined in designing more sustainable interventions. The findings imply that HEIs need to strengthen leading KPIs, coordination mechanisms, environmental intelligence, and long-term policy coherence to improve learning and teaching outcomes, without creating unintended negative consequences.

Future research pathways may include testing and refining the proposed models with wider institutional stakeholders and examining whether selected parts of the causal structure can be developed into SFDs. This would allow specific policy scenarios, such as changes to workload allocation, student recruitment, assessment design or investment decisions, to be explored more systematically.

Author Contributions: Conceptualisation, A.R.; methodology, A.R. and A.H.-F.; software, A.R.; validation, A.R. and A.H.-F.; formal analysis, A.R. and A.H.-F.; investigation, A.R.; resources, A.R.; data curation, A.R.; writing—original draft preparation, A.R. and A.H.-F.; writing—review and editing, A.R. and A.H.-F.; visualisation, A.R. and A.H.-F.; project administration, A.R. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Social Sciences, Arts, and Humanities ECDA of University of Hertfordshire, UK (protocol code BUS/PGR/UH/03233, 1 September 2017).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Qualitative interview data were generated and analysed in this study. Full interview transcripts are not publicly available because of participant confidentiality and ethical restrictions. Derived, de-identified coding summaries may be available from the corresponding author on reasonable request, subject to institutional and ethical approval.

Acknowledgments: The authors wish to acknowledge the valuable contributions of Reda Lebcir to this study. Sadly, Reda passed away before the submission of this paper. During the preparation of this manuscript, the authors used OpenAI, GPT-5.6, for the purposes of language checking. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following key abbreviations are used in this manuscript:

A&F	Assessment and Feedback
CLD	Causal Loop Diagram
CPD	Continuing Professional Development
GOS	Graduate Outcomes Survey
HEFCE	Higher Education Funding Council for England
HEI	Higher Education Institution
IFR	Ideal Final Result
KEF	Knowledge Exchange Framework
KPI	Key Performance Indicator
LT	League Table
OfS	Office for Students
PEF	Performance Evaluation Framework
PMS	Performance Measurement System
PRES	Postgraduate Research Experience Survey
QSD	Qualitative System Dynamics
REF	Research Excellence Framework
SD	System Dynamics
SFD	Stock-Flow Diagram
SSR	Student–Staff Ratio
ST	Systems Thinking
TEF	Teaching Excellence Framework
T&D	Training and Development
VSM	Viable System Model

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