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Applying VSM, SSM, and SAST for problem-structuring and problem-solving in health systems

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Abstract
Systems thinking can lend a powerful perspective for problem-structuring and problem-solving in health systems. Systems methodologies can serve to articulate assumptions rooted in mental models and individual values and help in facilitating convergence of viewpoints between differing stakeholders in an inclusive and participative manner. This paper presents a case-study where three systems methodologies – VSM, SSM and SAST – were used sequentially in the UK NHS to bring about value-based consensus between managers and clinicians overcoming legacy differences. The discussions highlight the contribution systems methodologies can make in unearthing causes of organisational dissonance, misaligned priorities, and deep-rooted conflict, and how such challenges can be resolved by working towards a higher-order stakeholder convergence through the application of certain systems methodologies in a creative and flexible manner. The discussions presented emphasise the importance of problem-structuring as an essential step before problem-solving. It is also argued that the former needs to flow through an intervention as an iterative process and that problem-structuring should not be regarded as a one-time activity. Learnings presented in this paper can be of equal value for systems and healthcare researchers and practitioners. This intervention can be located within the ambit of Holistic Flexibility, a recently introduced conceptual lens in systems thinking.

Keywords: Systems Thinking, VSM, SSM, SAST, NHS, Managers, Clinicians, Healthcare

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1. Introduction

Effective health systems management can lead to better healthcare outcomes. Mutual understanding and collaboration on purpose and goals between managers and clinicians is crucial in this context. This paper narrates an intervention that deploys three systems methodologies – Viable System Model (VSM), Soft Systems Methodology (SSM) and Strategic Assumption Surfacing and Testing (SAST) – for problem-structuring and problem-solving to overcome interpersonal differences between managers and clinicians to achieve strategic convergence in the National Health Service (NHS), UK.

The paper will start with an orientation to problem-structuring and problem-solving and highlight how problem-structuring methods can support better understanding of situations. This will be followed by a literature research that sets the context for the importance of a healthy relationship between managers and clinicians with specific reference to the NHS. The background to the intervention will be presented next that calls for problem-structuring and problem-solving, followed by a logic to the choice of the methodologies adopted. A narration of the intervention will then be provided that leads to the arrival of the intended outcome. The paper will close by highlighting the contribution of this research, its limitations, and avenues for future research.

Note that the terms, "project" and "intervention", have been used interchangeably in this paper.

2. Problem-structuring and problem-solving

Understanding of a problem from various dimensions and from the perspective of different stakeholders is necessary for effective problem-solving; problem-solving interventions can be futile if the problem itself being tackled is incomplete and driven by a singular perspective (Ackoff, 1979; Checkland, 1981; Chowdhury, 2019a; Eden, 1982; Flood & Jackson, 1991; Jackson, 1987, 2000, 2003, 2019, 2020; Mingers, 1992; Mingers & Rosenhead, 2004; Rittel & Webber, 1973; Rosenhead, 1986, 1989; Rosenhead & Mingers, 2001; Rosenhead & Thunhurst, 1982). Problem-structuring is a necessary first step for problem-solving in situations where there are multiple stakeholders, there are differences in worldviews with hidden power-dynamics, and where simplistic agreements are not possible.

Problem Structuring Methods (PSM) refer to approaches that bring together a range of systems methodologies and tools to understand complex situations that have a variety of intervening elements and intentions — both overt and covert — that demand immersive investigation, flexibility, and iteration (Rosenhead, 1989). PSMs are inclusive, participative, iterative, and they have the potential to permit identification of local improvements by merging various interests rather than proposing a global solution (Mingers & Rosenhead, 2004). PSMs offer the possibility of integrating both hard and soft data to achieve solutions that satisfice on separate dimensions rather than creating trade-offs. Therefore, PSMs require a combination of technical, institutional, and heuristic understanding (Murphy, 2005).

Problem-solving exercises preceded by PSMs need to embrace reflection and learning through its process considering that situations are always changing and solutions arrived-at in a particular context and time may not be relevant for a different context and time. Therefore, problem-structuring should not be treated as a stand-alone step. Rather, it should be seen as an ingrained characteristic of the problem-solving process. Flexibility and adaptiveness are central to this journey (Chowdhury, 2019a; Jackson, 2009, 2019, 2020; Snowden, 2015; Sushil, 2015; Taket & White, 2000).

3. Setting the context

The case, presented in this paper, is based on a Primary Care Trust (PCT) affiliated to the NHS (details in the next section). The NHS is the publicly funded healthcare service-provider in the UK covering the full range of primary, secondary, and tertiary care and includes services in mental health, ambulance, and social/community care.

Considering the scale and scope of the NHS, the UK Department of Health (DoH) inculcated general management principles during the 1980s following the Griffiths Report (1983) to introduce effectiveness and efficiency in the system aiming at more streamlined care delivery and patient outcomes. General management principles were introduced to corporatise the NHS with initiatives such as organisational structuring, goal setting, resource optimisation, optimal costing, division of responsibilities, performance management, and a division of decision-making powers between managers and clinicians (Chowdhury, 2019a; Enok & Markwell, 2010). The changes brought about a shift in power-balance that was

previously in favour of clinicians to one that was more divided and organisation-wide; the call was to establish distributed leadership between networks of smaller organisations and professionals at different levels (Rowling, 2011). Success in delivering satisfactory health outcomes in such situations depend on teamwork, interdependency, and collaboration (Akel & Elazeem, 2015; Atun, 2003; Tosanloo et al., 2019) and requires professionals to think beyond their previously narrowly defined job boundaries (Crosson, 2003). However, differences soon began to surface between managers and clinicians because they were driven by different purposes and mental models: Clinicians have an "individualistic focus" to deliver patient care and managers take a "broader perspective" of optimising the organisation (Chowdhury, 2019b; Enok & Markwell, 2010). Such conditions have often resulted in conflict between both the factions, negatively impacting the functioning of the NHS as a health system (Akel & Elazeem, 2015; Atun, 2003; Chowdhury, 2019a, 2019b; Demir & Kasapoğlu, 2008; Elfering et al., 2017; Francis, 20003; Granter & Hyde, 2010). A public inquiry, chaired by Francis (2003), reported growing rifts between managers and clinicians in the NHS and presented an urgent appeal to bridge the same. New management frameworks were frequently introduced and the managers' constant perusal with clinicians to work within the same are attributed to red-tape and declining quality of care (Brooks, 2006). This is aggravated by constant organisational change that the NHS commonly goes through, causing confusion and inconsistencies in the system; further, tracking the myriad of initiatives leads to focus on actual patient care taking a back seat and frustration amongst professionals (Chowdhury, 2019b; Granter & Hyde, 2010).

High stress on the job coupled with a variety of stakeholders often lead to conflict and an undesirable atmosphere at various levels in health systems (Berman-Kishony, 2011; Chipps et al., 2013; Forte, 1997; Guidroz et al., 2011; Patton, 2014; Shin, 2009). Stress further leads to reduced focus, memory lapses, low resilience to emotional setbacks, and poor body vitals (Forte, 1997). Care delivery can gravely suffer at the hands of professionals going through such challenges. Given the harm that conflict between managers and clinicians can potentially bring to healthcare outcomes, it is important that both groups work in unison with common alignment to purpose and goals. Both clinicians and managers need one another for effective functioning of a health system that is as large in size and as diverse in service provision as the NHS. Dr Gill Morgan, past CEO of the NHS Confederation, says: *"Doctors and managers have different but complementary*

roles and perspectives. Both are valid and both are crucial to delivering high quality patient care" (Enok & Markwell, 2010). Whereas clinicians need managers to resolve the complexity of the working environment that have organisational, social, political, and technological dimensions, managers need doctors because doctors are the vehicle of healthcare delivery (Cooper, 2007). A healthy manager-clinician relationship is central to ensuring the effective functioning of a health system and delivery of quality health outcomes. It is important that their worldviews merge towards a common purpose beyond divisions, interpersonal clashes, and misplaced priorities.

4. Background to the case

The author led the intervention presented in this paper. References will be drawn from works in selected works that report the methodologies used in the intervention in parts (Chowdhury, 2007; Chowdhury, 2019b,c; Chowdhury & Nobbs, 2008). This is the first research where the complete intervention has been brought under one roof and an argument has been presented on how three systems methodologies can together make a higher-level contribution to health systems. For the detailed case-studies, the reader should refer to Chowdhury (2019b,c).

PCTs were the erstwhile health services and social care delivery arm of the NHS that were responsible for specific geographical areas; they played the role of the last-mile delivery agencies. During the 2003–2006, the author was engaged with the Ferens PCT (pseudonym used for the sake of anonymity), based in the East of England. The author's engagement involved playing a lead role in designing of an Information Systems (IS) strategy for Ferens PCT that would enable better knowledge management in the Trust. This project was part of a larger initiative called Connecting for Health (CfH) initiated by the DoH that was being implemented to digitise the entire healthcare administration and care pathway under one mega system. The DoH had given considerable autonomy to local Trusts to adopt strategies tailored to their local requirements to implement the CfH initiative. The envisioned IS strategy for Ferens PCT would enable the CfH implementation at the local level.

The ground realities displayed the challenges presented in the previous section. There were multiple participants in Ferens PCT – both managerial and clinical (referred to as "key stakeholders" from here-on) – and there were significant overlaps, confusions, and misaligned priorities between them. The atmosphere was

buoyant with trust deficit and clinicians' resistance to the smooth implementation of the CfH initiative. Further, the problem-situation (why CfH was being implemented) was not well-defined (i.e., it was not clear why the CfH was being implemented in the first place). Finally, the atmosphere was dense with conflicting interpersonal dynamics and difference of opinions between the key stakeholders.
It was realised that the project mandate to design an IS strategy for Ferens PCT was remote and esoteric, given that the challenges rested at a more fundamental level. There were two emerging requirements in the Ferens PCT:

> **Problem-structuring:** Understanding the system-in-focus and aligning the key stakeholders to arrive at a consensus on the need for a local-level IS strategy.
> **Problem-solving:** Creating the IS strategy through a participative process achieving convergence of key stakeholders' worldviews.

Approval was sought and obtained from the project sponsors for an intervention that would address the above requirements.

5. Methodological choice

The System of Systems Methodologies (SOSM) (Jackson, 1999, 2000, 2003, 2006, 2019; Jackson & Keys, 1984) was used as the overall framework to decide on the methodological choice for the intervention. The SOSM aligns an array of systems methodologies in two axes: nature of the system (y-axis) and the relationship between participants (x-axis); see figure 1.

The SOSM presents six "ideal-types". In the x-axis, if participants have shared values and understanding, they are in a unitary relationship. If they have differences to the extent that they are still able to stand in unison for the system to function as a cohesive entity, they are in a pluralist relationship. If participants display divergence and power dynamics that are irreconcilable, they are in a coercive relationship. Coming to the systems dimension, if the parts of the system are limited, easily identifiable and have predictable interactions, it is a simple system. If there are multiple parts, outcomes of interactions of which can still be predicted and planned for, it is a complicated system. In case the elements increase multifold and give rise to complex interactions and unpredictable consequences, it is a complex system.

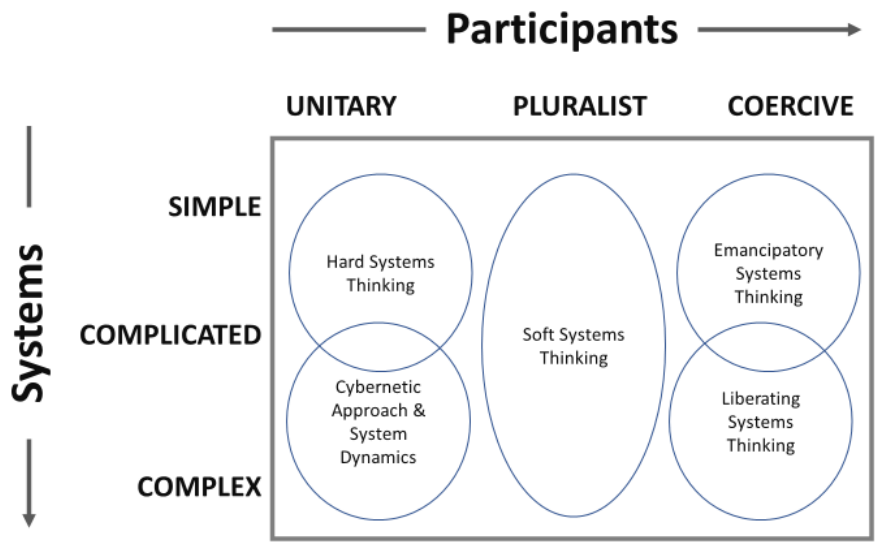

Figure 1: System of Systems Methodologies (adapted from Jackson, 2019; p. 757)*

The methodological choices pertaining to this intervention depended on the two emergent requirements in the context. Note that details of the methodologies are provided in the next section that justify their alignment to the specific dimensions of the SOSM.

- **Problem-structuring**: Considering the confusion, overlaps, and clash of priorities in Ferens PCT, a thorough understanding of the organisation structure and key stakeholder roles were necessary. Due to the realities of the NHS, the problem situation was considered in the complex-unitary dimension. The Viable System Model (VSM) was adopted for this step. Initial research (discussed in the next section) indicated that although the key stakeholders had different opinions, they could still stand together for the system to function as a cohesive entity if clarity and vision alignment were established. Hence, the situation was considered in the complicated-pluralist dimension of the SOSM. The key stakeholders had to be brought in alignment for a prospective agreement on an IS strategy. This required merging of worldviews in a participative and non-intimidating setting. Soft Systems Methodology (SSM) was adopted for this step.

- **Problem-solving**: Creating the IS strategy required collaborative design. This would need a higher-level convergence of ideas that would be reflected in a strategy that would be inclusive, relevant, and sustainable. The situation was considered to be in the complicated-pluralist dimension on the SOSM. Strategic Assumption Surfacing and Testing (SAST) was adopted for this step.

6. The intervention

6.1. Viable System Model (VSM)

Pioneered by Beer (1972, 1985) and based on cybernetic principles, the VSM aids towards a structural analysis of any organisation in the "known-to-be viable state" to reveal its constituent parts and study how they interact with one another. The VSM model sets out to explain how systems are capable of independent existence due to the prevalence of fundamental laws of viability. Leonard (1999) talks about two relationships that VSM seeks address: first, the horizontal relationship that is depicted between the parts of the system or the subsystem and its adjacent environment or area of operation represented by horizontal connections of information exchange; and second, the vertical relationship that connects the various levels of management within the organisation represented by a vertical nature of information exchange and control. The system demonstrates the quality of recursiveness that indicates its ability to replicate itself within its subsystems with corresponding functionalities with respect to differing levels of complexity. The complexity decreases as one moves from the larger system to its constituent subsystems. A VSM analysis recommends three levels of recursion study.

6.1.1. VSM of the Ferens PCT

VSM was used as a diagnostic model to study the Ferens PCT for its organisational structure and communication patterns that had a direct bearing on how IS was viewed by the key stakeholders. VSM follows two stages that will be elaborated below with the narration of its deployment in the Ferens PCT.

6.1.1.1. System identification: This step is meant to arrive at the system-in-focus that needs to be studied. A system identification was initiated using a combination of secondary and primary research. Tools deployed were literature research on NHS Trust organisations, interviews, Focus Group Discussions (FGD) with key stakeholders and a study of minutes of meetings (MOM) of the IS team. It is to be

noted that these tools have been clubbed under VSM here for the sake of ease in the narration; however, they were administered in the earlier stage in the research for an understanding of the on-ground situation.

Three recursion levels were identified with Ferens PCT being located in recursion level-1 as the system-in-focus. Recursion level-0, the higher-level hierarchy, was located at the regional structure of the NHS, consisting of the erstwhile Strategic Health Authority (SHA) that served as a bridge between the DoH and the local service delivery level agencies like the PCTs and other Trusts. Recursion level-2, the lower-level hierarchy, was at the subsystem level within the Ferens PCT, consisting of the functions that were performed within Ferens PCT. See Figure 2. System identification, through the recursion study, helped understanding of the system boundaries and emergent characteristics of the subsystems at identified levels.

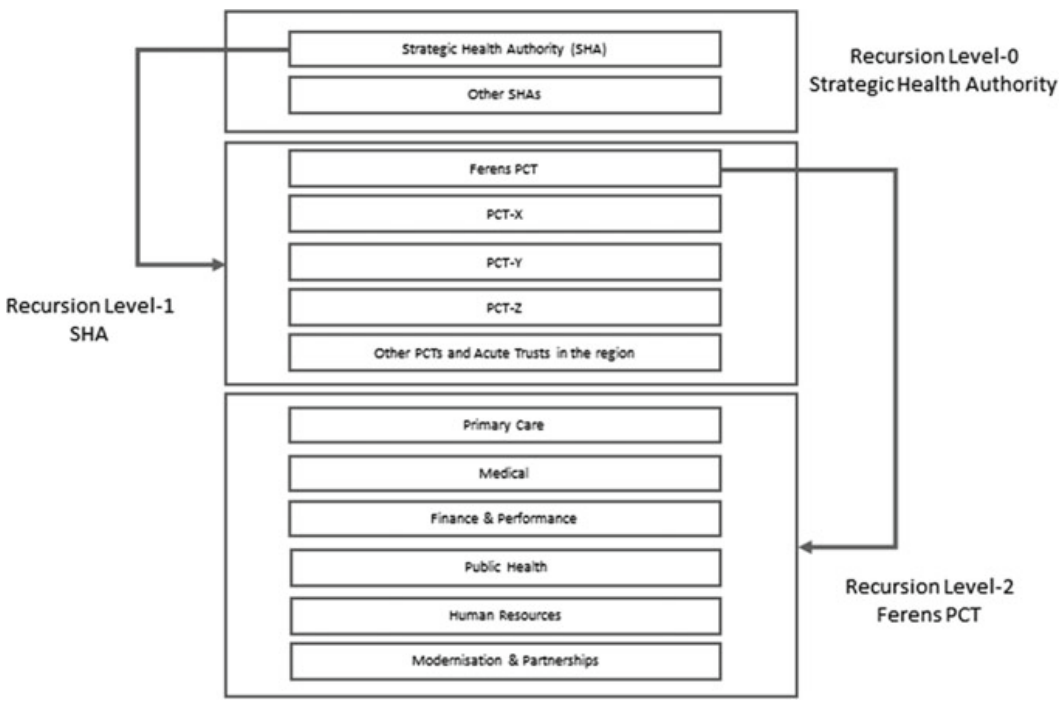

Figure 2: Recursion levels at Ferens PCT

6.1.1.2. System diagnosis: An elaborate exercise was carried out to understand the system-in-focus alongside its adjacent environment, operations, and localised management of the viable parts.

VSM identifies five subsystems:

- System-1 is the implementation system, where the actual operation of the organisation takes place. Therefore, there may be several systems-1. Each system-1 has its own responsibility and localised management that deals with its own operating environment. In Ferens PCT, this function was played by six directorates: Primary Care, Medical, Finance & Performance, Public Health, HR & Organisational Learning, and Modernisation & Partnerships.
- System-2 is the coordination system, which is responsible for maintaining a harmonious balance of functions between each system-1. Its tenets are information sharing, resources management, crisis management, and providing recommendations on course-corrections and organisational alignments. In Ferens PCT, the PCT Board and the Professional Executive Committee (PEC) jointly played this role.
- System-3 is the control system, which ensures the optimal alignment of policies and goals in the sub-systems. Its tenets are review sessions, monitoring meetings, target setting and tracking, and feedback and prioritisation. In Ferens PCT, the CEO and the Finance Director jointly played this role.
- System-4 is the development system, responsible for information passage between system-5 and the other sub-systems. It is outward focused and is in the look-out for new developments in the operating environment. Its tenets are environment scanning, research, and insights generation. This wide role was carried out by a broad set of teams – The Health Informatics System (HIS) team, the Performance Management team (which was under the Modernisation & Partnerships directorate), and Accenture (a large technology consulting company which was contracted to implement the CfH initiative, in the East of England, by the DoH).
- System-5 is the policy making and executive unit, the highest system that steers the organisation forward in a strategic manner and has a long-term view of the enterprise. Its tenets are strategic planning, organisational viability, and competitive sustenance. In Ferens PCT, the PCT Board and the PEC jointly played this role.

See figure 3 for the VSM of Ferens PCT.

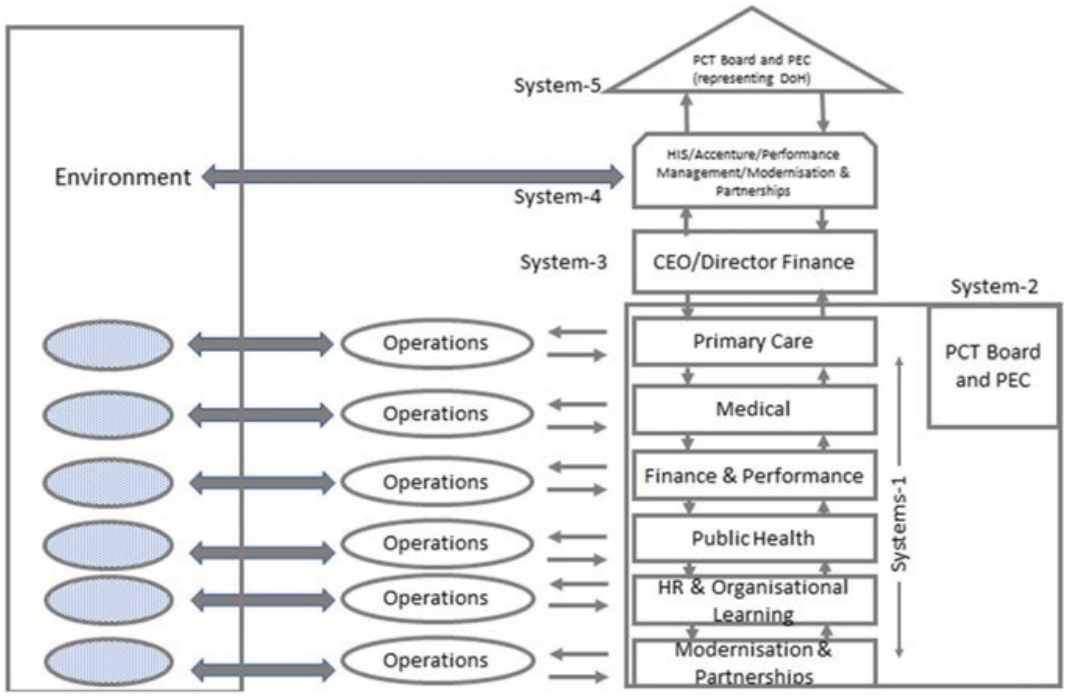

Figure 3: VSM of Ferens PCT as the "system-in-focus" at Recursion Level-1

The study revealed the structural nuances and related interpersonal dynamics in Ferens PCT in the context of the CfH initiative. Insights from the study are summarised below:

- **Lack of implementation accountability:** Out of the six directorates, not a single directorate was found to hold direct implementation responsibility for IS apart from the Performance Management team (under Modernisation & Partnerships), which had a stake in it. Due to a lack of clearly defined chain of command, there was confusion on who defined strategies, who was in control, and where accountabilities rested. Managers ended up pushing organisational goals on clinicians without understanding what counted as information. This negatively impacted clinicians' focus on healthcare delivery and bred frustration amongst the key stakeholders.
- **Coordination breakdown:** Apart from the breakdown in coordination at several levels due to lack of clarity of IS accountability, it was striking to note that there was no mention of the Regional Implementation Director (RID) from anyone in Ferens PCT. Reference to the RID was found in the literature research on NHS Trusts and CfH implementation. The RID was

appointed by the DoH and was responsible for managing interdepartmental relationships and mobilising support teams. The lack of mention of the RID showed a lack of knowledge or avoidance of acknowledgement by the participants. A breakdown of effective coordination meant that the system was at the mercy of incoherent efforts, divergent initiatives, and duplication and/or replication of work. This led to the clinicians' lack of trust in the new IS initiatives driven by the managers.

- **Lack of key stakeholder involvement:** Ferens PCT was responsible to devise an effective strategy for key stakeholder involvement and participation throughout the process of design and implementation of the CfH initiative. However, the study revealed that there was a lack of effective key stakeholder engagement and an overlooking of user-opinion during the initial stages of the initiative. This bred scepticism of the new system and caused the clinicians to resist change. Several managers also privately admitted to their frustration in the way the initiative was implemented without adequate stakeholder involvement.
- **System misalignment:** Alignment within the organisation was amiss with a confusing division of roles and responsibilities. At the highest level, the policy system was isolated and distant from on-ground realities. The policy system was unable to absorb the variety in the system due to lack of effective control and coordination mechanisms and a fundamental confusion in implementation accountability. The variety posed by the system was building up as one moved ground up from system-1 with progressive systems either being absent or ineffective. Gaps in key stakeholder engagement resulted in greater complexity. Control and coordination at the higher regional and national levels were chasing alignment parameters that were not relevant at the local level, further amplifying the variety.

The above diagnosis demonstrates the applications of the VSM in two ways (Espejo, 1989, 2003; Harnden, 1989; Jackson, 1992; Jackson & Carter, 1984) – (i) "structuralist" that seeks to understand causal processes and information exchange at the structural level; and (ii) "interpretive" that seeks to understand complex subjectivities and rich discourse of interrelationships between people.

6.1.2. Outcome of the VSM

The VSM exposed how complexity was built up in the system-in-focus from within its boundaries with organisational and interpersonal deficits, and from outside its boundaries from the regional NHS authorities and directives from the DoH. Challenges at two fundamental levels – organisational and interpersonal – were surfaced. Organisational gaps and structural inconsistencies were presented to the project sponsors constituting the six directorates and the CEO. This was followed by a workshop with the six directorates that identified areas of improvements and organisational alignments supported by an internal review mechanism for the CfH implementation. On the interpersonal gaps, it was agreed that the key stakeholders would be brought together in a participatory environment that would allow their convergence to create an IS strategy. However, there were two challenges that needed answering: (i) *why* an IS strategy was required, which is a process of reasoning rather than the process of choice-making; and (ii) *how* an IS strategy would be arrived-at, once the first challenge is addressed.

The next section elaborates the deployment of SSM to arrive at a convergence for *why* an IS strategy was required.

6.2. Soft Systems Methodology

Soft Systems Methodology (SSM) (Checkland, 1981; Checkland & Scholes 1990; Checkland & Scholes, 1999) offers a participative platform for stakeholders to bring together diverse perspectives and worldviews in an atmosphere of constructive deliberation aspiring for consensus. In IS projects, SSM does not address technical requirements or solutions but serves to address issues that may arise out of conflict of values and differing perspectives emanating out of differing worldviews (Andoh-Baidoo & Ngwenyama, 2005; Checkland & Scholes, 1999). The expert position is eradicated in the methodology as all participants receive an equal opportunity to share their understanding and establish their individual rationalities. SSM enables the appreciation of the human activity system by shifting the focus from the system per-se to the actors, all of who demonstrate purposeful activities in the system.

6.2.1. SSM with key stakeholders in the Ferens PCT

SSM is a seven-stage methodology that will be elaborated with the following narration of its deployment in the Ferens PCT. Participants are engaged in creative process of deliberation and discussion shifting their minds from the “real world” to

the "systems thinking about the real world" and back to the "real world"; see figure 4.

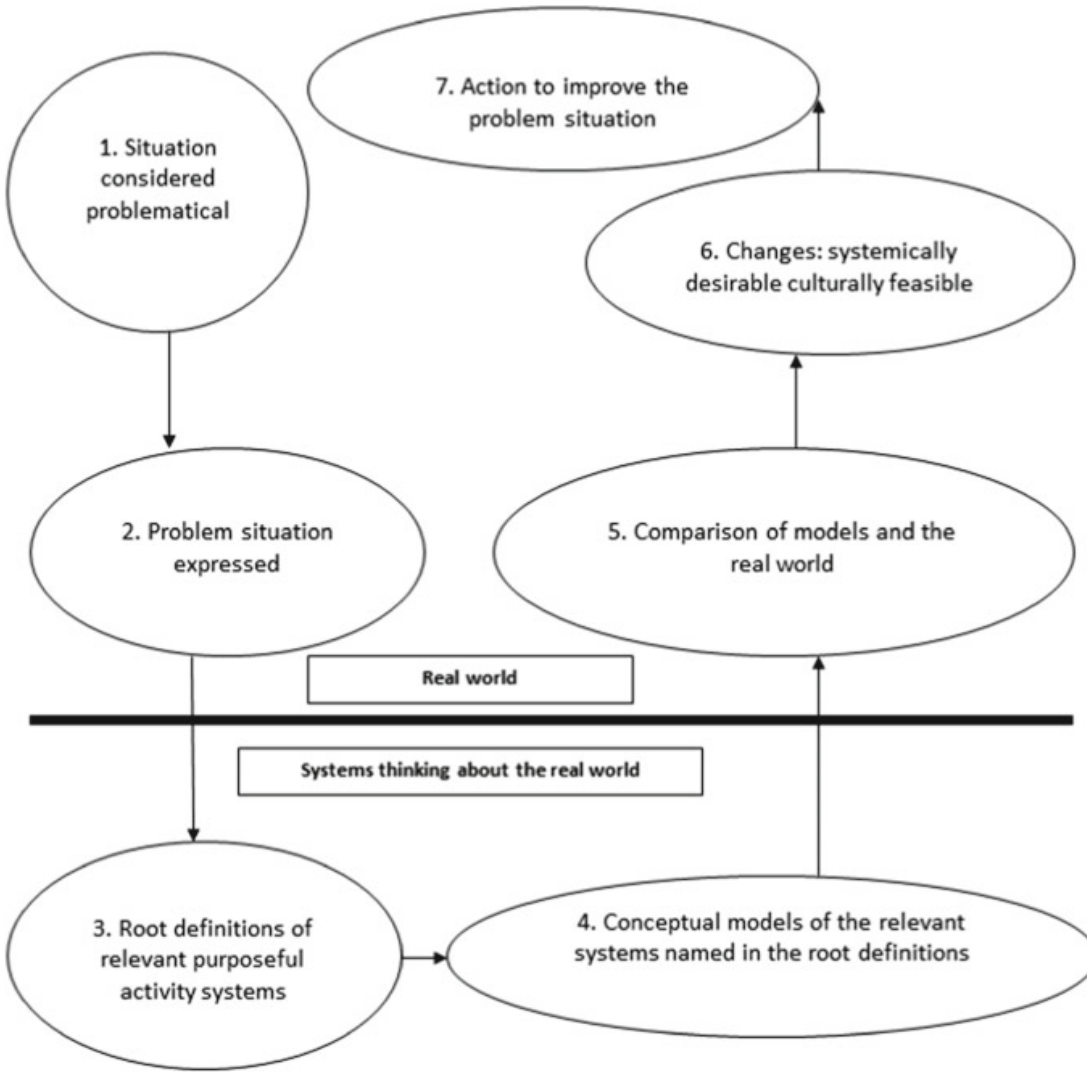

Figure 4: Seven stages of SSM

A questionnaire survey and individual interviews with key stakeholders were conducted in the initial stages of the intervention to gauge their perspectives on an IS strategy. This included collecting insights on identification, dissemination, and application of information. With inspiration from Critical System Heuristics (CSH) (Ulrich, 1983, 1987, 1988), the survey and interviews delved on the actual and the desired states of information management in the Ferens PCT. The SSM was

deployed bringing together ten participants with adequate representation of the key stakeholders from various levels. The same is narrated below.

6.2.1.1. Situation Considered Problematical: This step involves a general recognition of the situation as considered problematical. Insights from the questionnaire survey and interviews were presented as an icebreaker that exposed growing chasm between the key stakeholders. A brainstorming session was facilitated that surfaced the following pertinent issues:

- Confusion regarding what was defined as information
- Duplication of information collection and management
- Confusion over data ownership and access
- Inconsistencies in the use of information support platforms between various NHS entities
- Non-adherence to standard taxonomies
- Information inaccessibility despite its availability

6.2.1.2. Problem Situation Expressed: This step lets participants express the situation that they experience in a creative manner using visual representations called rich pictures. It offers an opportunity to participants to freely reflect and creatively express their positions, problems, and their relationship with others. See figure 5 for a rich picture by a clinical lead.

From the position of the clinical lead (in figure 5 identified in a black box), the reality was not comfortable. They had multiple stakeholders relying on them for decisions. The patient was depicted to be interacting with multiple touchpoints and had their own expectations. Multiple requests were depicted to be coming in from the general practitioner and other specialists in an incoherent manner. Managers were depicted in a negative manner with prongs in their hands ready to find faults with the clinical lead, demanding information, and imposing targets. At the base, the technology system was depicted to suffer from “poor definition”, ask for “too much” and offer “too little”.

Rich pictures from other participants narrated their own stories of the chasm between the key stakeholders. Managers depicted their frustration with clinicians

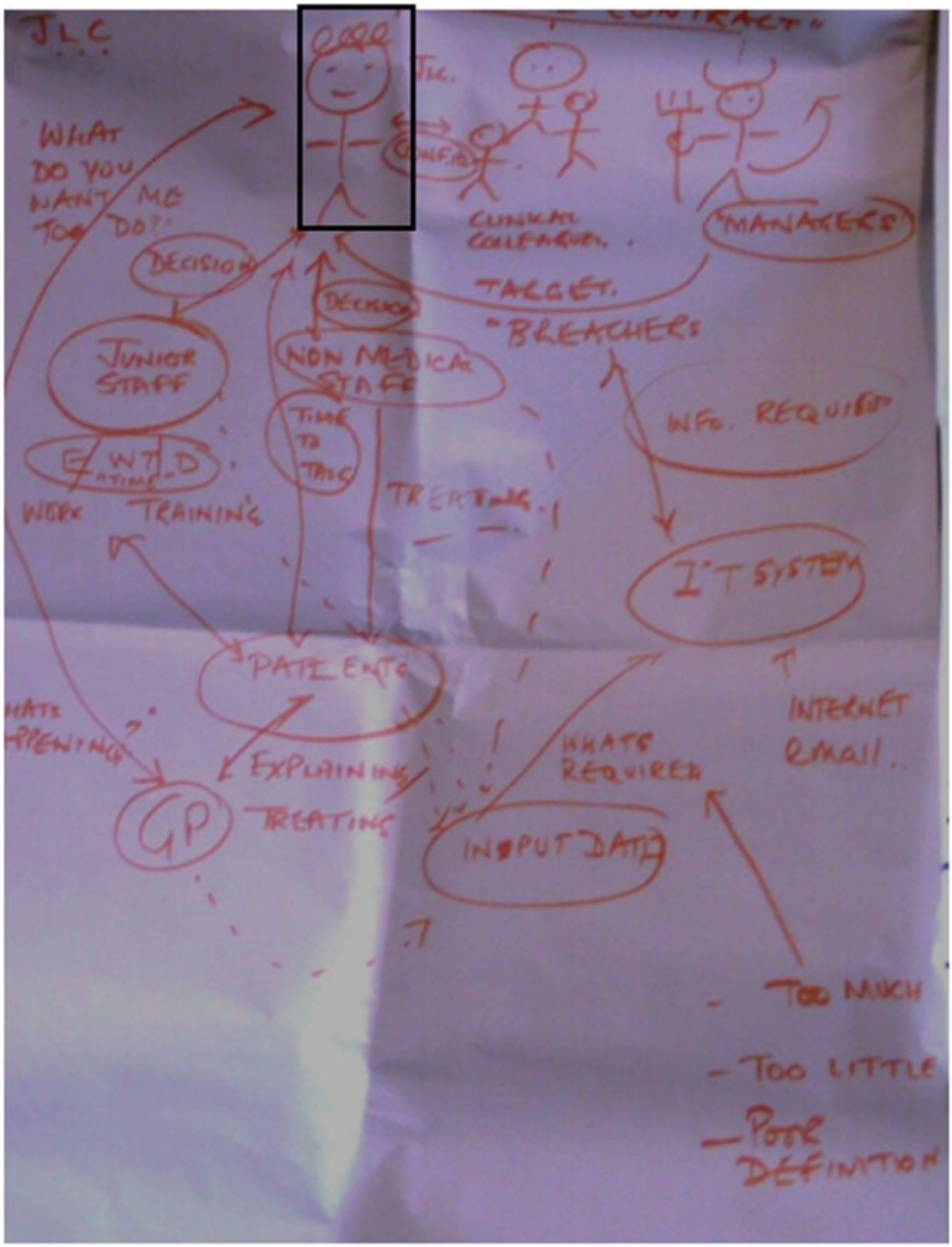

Figure 5: Rich picture by a clinical lead (identified in the black box)

who were described as uncooperative to change with time. A common theme for both groups was the frustration with inconsistent and incoherent technology initiatives being introduced by the DoH without adequate stakeholder consultation and involvement. This conveyed that although the divide between the key stakeholders was wide, it was not irreconcilable as the source of the frustration emanated at a higher policy level.

6.2.1.3 Root Definitions of Relevant Purposeful Activity Systems: Root definition is a condensed representation of the problem-situation covering Customers, Actors, Transformation, Worldview, Owners, and Environmental constraints (CATWOE). A CATWOE analysis helps understanding stakeholder perspectives holistically and in a wider context. It considers multiple dimensions and facilitates fruitful debate towards creation of viable solutions. The root definitions shift the minds of participants into the "systems world" as one's mental models surface while phrasing a root definition.

Two root definitions are highlighted for this discussion:

Clinician: Provide information management support, including the provision of routine and ad hoc information as required, to support the improvement of services for patients and carers.

Non-clinician/Manager: Develop a communication system to enable dissemination and sharing of information between all the key stakeholders in the geography in conjunction with the collaborative way of working to improve healthcare services and provide a more consistent approach to patients.
The root definitions expressed the overall sentiment that supported implementing a streamlined IS to improve healthcare outcomes. The CATWOE analysis of all root definitions depicted that the worldview of clinicians weighed more towards outcome-orientation and that of managers weighed more towards process-orientation. The differences in worldviews between the key stakeholders were then presented to all participants to help them understand the underlying causes of tensions between them.

6.2.1.4. Conceptual Models of the Relevant Systems Named in the Root Definitions: While still being in the "systems world", conceptual models are used to depict what the system "does" when the root definition depicts what the system

"is" (Jackson, 2000). Conceptual models bring out case-and-effect relationships of the system based on the root definition. This involves the expression of the minimum activities required to achieve the purpose of the root definition. A conceptual model consists of precise verbs to reach this intention. Since the conceptual model is derived from the root definition, both are similar. The conceptual models corresponding to the two root definitions cited above are presented in figure 6.

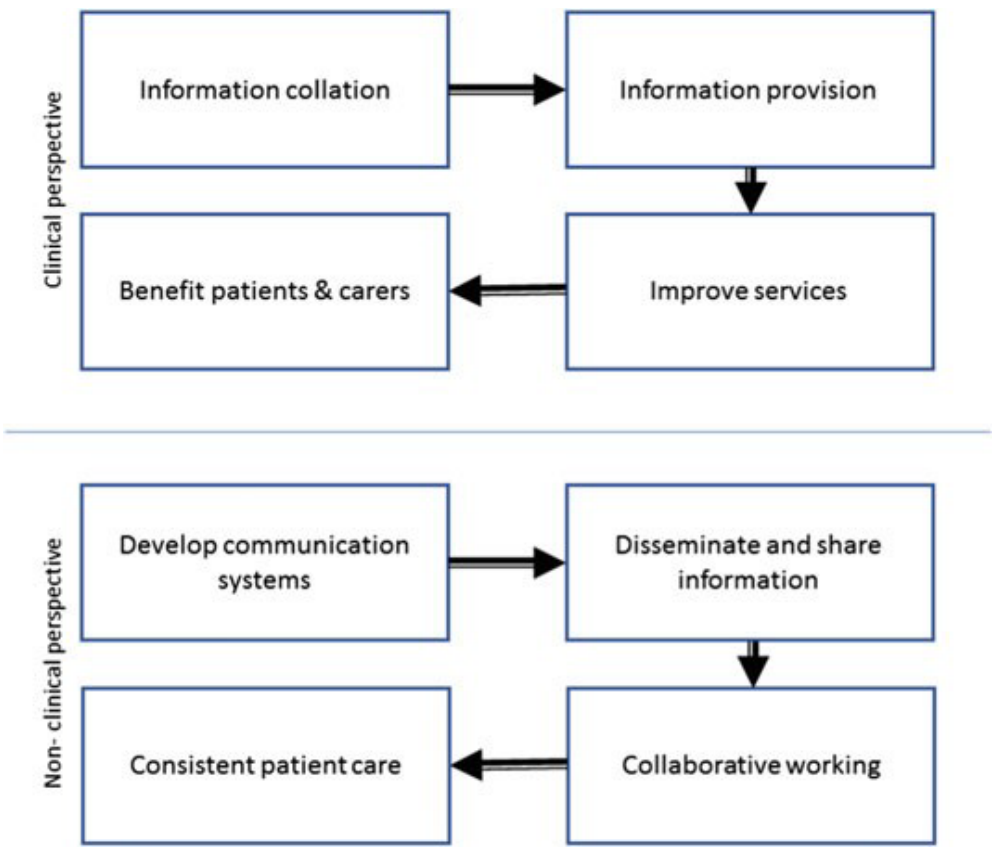

Figure 6: Conceptual Models by key stakeholders

The conceptual models further validated that despite differences and interpersonal dynamics between the key stakeholders, they essentially believed in the same success imperative, namely, better patient outcomes enabled through a streamlined IS.

6.2.1.5. Comparison of Models and Real World: This step brings the participants back to the "real world" where the conceptual models are compared with the real-world situation. Roles played by participating members in the system are critically reflected upon. Differences are likely to surface, which then need to be debated and discussed in the next stage.

Broad areas were charted out from the rich pictures, root definitions, and conceptual models to compare between the conceptual models and the reality in CfH implementation. These included stakeholder engagement, technology solution, system integration and interoperability, patient outcomes, and clinician-manager relationship. The CfH initiative had benefits, but it came with its own challenges that were also exposed during the VSM, the questionnaire survey, and the interviews with key stakeholders. Some additional challenges noted were the lack of evidence-based decision support systems in most care delivery centres, inconsistencies between general practices in electronic dataset systems used for storing patient information, the absence of centralised integration of the IS, and lack of IT competencies amongst clinicians who use the system. It was also exposed that an overemphasis on technology led to the lack of appreciation of human intuition and opinion.

6.2.1.6. Changes – Systemically Desirable and Culturally Feasible: This stage involves participants in a debate on their worldviews to bring about an accommodation of perceptions. Differing opinions are discussed and options are considered about how these differing opinions may best be overcome.
An overall agreement emerged that healthcare IS was a requirement and that it would enable better healthcare outcomes. Several operational details were agreed-on that included agreement on a common language for clinical records, a protocol for data ownership, storage and dissemination, and regular IS-related communication between the key stakeholders. There was a clear agreement that a collaborative approach was required to create the IS strategy for Ferens PCT for the implementation of the CfH initiative.

6.2.1.7. Action to Improve the Problem Situation: This is the final implementation stage where the derived plans are put to action. In an ideal-typical scenario, this would involve agreement on project management principles to facilitate implementation with articulation of roles, timelines and responsibilities, and

regular review. A governance structure would be set up to ensure seamless implementation.

It was realised that learning from the SSM needed to be leveraged towards a system design as desired by the key stakeholders. Findings from the SSM were presented to the Ferens PCT management and support was garnered to work with a core cross-functional team to develop a normative approach for healthcare IS, for which SAST was deployed.

6.2.2. Outcome of the SSM

The SSM established a common alignment for the need of an IS strategy for Ferens PCT that would enable the CfH initiative. It helped surface fundamental differences between clinicians and managers that stemmed from variegated individual worldviews exposing that such differences were not irreconcilable because both sides had been 'victims of the system' in some way or the other. It was agreed that a collaborative approach was needed for the key stakeholders to arrive at the IS strategy. The next step was problem-solving to collaboratively create an IS strategy, addressing the aspect on *how* such a system could be arrived-at.

One should note that elements of problem-structuring need to be reflected through the problem-solving journey in an iterative mode so that solutions arrived at are relevant and sufficient. This calls for participants to be open to negotiating with boundaries, revisit interrelationships, and be sensitive of emergent characteristics in the system – both intended and unintended. In this spirit, the next section elaborates the use of SAST for the problem-solving stage that incorporates tenets of problem-structuring in its essence.

6.3. Strategic Assumption Surfacing and Testing

Developed by Mason & Mitroff (1981), Strategic Assumption Surfacing and Testing (SAST) is a methodology that enables resolution of worldviews through encountering the same between two factional groups of stakeholders. Influenced by the philosophy of Churchman (1968), Mason & Mitroff believe that a holistic perspective can only be achieved by a synthesis of a variety of worldviews enabled by surfacing opposing perspectives and critical debate. According to Jackson (2003), SAST reflects Rosenhead's (1987) idea that problem-structuring and problem-solving require a satisficing rather than an optimising rationale that emphasises on an acceptance of conflict over submission to goals.

6.3.1. SAST in the Ferens PCT

SAST follows four stages that will be taken up in detail in the following elaboration of its deployment in the Ferens PCT.

6.3.1.1. Group Formation: Participants are divided into two distinct groups with an effort to maximise convergence of perspectives *within* the groups and maximise divergence of perspectives *between* the groups.

There were eight participants (from the same group of the ten participants who were involved in the SSM) with an equal representation of key stakeholders. During the initial group formation, participants divided themselves as per their professional backgrounds – managers and clinicians. Group-1 consisted of all managers and it was supportive of the prevalent top-down approach to IS. It was of the opinion that there had been adequate consultation with stakeholders for the CfH initiative. Group-2 consisted of all clinicians and it advocated for a bottom-up approach to IS. It was of the opinion that adequate stakeholder consultation and engagement had not taken place.

6.3.1.2. Assumption Surfacing: The aim is to formulate and express key assumptions that members in the groups harbour, in an imaginative and creative manner. Mason & Mitroff (1981) recommend three methods to facilitate this step: stakeholder analysis, assumption specification, and assumption rating.
A stakeholder analysis was facilitated with the two groups to identify who they thought their relevant stakeholders were. Once the groups created their own stakeholder list, a detailed stakeholder map was drawn-out converging the two sides that included primary and secondary stakeholders. It was emphasised that stakeholders needed to align with both the NHS and the CfH vision, values, and culture. See figure 7 for the final stakeholder map arrived at as a result of discussions in this step and in the last step where a normative approach to IS was developed (discussed later).

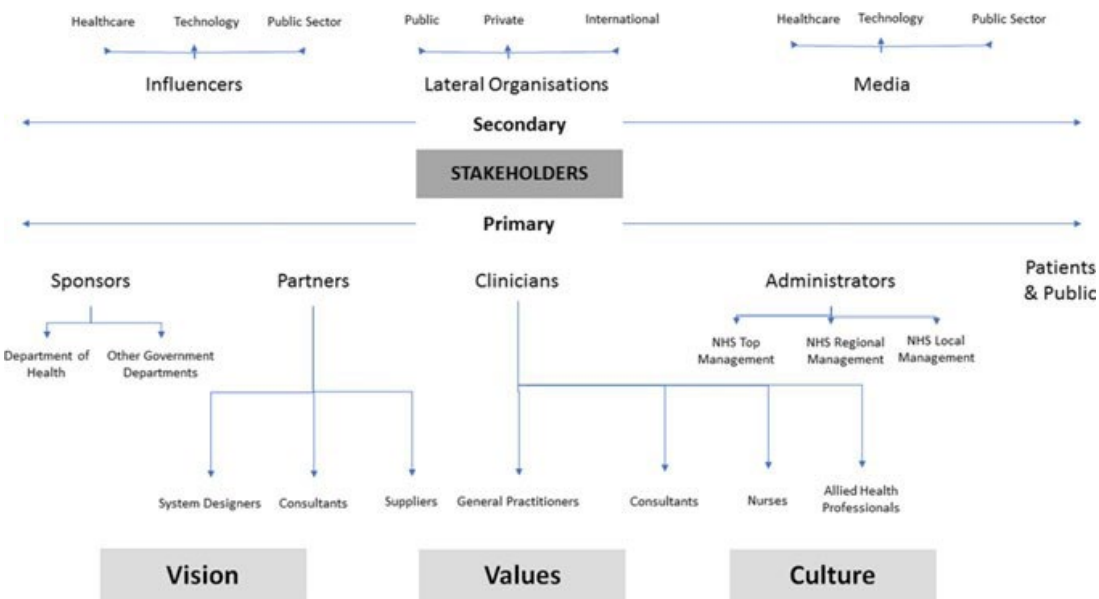

Figure 7: Stakeholder map

Assumption specification is the next step, where the two groups were first asked to state what their assumptions were. Assumptions are based on mental models that influenced participants to perceive and project the success of IS strategy. Participants were encouraged to be honest and drop biases that they would have carried by virtue of their roles and past interactions with colleagues. As part of this step, it was noted that an honest dialogue led some participants of group-1 to empathise with perspectives of group-2 and vice-versa. Hence, the exercise moved one step back to group formation and a minor reallocation of participants between the groups occurred. Group-1 and group-2 that previously represented managers and clinicians respectively later had a mixture of both sets of professionals after the reshuffle.

The assumptions from both groups were numbered for ease of reference and analysis. The groups were then asked to rate their assumptions in a chart against the axes of certainty and importance. See figure 8 for a sample of how both the groups made their assumption rating.

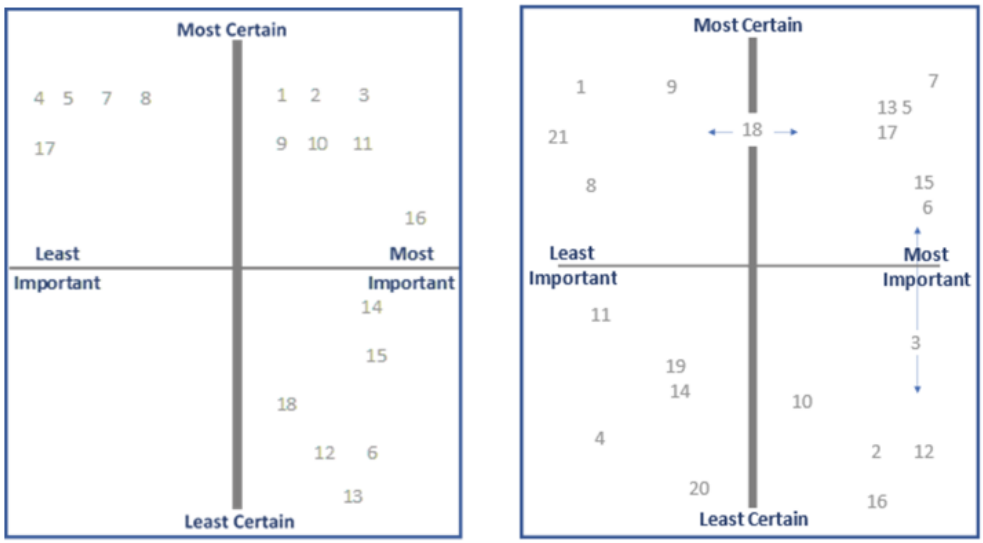

Figure 8: Assumption rating by both groups

In the assumption rating chart, assumptions in the most upper-right were those that were considered to be needing the most urgent attention.

Although the two groups had differing worldviews, early signs of convergence were noticed, as many of their assumptions were rather complementary to each other. For example, change resistance and user inertia of using new IS systems featured in the upper-right quadrant for both the groups; challenges associated with financial controls and budgetary complications featured in the lower-right quadrant for both the groups; fear of failure and lack of implementation/application accountability featured in the upper-left quadrant for both the groups. During the discussions, both groups talked about the vested interest of the private IT industry in the CfH initiative for lucrative business contracts, the political drive for the initiative rather than a genuine focus on healthcare outcomes, the unnecessary complexity introduced due to inclusion of too many services under the same initiative making CfH the 'elephant in the room', the lack of training for clinicians on IT skills, and the lack of adequate consultation of key stakeholders during the design of the initiative.

6.3.1.3. Dialectic Debate: Both groups are asked to debate their assumptions and viewpoints and are allowed to change their assumptions in what is called the "assumption modification" step.

Participants from both the groups were already beginning to see common ground even before the dialectic debate that normally anticipates a consensus. The commonality in the worldviews between both the groups was the groundswell for a healthy convergence. Lack of clinicians' involvement appeared to be a major challenge that both groups agreed on. Group-2 expressed that no one had approached the clinicians to ask what they really wanted from CfH. They expressed that what was positioned as a consultation process was more like an information giving session. The political nature of NHS initiatives and mismanagement of vendor contracts with unclear scope and lack of accountability appeared as common areas of concern. The groups agreed that several of the challenges could be overcome through partnership between management, clinicians, and the public, right from the beginning.

Later, the groups were offered the opportunity to modify their assumptions. The group that represented the top-down worldview (Group-1) changed their ratings on assumptions to indicate how government policies and cost-saving were a more real threat than earlier thought to negatively impact IS programmes in the NHS. The group that represented the bottom-up worldview (Group-2), apart from making a similarly change, also changed their rating to reflect the benefit of IS more positively, shifting away from the scepticism expressed earlier.

6.3.1.4. Synthesis: This stage is expected to result in convergence of worldviews through a process of modification of assumptions, negotiations, and accommodations. If the groups fail to arrive at a synthesis, the problematic assumptions and conflicting viewpoints need to be taken up for further research and deliberation.

The key stakeholders agreed on a way forward to work on a normative approach for healthcare IS for Ferens PCT. The following steps were formulated to this end:

- **Needs assessment:** This is the first step to assess the need for an IS – service improvement, better care records management, effective patient-care provider engagement, enhanced effectiveness in care delivery,

improved healthcare outcomes, etc. If systems are introduced without any need, it can take a toll on the organisation. New IS, introduced without any need, may come as a management-led initiative catering to management or political needs.

- **Stakeholder analysis:** Involves a thorough understanding of the stakeholder landscape including both primary and secondary stakeholders. In light of transformed mental models through the series of discussions, participants debated once again on relevant stakeholders and this led the exercise back to add to more assumptions and related stakeholders that was previously created as part of the "assumption surfacing" step. For the final stakeholder map created during this intervention, see figure 7. Primary stakeholders included those who were immediately engaged with the CfH initiative; secondary stakeholders included those who had an indirect capacity to influence. The media was specifically highlighted as it plays an important role in shaping public opinion and hence, required close engagement. Organisational vision, values and culture were highlighted as directional for the team.
- **System specification:** Involves understanding of what the vision of the system and the organisation is, and what can be realistically delivered in terms of the actual IS. It may be considered unrealistic to include the whole gamut of technological activities and features under one mammoth initiative catering the entire NHS. A technology feasibility study is recommended at this stage. There could be multiple iterations necessary, and planners may even need to be go back to the needs assessment stage to redefine and reinterpret initial understanding of the system requirements.
- **Context analysis:** IS design and implementation need to consider the industry, operational nuances, and organisational culture. Special mention was made on the aspect of confidentiality and sensitivity of patient information. This kind of information is unlike anything that can be found in other businesses. In terms of people, this is a context of highly qualified professionals who must be engaged and involved through all the steps. The importance of organisational culture was highlighted, because ignoring it may result in interpersonal conflict. Impressions counted; example was cited of a comment made by a participant belonging to the group-2: "we have not seen a single government IT project in a large scale succeed". These feelings and opinions need to be taken into consideration in the design of new IS.

- **Risk analysis:** Following were some of the risks highlighted:
    - Operational
        - Timely implementation failure
        - Technology failure
        - Supplier failure on contracts
        - Rapid change in project requirements
        - Breakdown in information confidentiality protocols
        - Rapid technology evolution rendering the original systems to be obsolete
    - People-related
        - Unwillingness to use the new system
        - Lack of capability to use the new system
        - Resistance to adopt the system due to interpersonal dynamics

The analysis of potential risks can even require designers to go back to the first stage of needs assessment and follow with the rest of the steps.

- **Development and Implementation:** Activities would include selecting implementation partners based on credibility, relevance, and cost. A robust project management office would need to be set up for regular review and monitoring. It may not be prudent to regard implementation as closure. Human expectation and system specifications are deemed to change; hence, the system would need to remain flexible and adaptable. This brought the groups to the overarching idea of cogenerative learning (elaborated in the next bullet point).
- **Cogenerative learning:** It is the process where the power relations between the facilitators (project management office and consultants) and the participants (key stakeholders) dilute due to their active involvement (Elden & Leven, 1991). To quote Elden & Leven (1991): "The insiders are not simply sources of data or sanctioners of studies and reports but actively help create and codetermine every phase of the research process — especially in the creation of new meaning. They are not merely consulted in each phase of knowledge production; they participate as co-creators. We call this empowering participation" (p. 133). The key stakeholders advocated for cogenerative learning to be regarded as the overarching philosophy.

See figure 9 for the normative approach to healthcare IS as collaboratively developed by the key stakeholders.

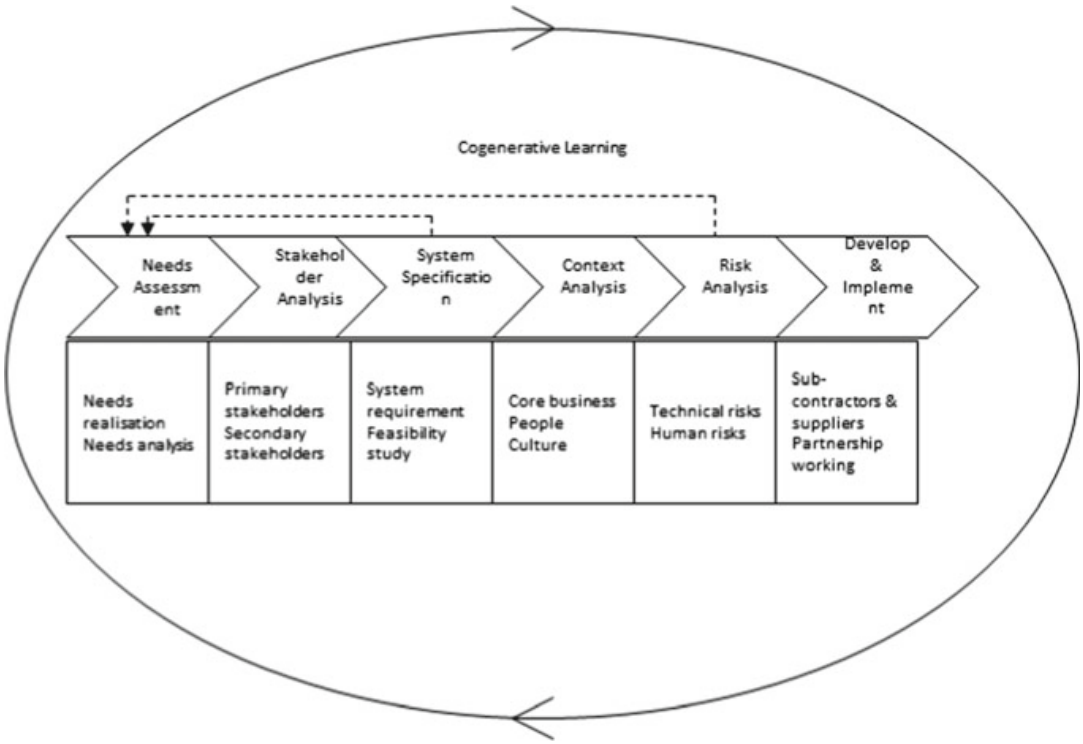

Figure 9: Normative approach to healthcare IS

6.3.2. Outcome of the SAST

The exercise was able to bring together two opposing factions and create a synthesis through a healthy and inclusive debate – a process that can be called strategic convergence (discussed in the next section). The groups were able to freely surface their own standpoints and talk about sensitive interpersonal issues aided by the tools of SAST, which were not otherwise surfaced with this level of clarity. Greater transparency helped to bring humility and self-awareness amongst the key stakeholders that created a conducive platform for them to collaboratively create a normative approach to healthcare IS. This approach was later presented to the Ferens PCT management in an action planning workshop and recommendations were arrived at. These recommendations were taken up by the Ferens PCT with the regional SHA within the consideration set of technical feasibility, product refinement, and CfH integration.

7. Discussion

7.1. Contribution of this research

This research brings together three systems methodologies under one umbrella of problem-structuring and problem-solving to arrive at a normative approach to healthcare IS. Overcoming professional differences is crucial for better health systems and therefore, enhanced healthcare outcomes. Adversarial interpersonal relationships can be a serious impediment in health systems (Patton, 2014; Shin, 2009) in an environment that is already complex and ambiguous and that suffers from effects of macro-level policy decisions that are often set in isolation from reality and that are beyond the control of professionals working in health systems (Harway & Harway, 2005). PSMs have the potential of bringing together a variety of factors such as negotiation devices, accommodations of multiple positions, power relations, understanding and learning, ownership of problems, and consequences of planned actions (Daellenbach, 2001; Foote et al., 2007; Franco, 2007; Jackson, 1991; Mingers & Rosenhead, 2004; Ormerod, 1997) as this research has demonstrated. Breaking away from a top-down way of planning, this research narrates a journey that is cooperative and empowering for guiding social change (Chambers, 1997) and thereby delivering on an "alternative approach to planning" (Cordoba-Pachon & Orr, 2010). This is an important consideration when Ulrich (2012) notes that problem-structuring skills of operations research practitioners lag behind problem-solving skills.

This intervention led to what can be called strategic convergence, which can be understood in terms of going beyond the obvious fact-based agreements to aspire for values-based consensus. Three imperatives of strategic convergence can be inferred from the intervention: (i) Stakeholder intent: Managers and clinicians had the intent to come together, be honest with their mental models, and expose their vulnerabilities; (ii) Worldview alignment: Through PSMs, participants were able to lead their worldviews to surface, clash, and transform; (iii) Action orientation: Participants were fueled by a bias to make change happen not just in theory, but also in practice.

The overall contribution of this research can be understood in the deployment of VSM, SSM, and SAST as the intervention seamlessly transitioned from problem-structuring to problem-solving, with the ultimate goal of achieving strategic convergence. In terms of the dimensions addressed, the focus of the methodologies,

their deployment nuances, and outcomes achieved; see table 1. Creative application of other qualitative and quantitative tools supported the systems methodologies.

	Problem-structuring		**Problem-solving**
	VSM	**SSM**	**SAST**
SOSM Dimension	Simple-Unitary	Complicated-Pluralist	Complicated-Pluralist
Focus	Problem-structuring	Problem-structuring	Problem-structuring & Problem-solving
Outcome	• *Organisational:* Uncovering of inconsistencies in the system leading to future planning with the management • *Interpersonal:* Arriving at two kinds of challenges to be addressed by understanding and converging key stakeholders	• Exposed areas of convergence between key stakeholders • Established a common alignment for the need of an IS strategy for Ferens PCT	• Achieved strategic convergence between key stakeholders driven by intent, alignment, and action-orientation • Arrived at the normative approach to healthcare IS
Deployment	• Applied both as a structuralist and an interpretive approach to unravel the organisation structure and information flow, and its	• Deployed in combination with questionnaire survey and interviews with inspiration from CSH	• Deployed in a way that the intervention could seamlessly transition from problem-

	interpersonal discourse and emergent social sentiment • Deployed with a combination of tools such as FGDs, interviews and document (including MOM) review	• Insights from support tools used to lead participants to explore convergence beyond differences	structuring to problem-solving • Deployed with openness for the exercise to shift between stages keeping in mind changing worldviews

Table 1: Contribution made by three systems methodologies applied in sequence to achieve strategic convergence

This research can be considered as addressing Jackson's (2019) view that a genuine pluralist approach must be "multimethodological as well as multimethod" (p. 573). This research demonstrates the principles of holistic flexibility in systems thinking that emphasises on a pragmatic stance to approach complex problems based on an understanding of system boundaries, the interrelationship between subsystems, and an appreciation of emergence supported by flexibility in thinking, methodologies, and resources (Chowdhury, 2019a). This journey was enhanced with the author himself being cognizant of his role in the research, considering his involvement in the change process; in other words, the researcher as a stakeholder (Gregory et al., 2020).

7.2. Limitations of this research

Although the intervention brought together managers and clinicians, it excluded patient representation. Patients, being the ultimate 'customer' of health systems, need to be involved in the design of health systems. Further, although the PSMs offered a relatively non-threatening atmosphere for the key stakeholders to surface their mental models and engage in an open debate, the research did not take into consideration hidden power-dynamics, if any, between and within the key stakeholders that may have influenced their articulation bounded by political

correctness and individual role-specific organisational guidelines of what they could express openly. In other words, coercion was not sufficiently considered as part of this intervention.

Deployment of systems methodologies was not easy. Participants struggled with concepts like root definitions, conceptual models, assumption surfacing, and assumption rating. The complexity introduced by such concepts often limited participants' thinking and expression abilities during the exercises. In order to overcome this challenge, an orientation to the approach and concepts was given to the participants. Although the orientation did help the participants with a prior idea of what was coming, it did not completely make them feel at ease with the technical aspects of the methodology. An important learning from this experience is that a practitioner does not always have to use technical jargon while deploying methodologies. Simple language can be used to involve participants and examples from related projects can be shared with them to enable them to grasp the new frameworks and concepts they would be working with. If time and resources permit, organising a prior training workshop, even a short one, can certainly help.
It is also to be noted that SAST operates with the acceptance of two different kinds of worldviews as ideal types, without giving much space to difference of worldviews in-between and beyond (Jackson, 2000). This may lead to a tendency in the practitioner to lead an intervention with a pre-conceived binary solution at the end of the intervention, without allowing for a wider scope of ideation and open-endedness in the outcome. This sentiment is reflected, to a certain extent, in the fact that there was an implicit understanding from the beginning of the intervention that an IS had to be developed at the end of the intervention as this was a necessary mandate for Ferens PCT. This understanding may have implicitly directed the intervention and participants towards a convergence. However, as Jackson (2019) notes, in case consensus is not reached, participants can be led back to the prior stage of dialectic debate in an iterative manner.

This research will benefit by further exploring the methodologies considering aspects of coercion and implicit agreements, and how such conditions may influence similar interventions. Further, more work needs to be undertaken to explore how the complexity of systems methodologies can be simplified for people outside the operational research and management science tradition.

Having discussed the benefits and limitations of the research from a methodological standpoint, the next section will provide a short note on the outcome of the IS intervention itself in the wider scheme of the CfH programme.

7.3. Outcome of the intervention

The intervention can be considered successful from the standpoint of the objective it was commissioned for – the creation of a healthcare IS strategy for Ferens PCT that could contribute towards the overall implementation of the CfH programme. With the findings from the intervention and the normative approach to healthcare IS, an action planning session was organised at Ferens PCT with key stakeholders from all the directorates of the organisation. The parameters covered during the action planning session included aspects around the structure, roles and responsibilities, integration efforts, stakeholder involvement, impact measurement, and, most importantly, the normative approach to healthcare IS that was collaboratively created for Ferens PCT. The final report and recommendations were presented to the regional SHA.

However, when it came to the larger CfH programme, it encountered serious challenges at the national level due to a range of factors (Chowdhury, 2019b). In 2007, Edward Leigh, Chairman of the Public Accounts Committee of the British House of Commons had famously claimed: "This is the biggest IT project in the world, and it is turning into the biggest disaster." The CfH programme was scrapped in 2013 due to several concerns that included a lack of proper project scoping, data security risk, inadequate technology solutions, lack of stakeholder engagement, clinical resistance, and mismanagement. Reports claimed that at the time of its discontinuation, CfH had already spent over three times its estimate (Espiner, 2009).

8. Conclusion

This paper presented a problem-structuring and problem-solving intervention led by the deployment of three systems methodologies – VSM, SSM, and SAST – in the UK NHS. The paper started with an orientation to problem-structuring and problem-solving highlighting the relevance of PSMs. This was followed by a literature research that established the importance of a healthy relationship between managers and clinicians in health systems. The context under consideration was introduced that called for the deployment of PSMs to overcome differences between two factions of stakeholders to inform the collaborative design of a

healthcare IS strategy. Following an orientation to the methodological choice, a narration was provided on the deployment of the methodologies to achieve the project objectives. Openness, participation, and flexibility were characteristics noted throughout the intervention, the result of which led to what was called a strategic convergence between the key stakeholders. Finally, contribution of the research, its limitations, and avenues of future research were highlighted.

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* At the time when this project was carried out, the SOSM had two levels in the system dimension – simple and complex. The problem-situation was considered in the complex-pluralist cell for the intervention. However, later (Jackson, 2019) the 'complicated' level was introduced in the system dimension. For this discussion, the problem-situation is considered in the complicated-pluralist cell as this is more suited to represent the realities discussed. However, this realignment does not or would not have influence(d) the intervention."

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