

SOCIAL SYSTEMS ENGINEERING

THE DESIGN OF COMPLEXITY

Edited by

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12

Holistic System Design: The Oncology Carinthia Study

Markus Schwaninger and Johann Klocker

12.1 The Challenge: Holistic System Design

Over several decades, health-care systems all over the world have been grappling with a formidable challenge. The issue is providing an integral kind of care, with the patient at the centre, rather than technology or doctors. Traditionally, over the last four or five decades, hospitals have increasingly suffered from an orientation that hinges on over-specialization and splintered forms of organization. This orientation threatens the quality of medical care, because patients tend to be treated in a fragmentary way. The perspective on sick people is as if they were conglomerates of organs that can be treated in isolation. The focus is on symptoms. Health-care systems often lack the ability to deal with syndromes that can have multiple causes with complex interrelationships. Normally, the main concern is applying high technology and advanced medication, instead of warranting patients' quality of life. While the pharmaceutical industry has been thriving on expansion and soaring profits, critics of modern health systems diagnose a different trend. They have gone so far as to indict these systems of making patients sick instead of curing them, with iatrogenic effects¹ as a rule rather than an exception (Brownlee, 2007; Illich, 1976). Critiques do not only come from 'outside' (i.e., from sociology, economics, etc.), even representatives of the medical professions deplore overtreatment and a mechanization of medicine going hand in hand with a dehumanizing trend (Allan and Hall, 1988; Hontschik, 2010; Loewit, 2010).

¹ Meaning 'disease caused by the doctor', in this case named *pars pro toto* for the health-care system.

These deficits have provoked calls for a holistic kind of treatment. The goal sounds ideal, but it cannot be achieved by giving pride of place to technical or financial means. By now, many leaders in hospitals have understood the need for a holistic approach to care, but very few have been successful in bringing it about. They are in a complexity trap. The stalemate of growing specialization in bureaucratic silos appears to prevent hospitals from coping effectively with increasingly perplexing disease patterns.

Our research question is then: How must health-care systems be designed to provide holistic, patient-centred care, at excellent quality and bearable cost? The main topic of this chapter is organization. This is a transdisciplinary, socio-technical undertaking with far-reaching implications. Organizational innovation is needed, and it can yield better and more abundant fruits than mere technological creations can.

The purpose of this chapter is to explore an exemplar of a long-term process aimed at achieving a holistic system design. The case is from health care. We trace back the process by which a comprehensive oncological care system was built in the Austrian province of Carinthia, with Klagenfurt as its capital. The study covers a period of roughly 30 years, until 2015. It is more than a showpiece, because not only its successes but also the, albeit sparse, downsides along the way are analysed.

The chapter has started with the issue of a holistic system design emerging from the traditional state of established health-care systems. We continue in Section 12.2 with an account of the methodology that guides the enquiry. There then follows the main part of our contribution: we first introduce the case study with a picture of the initial situation in the mid-1980s. Thereupon, we provide an account of the evolution of the oncological care system as it has been designed and built over 30 years. Along the way, several systemic concepts and methods are gradually introduced, as they have been used in the course of that process. In Section 12.3 we then provide an overview of the fruits reaped, and reflect on the strengths as well as the limitations of the health-care system under study. In Section 12.4 we synthesize the analytical components generated. The main question will be what can be learnt from the case. A concise set of insights, teachings and implications concludes the chapter.

12.2 Methodology

We chose the method of a one-case setting. This method is indicated here because the enquiry is longitudinal and revelatory (Yin, 2014). Furthermore, the system under study confronts ubiquitous and overwhelming complexity. Therefore, we have to rely on multiple sources of data to illuminate the approach pursued for dealing with the challenging issues under study. Our account of the development of the oncological care system (OCS) reveals several surprising outcomes achieved by a consequent use of systemic concepts and methods in system design.

To guide the presentation, we rely on a process diagram (Figure 12.1) that stems from a systems approach denominated ‘Integrative Systems Methodology’ (ISM) (Schwaninger, 1997, 2004).²

² For applications, see also Weber and Schwaninger (2002) and Schwaninger (2013).

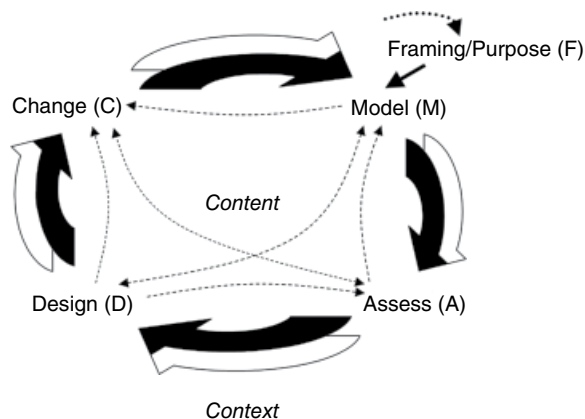


Figure 12.1 Integrative Systems Methodology for dealing with complex issues – a process diagram.³

ISM is a heuristic⁴ by which problem-solvers can enhance their repertoire of behaviour (cybernetically: ‘variety’; Ashby, 1956) in dealing with complex issues or problems. As shown in Figure 12.1, ISM stresses three dimensions. The first two dimensions are reflected in the two loops on which it is based, namely a content loop and a context loop (hence the double arrows). With ‘content’ we are referring to the activities or operations of the system under study, and with ‘context’ to the structural and cultural frame into which it is embedded. Content is about what the system ‘does’, context about how it organizes itself (or how it is organized). Both of these dimensions require different conceptual tools for dealing with complexity. In the following we will use two systemic methods, qualitative system dynamics modelling at the content level and cybernetic modelling for context. The third dimension is process, in the sense of the sequence of the operations, expressed by the arrows. The two loops in Figure 12.1 are separated only for the purpose of analysis. In fact, they are intertwined and in practice show overlaps. They revolve iteratively, alongside a set of operations. The number of these operations could vary as a function of the notation. Here, a set of four operations is used – modelling, assessing, designing and changing – which can be sufficiently well distinguished and specified.

Given the circular structure of the process, one could start anywhere with its description. Also, in actual practice, the starting point could be anywhere.

Sometimes, actors are suddenly confronted with an assessment or a model from which they have to proceed. We shall take ‘framing’ (including such aspects as purpose and goals or aims) as the point to start with, framing being a kind of anchor for sense-making. It addresses

³ This scheme was inspired by earlier works by the cybernetician Raúl Espejo (1993), namely his *Cybernetic Methodology*, and by the postulate to study content, context and process of change, as formulated by the organization scientist Andrew Pettigrew (1985, p. 50).

⁴ ‘Heuristic’ can best be translated as ‘the art of finding’. Stafford Beer defines ‘heuristic’, a contraction of ‘heuristic method’, as ‘a set of instructions for searching out an unknown goal by exploration, which continuously or repeatedly evaluates progress according to some known criterion’ (Beer, 1981, p. 402). Engineering is defined by its method: heuristics (Koen, 2003). Hence, ISM is close to engineering methodology.

fundamental issues: Which are the purpose and aim of the process? What is the system-in-focus? Which are the relevant perspectives? These are questions that should be dealt with early on. Modelling then includes tasks such as specifying the goals of stakeholders and the factors critical for attaining those goals, foregrounding issues and elaborating models. Assessing comprises tasks such as apprehending the dynamics of the system and simulating and exploring scenarios, as well as interpreting and evaluating simulation outcomes.

Designing includes tasks such as ascertaining control levers and designing strategies, organizational contexts and action programmes. Under the term ‘change’, all the tasks that encompass the realization of strategies and action programmes are included. All these operations are about enhancing systemic evolution.

Please note that ‘design’ in a wider sense encompasses earlier tasks such as modelling and assessment. Anyhow, the diagram shows that the process is not the sequential procedure which the main arrows might suggest. As the additional dashed lines show, the process is characterized by multiple communication processes involving feedback, validation and control. ‘Feedback’ here occurs when results and insights are fed back to earlier phases (e.g., from design to model). ‘Validation’ is a process by which the quality of models and strategies is constantly improved. Finally, ‘control’ is the process by which results are compared to goals, with the ensuing steering and regulation, when necessary. The schema is a simplification, which focuses on the general process characteristics, without any claim to final completeness.

Adhering to the aim of maximizing the space for the substantive issues of the case study, we refrain from bringing in the more detailed scheme of ISM, which has been published elsewhere (Schwaninger, 1997, 2004, 2013). The main point about the diagram in Figure 12.1 in the context of socio-technical system design is the need for proceeding simultaneously at the content and context levels: (a) resolving the issue as regards content and (b) embedding the process in a supportive organizational context. In the following, the abbreviations used for the phases in the diagram – F, M, A, D, C – will be used to denote the sections of the case study.

12.3 Introduction to the Case Study: Oncology Carinthia

12.3.1 *Setting the Stage*

To start with, a clarification of the role of the authors is needed; for their names, we will use the abbreviations MS and JK. In 1984, JK was put in charge of building an oncological care unit situated in the Department of Internal Medicine at the central hospital (*Landeskrankenhaus*, in short ‘LKH’) in Klagenfurt, the capital of Carinthia, one of the nine federal states of Austria. Over the ensuing 30+ years JK pioneered and directed the development of an oncological care system covering the whole state, and involving 10 hospitals as well as multiple local physicians. He has managed that system over all these years, and is the main source of information for this case study. Early on, in 1985, he called in MS, who is an organization scientist, to help him conceptually, as a consultant and coach, a role that he continues to hold. According to JK, much of the successful evolution of that health-care system is due to that cooperation. Normally, MS did not appear in front of the staff of the unit, except at certain internal conferences and workshops, for talks and discussions related to the organization and leadership of the system under development.

Oncology, the domain of medicine that deals with tumours, is an interdisciplinary field, by definition. It involves virtually all medical disciplines – internal medicine, radiology, surgery,

gynaecology, orthopaedics, neurology, urology, pneumology, haematology, etc. First of all, cancer can appear in any organ of the human body. Second, its therapy often requires a combination of measures, such as medical tumour treatment (chemotherapy, hormone therapy, immunotherapy and antibody therapy), radiotherapy, surgery and psycho-social care. Third, the approaches to therapy are manifold. That has been primarily a consequence of the complexity of the cancer problem, but also of the relative youth of oncology as a field, back in 1985. For most therapies at that time, the physician could not rely on a trusted basis for decision-making, while the progress in pharmacology and medicinal technology kept shaping new recommendations and facilities.

In practice, the need for interdisciplinary therapies was met only rudimentarily or not at all. This was not only the case in the hospitals of small and mid-sized municipalities. Even in the largest facility of the state, the LKH Klagenfurt, an interdisciplinary mode of operation transcending the borders of different wards was not much used. It occurred in a rather aleatory and sporadic fashion, because it required overcoming bureaucratic barriers. In addition, cooperation could be achieved only if champions succeeded in winning over members of different departments, who were already loaded with tasks.

In that situation the chosen form of therapy was often less a function of the patient's syndrome than of the methods which the respective therapist had mastered or was especially interested in. To formulate it in a pointed way: if the patient landed in the hands of a surgeon, he or she had a surgery. In case they were under treatment with an internist, they had to undergo chemotherapy; under the auspices of the radiotherapist, they would undergo radiotherapy.

In contrast, the desirable approach for an oncological care system would necessarily use all available therapeutic modalities and infrastructure, in a sequential or combined mode, and customized to each specific case.

We will now describe the organizational development process, following the logic of Figure 12.1, with an emphasis on content in Sections 12.3.2 to 12.3.4, on context in Sections 12.3.5 to 12.3.8 and on the overall process in Section 12.3.9. The final Section 12.3.10 is about the attained results.

12.3.2 Framing: Purpose and Overall Goals (F)

JK and the directors of the state health authority, with the directors of the LKH Klagenfurt, shared a common vision. They defined the purpose of Oncology Carinthia as a health system that should provide the highest possible level of oncological care, covering the whole country. They then agreed upon three general goals:

- (a) Guarantee of excellent oncological care in the context of the central hospital, using all the resources available within that powerful institution.
- (b) Provision of fast and high-level care for oncological patients all over the federal state (i.e., also outside the capital – in small towns and in the countryside, as far as possible ‘on the spot’).
- (c) An increasingly preventive orientation of oncological medicine in Carinthia.

The central oncological care unit was formed.

12.3.3 Mapping the System at the Outset (M)

We now sketch the actual and potential components of the system and the initial steps in the making of the oncological care system. Carinthia covers an area of 9500km² and had about 500,000 inhabitants at the time. The socio-geographic structure was 'healthy', with no excessive urban concentrations. Besides the capital Klagenfurt (86,000 inhabitants), several district centres exhibited their own lively economic, social and cultural activities. Altogether, Carinthia had thirteen hospitals potentially apt to be included in a network of oncological care. Four of them were public (LKH) and the rest private or of a religious order, as in the case of St. Veit (*Krankenhäuser*, in short 'KH' or *Sanatorien*, in short 'SAN'). The number of independent physicians included about twenty internists, of which only one specialized in oncology. Many of them were also candidates for joining the network, to provide supportive care.

Statistically, around 3000 new cancer incidences per year could be expected, 40% of them within the zone of Klagenfurt. The rest were distributed among three regions:

- Villach, Spittal, Laas (30%)
- Wolfsberg (20%)
- Friesach, St. Veit (10%).

These zones are denoted approximately in the map of Figure 12.2. This is already a historical document from the 1980s, drawn for the 'Oncology Case' which we wrote for the University of St. Gallen, Switzerland. There we gave a seminar around that case, at the master level,

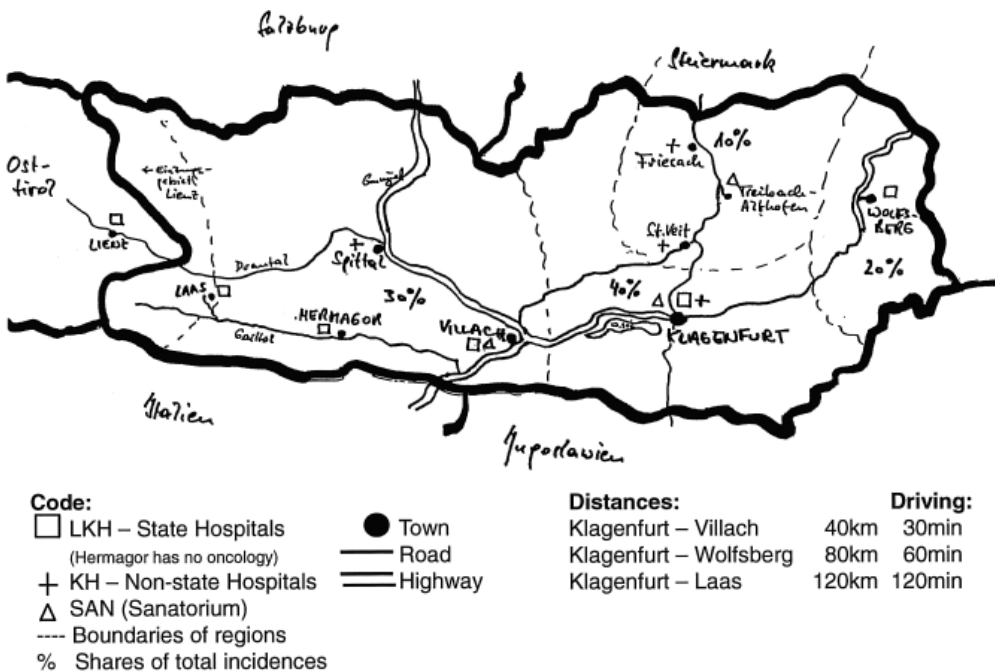


Figure 12.2 Map of Carinthia with hospitals.

periodically for about 20 years. These seminars always conveyed useful impulses for the development of Oncology Carinthia.

Assuming a 50% five-year survival rate, the yearly stock of incidences to be cared for was around 11,000,⁵ either by acute treatment or by follow-up therapy.

In a conversation between JK and the director of the LKH Klagenfurt towards the end of 1984, some vital issues for the joint endeavour were raised (extract from the conversation, based on notes of JK):

JK: 'There is no infrastructure for a serious oncological treatment...'

Director: 'What do you mean by *serious oncological treatment*?'

JK outlines his concept of an interdisciplinary care, which also reaches the population in the countryside. He pleads for a network organization, encompassing all relevant resources across the state, to ensure excellent care services all over Carinthia. The director finds these plans somewhat 'high-flying', but he is also attracted to the idea. Finally, JK also remembers the initial session with the state authority:

Director: 'For the time being, I cannot promise you large budgets for this project. At the moment, I only see a possibility to hire modest additional staff starting two years from now. But you are free to use the staff of your department (internist ward) and gain the support from other units... As you know, our purchases of new lab and therapy equipment is up to the general technological progress, in both the Klagenfurt LKH and the peripheral hospitals.'

JK: 'You are addressing the formal part of the problem... What I am even more concerned about are the informal aspects... Both nursing staff and doctors know little about oncology. Therefore they do not see the positive side. They also lack know-how, particularly outside Klagenfurt. To be honest, even we oncologists do not know much about the topic.'

Director: 'What do you mean?'

JK: 'It is unclear which therapies are being used and which ones are successful. Strictly speaking, we would have to agree periodically upon precise therapy strategies for the main indications, and apply these consequently. We would also have to examine the results continually, and adapt the strategies in the light of new knowledge.'

Finally, the two agreed on a first realistic objective: the build-up of an oncological care unit centred in Klagenfurt. This would comprise an allotment of ten beds for intensive therapeutic situations and an ambulatory where patients could be treated and therapy concluded, also receiving aftercare. They also agreed that the goal would not be a central oncology clinic:

- The creation of a ghetto of cancer sufferers had to be avoided. Patients should, to the greatest possible extent, be treated in the department that was their 'home'.
- The journey to a distant clinic is time-consuming and wearing. The proximity of family is a major supportive factor in the healing process. For both reasons, sufferers should be treated as close to their homes as possible.

⁵ The new incidences (3000 p.a.) are a flow, while the incidences to be cared for (11,000) are a stock.

Subsequently, the LKH management endowed JK with the mission to build a consultation service involving other hospitals.

JK had collected practical and scientific experience on the matter of ‘cancer’ over years, including work at a Swiss oncological centre with a worldwide reputation for both its management and doctors. He knew that in addition to the professional, medicinal aspects, he would be confronted with demanding organizational and leadership issues in order to achieve his goals. He was fully aware that the medical infrastructure lagged behind what he envisioned. Concerning structural aspects of the emerging system, JK was clear about several points:

- (a) He calculated that a health-care centre with oncological focus needed to serve a catchment area of between 200,000 and 500,000 to 550,000 inhabitants. Carinthia was in that range.
- (b) He had a clear concept of a structure for interdisciplinary work. Two experienced and highly competent oncologists would be needed, one with an internist and one with a radiology background. Such a team could cover the ambulant part as well: treatment, aftercare and consulting, including the maintenance and orchestration of relationships with the specialized departments (surgery, urology, otolaryngology, etc.). But that is only part of the story. For cases of cancer in wards for gynaecology, otolaryngology, paediatrics or pneumology, interdisciplinarity always means that the pertinent specialists call on the oncologists. The treatment should be planned under the lead of the oncologists, while the therapy and aftercare should be carried out by the specialists. In the aftercare phase, local independent physicians can also become active.
- (c) Not all activities in the chain *detection*→*diagnosis*→*therapy*→*aftercare* need to be performed in the ambulatories and wards of hospitals. Simpler forms of therapy and certain measures of follow-up care can be delegated to independent general practitioners and specialists.
- (d) Prospects should be treated only as in-patients if absolutely necessary (e.g., in case of major surgeries) but then be relegated to the ambulant mode.
- (e) He estimated that about two-thirds of the cases would fall under the domain of internists, and the rest to other departments.

12.3.4 A First Model (*M*) and Assessment (*A*)

Early on, JK and MS drew a first model, using the methodology of qualitative system dynamics, to provide an overview of the most important factors making up the system-in-focus and their dynamic interrelationships. Their aim was first to understand and assess ‘how the system ticks’. Second, they wanted to discover the priorities and levers for the design of the system.

They attempted to elicit the relevant perspectives on the system-in-focus. The schema in Table 12.1 distinguishes the main stakeholder groups (‘interest groups’) and their goals with respect to the system-in-focus. Then the key factors (i.e., aspects critical for the attainment of these goals) are ascertained.

The goals and key factors stand for components that may constitute a model of the system under study, such as the one in Figure 12.3: that is, a causal loop diagram (CLD)⁶ (i.e., a qualitative representation giving a first idea of the dynamics of that system).

⁶ CLDs are devices stemming from System Dynamics, a methodology for modelling and simulation, going back to Professor Jay Forrester (see Forrester, 1961; Senge, 1990; Sterman, 2000).

Table 12.1 Stakeholders, goals and critical factors

Interest groups	Goals	Key factors
Patients and their families	Be healthy Suffer little	Prevention Quality of life Quality of care
Champions of oncological care	Be excellent professionals Have an interesting job Realize their ideas Lead an effective team	Motivation Research and knowledge management Strong infrastructure Cooperation Effective coordination
Local hospitals and doctors	Qualify in oncology Become members of care network	Training Cooperation
Professional staff	Have an interesting job Have a bearable job Become more qualified	Training Psycho-hygiene Cooperativeness of other units involved
State authorities and central hospital administration	Effectiveness of care system Efficiency of care system	Low incidence of cancer Cancer prevention Success of care High productivity Coordination
Public in general	Stay healthy	Social and ecological consciousness Quality of environment Healthy behaviour

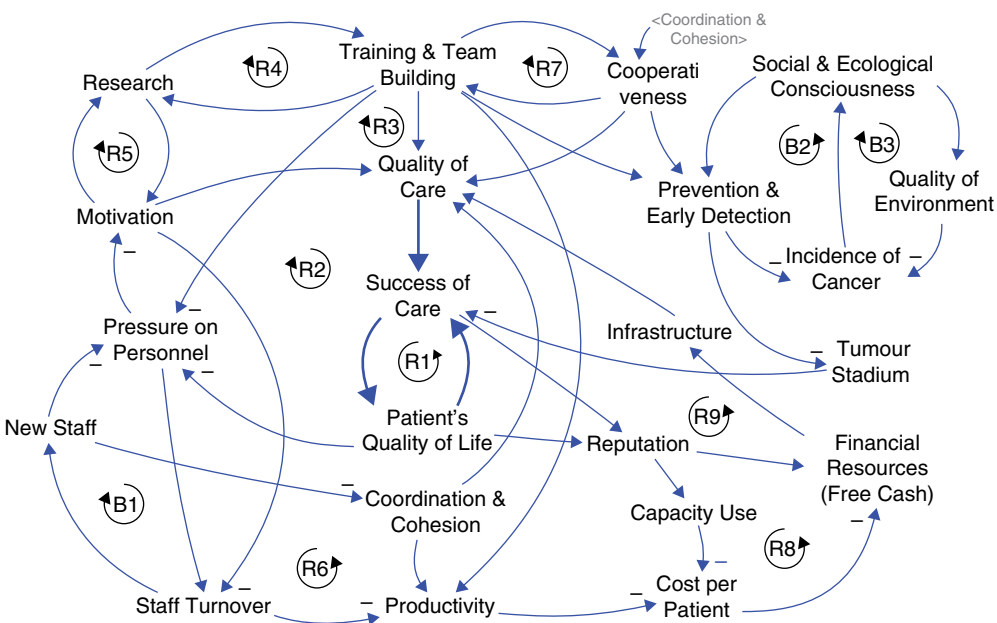


Figure 12.3 Causal loop diagram showing the dynamics of the system-in-focus.

In the diagram, arrows denote causal relationships and signs show the directions of those relationships. All arrows that carry a negative sign denote that the two connected variables point in opposite directions [e.g., more personnel turnover leads to less productivity (and less personnel turnover leads to more productivity)]. All arrows not provided with signs implicitly show connections of variables pointing in the same direction (e.g., more quality of care entails higher success of care).⁷ The diagram shows nine reinforcing ('R') and three balancing ('B') loops. The polarity of a loop is the result of a multiplication of all signs in that loop. Loops with even numbers of negative signs are always reinforcing (e.g., loop R1 [zero minuses]: '+' * '+' = '+'; loop R8 [two minuses]: '+' * '-' * '-' * '+'...). Loops with uneven numbers of negative signs are always balancing (e.g., loop B1: '+' * '-' * '+' = '-'). Reinforcing loops promote either increase or decrease, both of which, if not attenuated at some point, will entail destabilization eventually. Balancing loops lead to attenuation, and potentially to equilibrium. The benefit of distinguishing these two kinds of loop is that those dynamics can be identified which make the system develop on the one hand, and which lead to a balance of the system on the other hand. For technical details, see Sterman (2000, chapter 5).

The number of reinforcing loops is higher than that of the balancing loops, because Oncology Carinthia is still in an early phase, heading for development. A brief summary will uncover the meaning of these loops.

- R1: the *core loop*, a 'motor' where a patient's quality of life is a function of quality of care, entailing successful care. The quality of life for patients dynamizes successful care, because patients can contribute more to the healing process and to a positively spirited milieu.
- R2: the *motivation loop*, where motivation drives the quality of care and is driven by successful care and the patient's quality of life.
- R3: the *qualification loop*, where training enhances quality of care, which motivates people. Motivated doctors engage in research, which improves training activities.
- R4: the *knowledge loop*, where research and training dynamize each other.
- R5: the *research loop*, where professionals' motivation thrives on their research engagement, and motivation triggers commitment to that additional work.
- R6: the *productivity loop*, where productivity is strongly affected by quality and success of care, which reduce pressure on personnel and staff turnover. Productivity strengthens the financial position and thereupon the infrastructure, which is a prerequisite for service quality.
- R7: the *cooperation loop*, cooperativeness, which is itself driven by coordination and team cohesion, triggers competence enhancement, expressed in training and team-building.
- R8: the *financial loop*, where the reputation of the oncological care system attracts new patients, leading to higher capacity use. As the cost per patient is diminished, the financial and infrastructural position improves. So do the quality and success of care, which again strengthen the reputation.
- R9: the *external funds loop*, similar to R8, but showing a direct link from reputation to financial resources, denoting an improved position for gaining funds from external sponsors.

⁷ To make generally correct the statement 'X and Y move in the same [opposite] direction', a more precise formulation is necessary: 'If X increases, Y increases above [below] what it would have been' (Richardson, 1997).

- B1: the *personnel dynamics loop*, where staff turnover implies staff leaving and new staff coming in. The higher that index is, the less pressure on personnel (*new staf*→*pressure on personnel has a negative link*); thus, less pressure on personnel decreases staff turnover. This is a balancing loop that regulates (balances, controls) turnover through new staff, since new staff decrease pressure.
- B2: the *prevention loop*, where incidence of cancer is regulated (balanced, controlled), to some extent, through consciousness, prevention and early detection, which lead to lower incidences of cancer.
- B3: the *ecological loop*, where incidence of cancer is regulated (balanced, controlled), to some extent, through consciousness and quality of environment, which lead to lower incidences of cancer.

Loops B2 and B3 hypothesize very long-term dynamics, congruent with the vision that prevention should have greater prominence in Carinthia than in the past.

The logical structure and the impact of the CLD in Figure 12.3 highlight the crucial role of quality of care, patients' quality of life and the priority of human resources over financial and infrastructural resources.

This CLD is focused on aspects of content (inner loop of Figure 12.1). It helps in understanding how the system 'ticks', and was also used at various stages when scenarios of the development of the system were discussed. The CLD signalled those 'places' where interventions would be indicated. In Sections 12.3.6 and 12.3.7 we describe how the respective measures were taken.

12.3.5 The Challenge Ahead

The idea of the champions was, first of all, to set the norm to enable an excellent level of care (including quality, reliability and high speed). Strategically, that care had to be delivered locally (i.e., be as decentralized as possible), and central only where absolutely necessary, with intelligent use of all available resources. There were problems ahead:

- resistance of medical departments that should join the effort;
- weak know-how and lack of interest among peripheral hospitals;
- deficits of knowledge among independent physicians;
- fear among doctors and nursing staff over increasing demands and uncertainties;
- low motivation among staff;
- no formal authority among oncologists about parties that should be included;
- scarce budgetary means;
- limited personnel capacity in the central oncology unit;
- low interest, among authorities, in preventive care.

In the face of these issues, the challenges presented themselves as follows:

- winning the cooperation of medical departments at the Klagenfurt and peripheral hospitals;
- multiplying know-how and enhancing knowledge-building in the peripheral hospitals;

- involving and linking multiple resources;
- creating robust and nimble structures to enhance the viability of the oncological care system;
- information management – making data and information available for the control of therapies and the creation of new therapy options;
- balancing decentralized and centralized care;
- balancing the efficiency of care operations and the effectiveness of care strategies.

In sum, the venture ahead was very demanding. A high diversity of tasks had to be achieved, distributed human and technical capacities had to be networked skilfully, flexibility was to be built into the system and the restriction of high scarcity of resources had to be taken into account.

12.3.6 *A First Take on Design (D): Ascertaining Levers*

The CLD in Figure 12.3 reveals tangible dynamic features. From there the next question follows naturally: Which are the levers to improve the system in line with the purpose and goals as defined at the outset? At that point the goals were already much more concrete and integrated in the model of the whole system, because the variables were derived from the key factors representing all stakeholders.

Model analysis directed our attention to three main levers: (a) psycho-hygiene for the staff; (b) structures, information systems and knowledge management; and (c) leadership (bold parameters in Figure 12.4). The kinds of interventions chosen thereupon were not a result of the CLD per se, but they emerged in the champions' ongoing discussion of challenges and pertinent responses. The CLD made the 'mechanisms' driving the system under study transparent. Hence, it was a vehicle for keeping that discourse going. In the ensuing efforts the identified levers were put into practice in sophisticated ways, as will be shown.

These levers have the character of strategic parameters with great potential:

- Psycho-hygiene.* The staff in oncological care are subject to a stress load that tends to be greater than in other professions. Therefore, introducing psycho-hygienic measures was crucial, to sustain and foster the psychic health of people, adopting both preventive and restitutive measures.
- Structure, information system and knowledge management.* Structure is a powerful device that was considered crucial for strengthening quality of care, coordination and team cohesion. In addition, information systems and knowledge management were prominent in strengthening research.
- Leadership.* Ultimately, everything in an organization is subject to the influence of leadership and hinges on its quality. Motivation as well as coordination and cohesion were identified as two main aspects to be strengthened by that driver. Coordination and cohesion then impinge strongly on cooperation. Equally crucial was a major effort to win the cooperation of all necessary parties.

Moving these levers served to create a context (outer loop in Figure 12.1) that would govern what we call 'content' – the operating activities of the OCS. The context parameters proved highly effectual in changing the dynamics of the content variables (Figure 12.3).

12.3.7 From Design (D) to Change (C)

The levers ascertained in the last section were used early on to develop the system, and they go on being important today. First of all, *leadership* was strong from the start, when the champions took over the mandate to build a new OCS. To make their moves successful, the champions adhered to certain strategic leadership principles (Malik, 2008):

- *Show competence, be modest, reliable and persistent.* Competence in oncological matters, demonstrated humbly, was the way to be accepted for the champions, who gradually gained an image of reliable, enduring partners.
- *Be cooperative and compliant.* Instead of imposing their position, they opened a dialogue, leading to a game in which both sides could win.
- *Learn ambiguity tolerance.* This was necessary to become able to live with the trade-offs that always emerge in situations with multiple players.
- *Explain one's own behaviour.* Some of the champions' moves were bold. They had to explain themselves in order to win acceptance.
- *Training by practice and by attractive events.* Knowledge-building was a key issue. As people embodied that knowledge, both learning-on-the-job and cultural events, which fostered the interchange of people, were imperative.
- *Convince by evidence and results.* The champions started with modest but promising results, avoiding big words and letting events speak for themselves.
- *Constructive tenor.* Negative critique was avoided and the whole discourse led to a build-up of positive energy in the team, which gained cohesion and momentum.

Second, the leadership was not only competent and focused on substantive matters; it was also perpetually concerned with human beings – patients and staff. This humanistic orientation was very effective in salutogenic terms,⁹ but it was also very demanding for the staff. The permanent confrontation with difficult situations – strenuous health conditions, tortuous treatments, troublesome fates – tended to exhaust nurses and doctors. The leaders of the OCS were perfectly aware that given these socio-psychological conditions, a special treatment of the staff was required: they called it *psycho-hygiene*, and gave it the highest priority (together with quality of care). Measures taken included scheduled, structured and at the same time easy-going team sessions, team supervision, offers of psycho-oncological seminars with self-experience, yoga, drumming workshops, round dancing, etc.

Third, organizational structure was crucial for the people working in the OCS. The first structural provisions aimed to win the cooperation of the departments and peripheral hospitals. Our approach encompassed:

- offering knowledge and support;
- regular meetings (tumour boards) and ad hoc meetings (tumour councils);
- offering permanent readiness of oncologists for consultation about difficult cases (hotline for inquiries);

⁹ The term 'salutogenesis' derives from the Latin '*salus*', health and the Greek '*genesis*', generation. The salutogenic framework (Antonovsky, 1987) conceptualizes an approach to health care that concentrates on the factors supporting health and well-being rather than the factors causing disease.

- active duty 24-7 for emergencies;
- initially focusing on easy, success-prone treatments;
- regular educational events, which included presentations on therapeutic successes.

Two concepts of this design need to be specified. Besides the typical regular department meetings, two forms of teamwork were systematically cultivated, namely tumour boards and tumour councils. A tumour board is an interdisciplinary body at the hospital level, which brings together doctors of the site dealing with tumour cases, with the support of an oncology team member. It takes place in a fixed rhythm and deals with the set of current tumour cases of the hospital: diagnosis and therapy are discussed, and a decision on how to proceed is taken (by consensus). The second kind, tumour councils, are meetings where doctors in charge of one or more cases, supported by oncologists, go to patients and confer on the spot. Normally, such councils are invoked by the patron of a case in one of the specialized departments (e.g., surgery or gynaecology), in those cases which cannot be taken care of by the regular tumour board (e.g., given their urgency). These two concepts are crucial for the evolution of the OCS, and will be taken up later. For more about structural change, see the next section.

12.3.8 *Progress in Organizational Design (D)*

As this is a chapter in a book about social systems engineering, we are emphasizing the structural aspects of organizing (context loop in Figure 12.1). We are focusing on design, transformation, problem-solving and controlled experimentation. Indeed, the first thing we designed in Oncology Carinthia was organization structure, in order to put the normative principles and strategic orientation into practice.

The structural diagnosis and design of the OCS was of primary importance in the evolution of that system. Structure is not merely the expression of a state, for it changes behaviour. And change was needed if the oncological system was going to take shape. Structure and other levers were the components we could manipulate directly. Many of the factors that constitute the competencies of the organization could be influenced only indirectly. This becomes visible when following the arrows in Figure 12.4. For example, leadership cannot influence quality of care directly, but indirectly (e.g., by strengthening the motivation of the staff).

Soon after embarking on the new venture we used a powerful device of organizational diagnosis and design, Stafford Beer's Viable System Model (VSM) (Beer, 1981, 1984, 1985). That model is extraordinary in that it claims to define not only the necessary but also the sufficient structural preconditions for the viability of any organization. The model has been tested in multiple case studies (for an overview, see Schwaninger, 2009; Schwaninger and Scheef, 2016) and in two surveys (Crisan Tran, 2006; Schwaninger and Scheef, 2016). After Beer's original works, other authors have made methodological contributions to facilitate the application of the VSM (e.g., Espejo and Reyes, 2011; Espejo *et al.*, 1996; Hoverstadt, 2008; Pérez Ríos, 2012).

To facilitate the understanding of our following account of the organization design for Oncology Carinthia, we start with a resumé of the theory of the VSM and its implications for organizational diagnosis and design.

1. **Components of the model.** An organization¹⁰ is viable if, and only if, it has a set of components – which are management functions (also called ‘systems’) – defined as follows (see Figure 12.5):

- **Component 1.** The largely autonomous, basic operative units which adapt to change and optimize the ongoing business. Basic units (denoted as circles), with their respective management (square boxes), are called ‘primary units’. Examples: a company’s business units, a division, a hospital.
- **Component 2.** This is the *coordination* function, which reduces oscillations and enhances self-regulation. For example, the reporting systems, operative planning, internal service units, standards of behaviour, knowledge bases and a good deal of communication.
- **Component 3.** The operative management of the organization as a whole. In a company we would have the *executive corporate management* here. It provides overall direction, allocation of resources and striving for an overall performance optimum, which often differs from the optima of the subsystems (primary units).
- **Relationship components 1–3** (vertical channel). Negotiation of goals and resources – accountability, budgetary control/management by exception, intervention (only if the cohesion of the whole organization is threatened).
- **Relationship components 1–2–3–3*.** Attenuation of complexity, filtration of messages coming from basic units to inform system 3 and relieve channel 1–3. Enhances organizational cohesion.
- **Component 3*.** The *auditing channel*, where the information flowing through channels 1–3 and 1–2–3 is complemented and validated via direct access to the basic units. For example, monitoring and management by walking around, informal communication as in social and cultural activities.
- **Component 4.** Also called the *intelligence* function, it stands for the *long-term orientation* to the future and the overall environment, including exploration, modelling and diagnosis of the organization in its environment. Here we have organizational development, strategy (in interaction with component 3), research and knowledge creation. Component 4 can trigger emergence (of new system properties) via self-reference; that is, the reflection of the system itself and, if indicated, its reframing and redesign.
- **Relationship components 3–4.** Interaction of short- and long-term as well as internal and external perspectives, processes of strategizing.
- **Component 5.** The identity as manifest in the supreme norms and values that govern the system – the *ethos* of the organization or *normative management*, also called *policy* function (Espejo and Reyes, 2011). Striking the balance between present and future, keeping the internal and external perspectives in proportion, within a long-term or even timeless horizon. Component 5 is often (partially) codified in corporate charters, credos, value statements, etc.
- **Relationship components (3–4)–5.** Moderation of the interactions of systems 3 and 4, solution or dissolution of conflicts between the distinct logics of these systems.

¹⁰ This theory also holds for other social systems, e.g., families, teams or societies.

See also the Appendix to this chapter. Components 1–2–3–3* represent the operative system and 2–3–4–5 the meta-system of the organization. In addition, certain alert devices can always be identified in viable systems. Beer (1985, p. 133) calls them ‘algedonic signals’ (from the Greek ‘*algos*’, pain and ‘*hedos*’, pleasure). These warning systems send signals of imminent danger directly up to component 5, to trigger a crisis management. This component will not be analysed further here.

2. **Principle of recursion.** *The viability, cohesion and self-organization of a social body depend upon these functions (components 1 to 5) being recursively present at all levels of its organization.*

A recursive structure comprises autonomous units within autonomous units. Moreover, a viable organization is made up of viable units and is itself embedded in more comprehensive viable units. Each unit, inasmuch as it is producing the organization’s task, rather than servicing or supporting this producing, replicates – in structural terms – the totality in which it is embedded. It has all the functions outlined under (1), to be able to manage, from start to finish, the processes for the purpose of which it exists.

3. **Diagnosis and design.** *Any deficiencies in this system, such as missing functions, insufficient capacity of the functions or faulty interaction between them, impair or endanger the viability of the organization.*

Accordingly, the screening of any social system in terms of the VSM almost invariably brings to the surface valuable diagnostic points (Schwaninger, 2006). This is the use of the model in the diagnostic mode. In contrast, a system’s viability can be substantially enhanced if it is designed or improved according to the tenets of the VSM. This is the use of the model in the design mode.

Following the principle of recursive structure, an organization can be modelled as a cascade of viable systems embedded in more encompassing viable systems. Figure 12.5 visualizes such a structure with two levels of recursion. In the following we refer to four levels (Figure 12.6).

The organization of the Carinthian health-care system was the product of pragmatic structuring that found its expression in the organization charts as can be found in most organizations today. At that time, the principle of viability was not a category used in the management discourse of that system.

We reflected on the status quo and concluded that the use of the VSM could add great value. In particular, we found the category of viability important. In addition, we were attracted by the fact that the model focuses on deep structures, as opposed to superficial structures. It is suspicious of defining sections based on perfunctory criteria and arbitrary hierarchical positions, as encountered in conventional organization practice. Organizational work with the VSM considers basic functions, relationships and information flows. It brings the environment and the customer into the organization chart. And it builds structures for effective governance. Finally, and most important, it provides structures for the absorption of complexity for the whole organization, along the lines where that complexity emerges.

Figure 12.6 visualizes the structure of the OCS as implemented within three years. The power of recursive organization design is visible from the diagram: the organization unfolds its capacity to absorb environmental complexity along the fronts where that complexity unfolds. Thus, the organization is in a position to respond effectively.

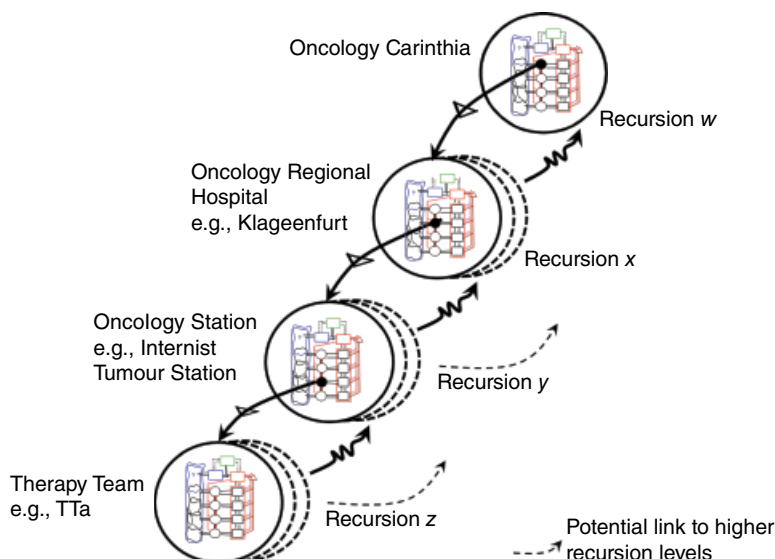


Figure 12.6 Oncology Carinthia as a recursively structured system.

We decided early on to use the VSM mainly in the design mode, and have done so ever since. We also made use of it in the diagnostic mode – when you are trying to design a better organization, you need to be aware of the flaws in the extant one.

Please note that at the second level (recursion x – oncology regions), LKH Klagenfurt figures as a regional hospital, just as St. Veit, Villach, etc. would. This is distinct from the central oncological unit, which manages Oncology Carinthia as a whole and which is seated in that hospital as well.

A generic representation of the VSM can be found in the formulas in the Appendix.

In Table 12.2, a schema is presented which reflects a paragon for the structure of Oncology Carinthia, as designed and implemented in the 1990s to put the strategy in place.

A system-in-focus is a unit of oncological care at any level of recursion. In other words, the overall health system is outside the influence of JK, and will only marginally affect his area of responsibility. At the first level (recursion w), the system-in-focus is the whole OCS of Carinthia. At the next recursion level (recursion x), it is the oncology in a region (e.g., Klagenfurt, Villach or Wolfsberg), where it is centred around the central district hospital (LKH) and other local clinics. Finally, at recursion level y , it is an oncology station such as a tumour ambulatory or a subsystem of the internist's ward.

The table discloses a number of unconventional features of the system, as implemented in the OCS. Basic units are the individual hospitals, but individual local oncologists can also have such a function (e.g., when they assume full responsibility for the therapy or aftercare of a patient). In the case of recursion y , the structure is based on teams.¹² The basic unit here is not a doctor or a patient, but a connection of four components, namely patient and family,

¹² Or systems of interaction, if we take – with Luhmann (1995) – communications as the primary components of systems.

Table 12.2 Recursive distribution of tasks in the oncological care system¹³

	Recursion w: Oncology Carinthia	Recursion x: Oncology regions (e.g., Oncology Klagenfurt)	Recursion y: Oncology stations (e.g., tumour ambulance)
Basic units	Oncology Klagenfurt, Oncology Villach, Oncology Wolfsberg, oncology in six further hospitals	Oncological ambulance, oncology ward at internal station, <i>n</i> local practitioners with oncological competence	<i>N</i> teams (interaction systems, including patient and family, physician and nursing), <i>n</i> local practitioners with oncological competence
Component 1: Local management	Heads of basic units: oncologists	Heads of station: oncologists or internists	Patient & family
Component 2: Coordination	Standard therapies, tumour database, training, oncology circle, doctors' letters, electronic messaging and conferences	Tumour database, tumour boards and councils, coordination sessions (radiotherapy/haematology/pathology), standard therapies, training, doctors' letters	Tumour councils, standard therapy plans, daily station meeting, nursing guidelines, coffee break
Component 3: Executive management	Lead team OCS (2 oncologists, 1 internist-oncologist, 1 radiologist-oncologist)	Management team/local leaders (physicians and nursing staff; 9 persons)	Station leaders (physicians and nursing staff in charge)
Channel between components 1 to 3	Allocation of time and OCS staff, management by objectives, definition/negotiation, standard therapies	Allocation of time and personnel, design/negotiation of therapy plans	Assignments/requests, participation
Component 3*: Audit channel	Visits to local oncology units, phone calls, messaging, special studies, inquiries, tests, informal communication, cultural events	Medical visits, phone calls, messaging, informal communication	Medical visits, continual contact/conversations with patients, informal communication
Component 4: Organizational development/strategic management	OCS leaders team, therapy and prevention strategies, ongoing research, congresses and symposia, networks, strategy workshops	Development plan, future-oriented education, management team, leaders OCS	Station development plan, future-oriented education, leaders of station, leaders OCS, head internal station
Component 5: System ethos/normative management	Ethos OCS – values, principles, vision and mission, management framework OCS, leaders OCS	Values, principles, vision and mission, ethos OCS, management framework OCS, local management team, leaders OCS	Values, principles, vision and mission, ethos OCS, leaders of station, leaders OCS

¹³ For relationships not detailed in this table (e.g., 1–2, 3–4, etc.), see the generic descriptions above.

doctor and nurse. Each one is an integral part of the therapy team, but none is only a member of that unit. Doctors and nurses are also members of other similar teams, just as the patient and the family are at the same time members of other social systems.

To highlight some of the features outlined in Table 12.2, we comment mainly on the innovative aspects and revert to all four recursion levels.

Component 1. A remarkable feature of the local management (component 1) in recursion y is a reversal of the conventional arrangement. The management function (i.e., the primary regulatory responsibility) is with patient and family. This corresponds to the emancipatory idea of valorizing the role of the patient, who becomes the main agent pursuing his or her health. Making this philosophy real requires – despite this declaration about structure – that the medical and nursing staff take a different view than is common in most health systems. The patient is not a passive object to be manipulated according to expert considerations, but a force aligned with the joint quest for a successful treatment. This novel view did not emerge by itself. The champions played a crucial part in conveying the inherent values, via discourse and acting-by-example.

Component 2. A crucial role in coordination (component 2) is with the tumour boards and councils (recursion x). These are virtual units,¹⁴ in which the medical cases are discussed with themes ranging from diagnosis to therapy. The cases treated by a tumour board vary in number and size; usually the therapies are defined by these boards. The tumour council is a kind of individualized tumour board (see below). Other group initiatives are the oncology circle at recursion w and the coordination meetings of radiologists, haematologists and pathologists at recursion x . This principle greatly increases both the efficiency and effectiveness of oncological care. Finally, standard therapies, training, messaging and the doctors' letters edited by the Klagenfurt oncologists fulfil an important coordinative function.

Component 3. The executive management always involves oncologists and nursing staff. Only at the last recursion (recursion z), which is not elaborated in detail in Table 12.1, are the managers patients and family.

The connection between local and executive management (components 1 and 3), at the different recursions, makes use of the precious but very limited capacity of that vertical channel. Here is where the negotiation and control of goals, as well as the allocation of resources, in addition to important feedback mechanisms and participation, take place.

Hospitals that do not have their own specialized oncologists benefit from a new service installed as a mobile unit. This is a resource of recursion w deployed for the hospitals at recursion x . The oncologists from Klagenfurt visit the peripheral hospitals – physically or virtually¹⁵ – in a constant weekly (LKH Villach, LKH Wolfsberg, KH St. Veit) or two-weekly rhythm (hospitals Spittal and Friesach), all others occurring as needed. They participate in the respective local tumour boards and also now and then, if indicated, in the local tumour ambulatories. In this way they make their expertise available, therewith contributing to the quality of the decentralized operations. The idea here is that the doctor comes to the patient,¹⁶ rather

¹⁴ In many of the processes at the OCS, virtual forms of organization are adopted at the team level. Teams in the OCS are flexible in that they are formed as changing casts drawn from resource pools that exist in different locations. The resources are there, but the teams materialize in response to changing needs. They work across space, time and organizational boundaries (Lipnack and Stamps, 2000), reverting to personal contact, other communication media (mainly electronic connections) and information systems (e.g., tumour database).

¹⁵ Until 2015, the journeys of the oncologists were almost entirely replaced by a teleconferencing system.

¹⁶ This idea is also constitutive for the profession of barefoot doctors in India.

than the patient 'feeding the system'. In addition, the mobile doctors are a vehicle for knowledge transfer, and indeed, the oncological know-how at the periphery has made great progress over the years. Meanwhile, the KH in St. Veit has hired its own oncologists.

Component 3.* The audit channel (component 3*) comprehends direct forms of access to the basic units (e.g., at recursion w , the visits to local oncology units). At recursions x and y , the medical visits are crucial, because they give the professionals a first-hand impression of the local care situation and the individual state of the patient. Also, informal communication and cohesion-building socio-cultural activities play a crucial role here at all levels.

Among the cohesion-building measures are the coffee breaks in the wards, the 'onco-lunches' that gather OCS people of Klagenfurt and beyond, and the yearly oncology symposia which bring together oncologists from all over the state plus colleagues from the neighbouring state of Styria. These events fulfil both coordination and auditing functions. In certain cases they might also contribute to the intelligence function.

Component 4. This *intelligence* function fulfils tasks ranging into the long term and the wider environment. These tasks are, in the first place, the concern of the OCS leaders team, whose members are involved in the strategic development at all three levels of recursion: at recursion w as the pioneers and masterminds, at recursions x and y in support roles. In the latter it is the managers/leaders of these recursions who are the designers of the long-term future of their units, making up development plans and providing their staff with education for the future. The development of therapy strategies, going hand in hand with research activities and international activities in knowledge networks, is mainly in the hands of the OCS leaders at recursion w . Knowledge is built up in the process, mainly at recursions w and y .

Component 5. Finally, the system's identity, manifest in the ethos of the system, with normative management has become a systemic braid that connects members and organizational cultures of all recursion planes. Shared values, principles, vision and mission are the same for all three recursion levels, but they need different people to enforce and exemplify them, namely the leaders at each level. In this structure, as shown in Table 12.2, one and the same unit often fulfils different roles with respect to the management components. For example, on recursion w the management team is active in both functions, executive management (component 3) and strategic management (component 4).

The structure outlined here is a network, and so it need not be emphasized that the activities therein involve various forms of networking and communication, from formal to informal and from personal to electronic. That network is crucial for the alignment of the views of multiple purposeful actors with different goals and interests. And it enables building a shared corpus of knowledge over time. Much of that knowledge is tacit know-how (Nonaka and Takeuchi, 1995), embodied in the people and teams of the organization.

In addition to the 'master structure' just described, we will now delve, in more detail, into one crucial organizational feature mentioned – the teams at various levels, which are of three kinds.

First, the therapy team is the nucleus of the structure. These self-regulating teams are formed around each patient, as the primary units at recursion z . The care here is accomplished by the patient, his or her family, a medical doctor and a nurse. Besides its therapeutic function, the team also engages in prevention, as far as possible. While patient and family are members of that team only, doctor and nurse are normally also part of other teams, around other patients. They are always virtually present in each of these teams, but physically present only at certain times.

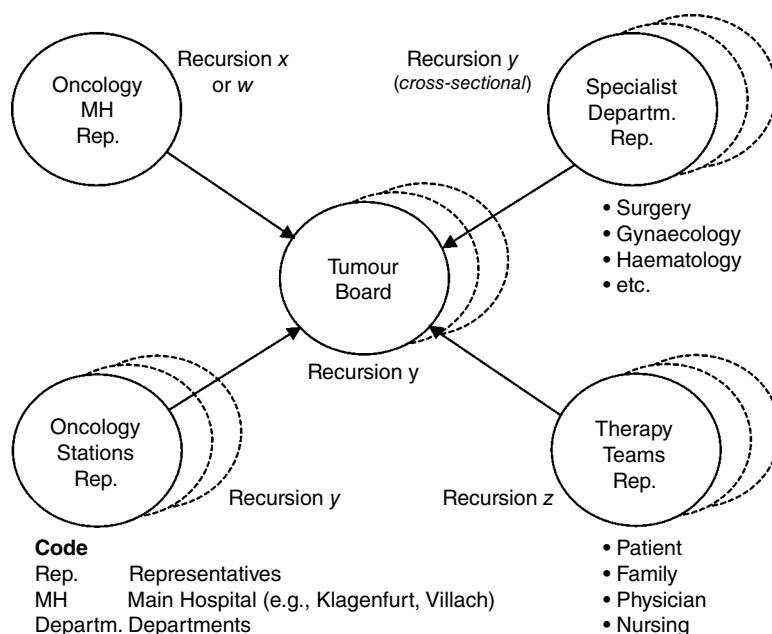


Figure 12.7 The constitution of tumour boards.

Second, the tumour board at recursion x is a platform that manages the continuous flow of cases to be dealt with in a given hospital.¹⁷ It also plays a role in the building of local knowledge. A tumour board is formed by members of different organizational units of different recursions (x and y , or even x , y and z). See Figure 12.7. A tumour board meets regularly to investigate the current cases under treatment. The local oncologist, if extant – and if not, a mobile oncologist from the hub – as well as members of specialist departments (surgery, gynaecology, haematology, etc.), constitute that body. Whenever indicated, representatives of therapy teams join the board. The interaction in tumour boards is supported by the latest communication technologies, for example if (additional) oncologists from the hub need to be involved selectively. The leadership of the board is in the hands of an oncologist.

The arrows in Figure 12.7 denote the provenience and inclusion, in the board, of members of different organizational groups; the multiple communications in the group are not specifically represented. The diagram visualizes how members of several recursions, normally two (x and y), possibly three (x , y , z) constitute such a body. The composition of the board varies as a function of the cases to be treated. The specialized departments are of the support function type, and they are represented as the cases demand.

In the central hospital at Klagenfurt (LKH) – recursion x – more than one tumour board has been formed. Cancer patients have their treatment across different specialized wards, gynaecology and pneumology being two prominent examples. One of the oncologists moves from the LKH oncology unit to these departments, where he or she participates in visits to cancer

¹⁷ Tumour boards can also be formed at recursion level x .

patients, in this way forming a local tumour board, together with the local doctors in charge. This approach was later copied in the largest of the peripheral clinics, as it developed internal capacity for oncology.

Finally, the tumour council is an entity that forms itself spontaneously, if a case needs a level of attention that goes beyond the possibilities of the tumour board. The composition of these bodies varies, according to three criteria: (a) an oncologist is always present; (b) the responsible doctor ('patron') and normally the nurse in charge of the case are present; (c) other specialists are on the team as needed. A tumour council can be summoned whenever a doctor or nurse from a specialist department needs assistance in dealing with a difficult case. In that instance, an oncologist visits the respective ward, where he gathers with the local medical and nursing staff and most important, the patient, in an on-site inspection ('ad-hoc meeting'). Hence, the tumour council bundles distributed resources flexibly and effectively, and is a major factor for the quality of care.

These more or less virtual teams are of a non-hierarchical ('heterarchical') type (McCulloch, 1988; Schwaninger, 2009). They have proven to be efficient and powerful: they enhance the quality of care, an optimal use of available resources and growth of the body of knowledge. Also, an increase in the cohesion of those dealing with cancer and the cooperativeness across disciplines and departments has been clearly observable. Cultural events are regularly planned to support this process. For example, once a year, a gathering of medical and nursing staff from the oncology units in Carinthia and Styria, the neighbouring state, takes place in Bad Kleinkirchheim, a beautiful resort. The purpose of these events is to exchange ideas and get information about new developments in the field. Similar events take place, on a smaller scale, for the Carinthian staff, normally combined with a concert.

The mobile doctors as well as the tumour boards and councils are instances of decentralization. Nevertheless, certain technical resources could not be decentralized *ad libitum*. For example, back in the 1990s a laser canon cost 700,000 euros (i.e., close to US\$1,000,000). At the beginning, only one of these machines was available, in Klagenfurt. A few years later a second one was installed in Villach. The other hospitals continue without such infrastructure, and patients must travel to get radiologic treatment.

The structures analysed here represent the current state-of-the-art. They were crucial for reaching the goals set at the beginning, and which we have gradually approached. For the future there is still space for improvement. For example, the preventive strand of our activities is still weak, and should be strengthened. We are up-to-date on early detection, but hardly present in public or as supporters of other information agents to promote healthy behaviour.

12.3.9 The Evolution of Oncology Carinthia (C)

Taking a broad view on the evolution of Oncology Carinthia, we can discern remarkable changes which have shaped that system. Gradually, doctors confronted with tumour instances came to understand the advantage of close cooperation with the oncological care unit established at LKH Klagenfurt, consisting of an internist-oncologist and a radiologist-oncologist. Even those who had rejected the new approach initially moved on to cooperative and even supportive behaviour.

The concept of virtual teams was introduced. Doctors increasingly took part in tumour boards, invoked councils and conferred with the oncology hub. The 24-7 on-call service was

a major factor in building trust and gave security when a doctor took on a treatment. The concept of mobile units added a new dimension in providing high-quality care covering the whole state. The introduction of these units and the virtual teams approach also added enormous flexibility to the provision of service capacity.

In this way a growing share of the departments, in the LKHs as well as at the KHs, was integrated into the OCS. Increasingly, tumour boards and councils were established. The oncology champions were surprisingly active in research, participating in congresses and professional networks. Following the principle 'as central as necessary and as decentralized as possible', intensive-care patients were medicated at LKHs, under rigorous supervision of the oncological experts, while easy-to-manage cases could be treated at the clinic closest to their homes, frequently in ambulant mode: a patient-friendly but also very economical way to provide oncological care. Altogether, an excellent level of care relative to the scientific state-of-the art was realized at Oncology Carinthia: the OCS had become an effective health-care system.

12.3.10 Results

The case studied here is a showpiece that demonstrates two things. At the content level, it shows the huge potential of service industries for increasing quality and productivity, even in cases of severe resource restrictions. At the context level, it makes the strength of holistic system design palpable. We were successful in conceiving Oncology Carinthia as a viable and adaptive whole, by supporting the evolution of the OCS conceptually and methodologically with systemic methods.

The first result is the organization design that has been accomplished. It is conceived around the patient as the focal point, with all features of a network organization. Patients and their families, often factored out from organizational plans, are the prime agents of the system in Oncology Carinthia. Both are crucial in the process of recovery. The central hospital and nine more clinics, as well as registered doctors, are part of the care network, with a pivotal oncology unit as the main knowledge hub and coordinating agent. Among the innovative features of the structure are cross-sectional teams, transdisciplinary collaboration, the concept of mobile units that bring doctors to the patient rather than the other way around, and networks both inside and across the hospitals. The care process covers all phases from prevention to medical treatment to follow-up care and psycho-social accompaniment. It follows essentially a salutogenetic orientation. One of the strengths of the arrangement is that both the design and management of the process are governed conceptually, with a heavy dose of theory. The implementation is an infinite learning process. In sum, an intricate, systemic path of dealing with the enormous complexity at hand has been discovered.

A second result is the stunning performance of the OCS. Despite an extreme scarcity of financial resources, both the quality and success of oncological care have been increased. The system under study has become a showcase of holistic medical treatment that has evoked sustained interest in professional circles all over Europe and beyond.

Third, Oncology Carinthia stands as an exemplar for the successful management of expertise. The influence of organizing and managing in general on the evolution of the system has become tangible. Yet it has not provoked the likely conflict between medical and managerial logics, which often deteriorates the qualification of professionals (Boos and Mitterer, 2014).

Instead it brought to fruition a constructive force for the system's viability. The reason is twofold. On the one hand, management in this case has never become a pathologically autopoietic system (Beer, 1979) – in contrast, it has been instrumental in pursuing the purpose of the whole system-in-focus: a state-wide, excellent level of care, enabled by transdisciplinary collaboration. On the other hand, management, including leadership, was radically decentralized and, furthermore, integrated or 'dissolved' into heterarchical, mobile and virtual structures. This has entailed a powerful rise in the repertoires of behaviour ('variety') at all levels of the organization, enabling multiple agents to cope with complexity forcefully. Oncology Carinthia has become more agile in both time and space.

The concerns and needs raised initially (Sections 12.3.1 to 12.3.3) were met fully by the organization developed within roughly ten years (1985 to 1995): by then the new system was running at 'full steam'. In fact, the outcomes exceeded all expectations. A major factor was the substantial freedom granted to the champions by the state health authority of Carinthia.

Some of the results were unexpected. For example, the evidence that (a) organizational structures can be nimble and robust at the same time and (b) a more complex structure is not necessarily more expensive; it can even be more economical.

The results referred to here are not an endpoint. On the contrary, the OCS team has seen itself confronted with new challenges along the way. Over time, competencies evolved and structures had to develop as well. Transformations of structure took place for meeting new needs. For example, the establishment of two transdisciplinary units, a central ambulance and an oncological ward for special cases, as well as the foundation of an intensive care unit for oncology.

We were not dealing with a machine, but with a social system. Hence, the design approach was both formal and informal. The results were emergent. Culture and structure were always 'in progress', adapting and evolving. We have claimed that the OCS Carinthia has become a highly effective system of health care. Can this claim be upheld in view of empirical data?

We consulted the 'Tumorregister Kärnten' (Tumour Database Carinthia) in Klagenfurt, to examine if there was any evidence of medicinal effects of the OCS, over the period covered by our study. We received long-term data series on the evolution of five-year survival rates, in Carinthia, for the five main entities of cancer indications (Figure 12.8). Five-year survival rates are the most important indicator of effectiveness in oncological care (Ziegler *et al.*, 2007).

The axes in the five graphs show the period of survival after the treatment (from 1 to 5 years) and the percentage of patients surviving (1.00 being 100%). Each graph shows two curves, one for the period 2005–2004 and the other for 2005–2013 (in the case of stomach cancer, for 2001–2006 and 2007–2013).¹⁸ The graphs tell us two things: (a) for prostate, lung and stomach cancer (Figure 12.8, left), there is a highly significant improvement in survival rates from the first to the second period. The respective p -values of the log-rank test are $p < 0.0001$ for the first indication and $p < 0.01$ for the second and third indications.¹⁹ (b) For colorectal cancer and breast cancer (Figure 12.8, right), there is a trend indicating improvement, even though the level of significance is less impressive. Here, the p -values are at $p < 0.1$.

¹⁸ Initial values n (number of patients): prostate, 3828 (2005), 3819 (2005); lung, 2734 (1995), 2908 (2005); stomach, 783 (2001), 848 (2007); colorectal, 3259 (1995), 2953 (2005); breast, 3579 (1995), 3760 (2005).

¹⁹ According to the null hypothesis, there is no difference between the two survival curves. Given the results of the log-rank test, the null hypothesis is refuted.

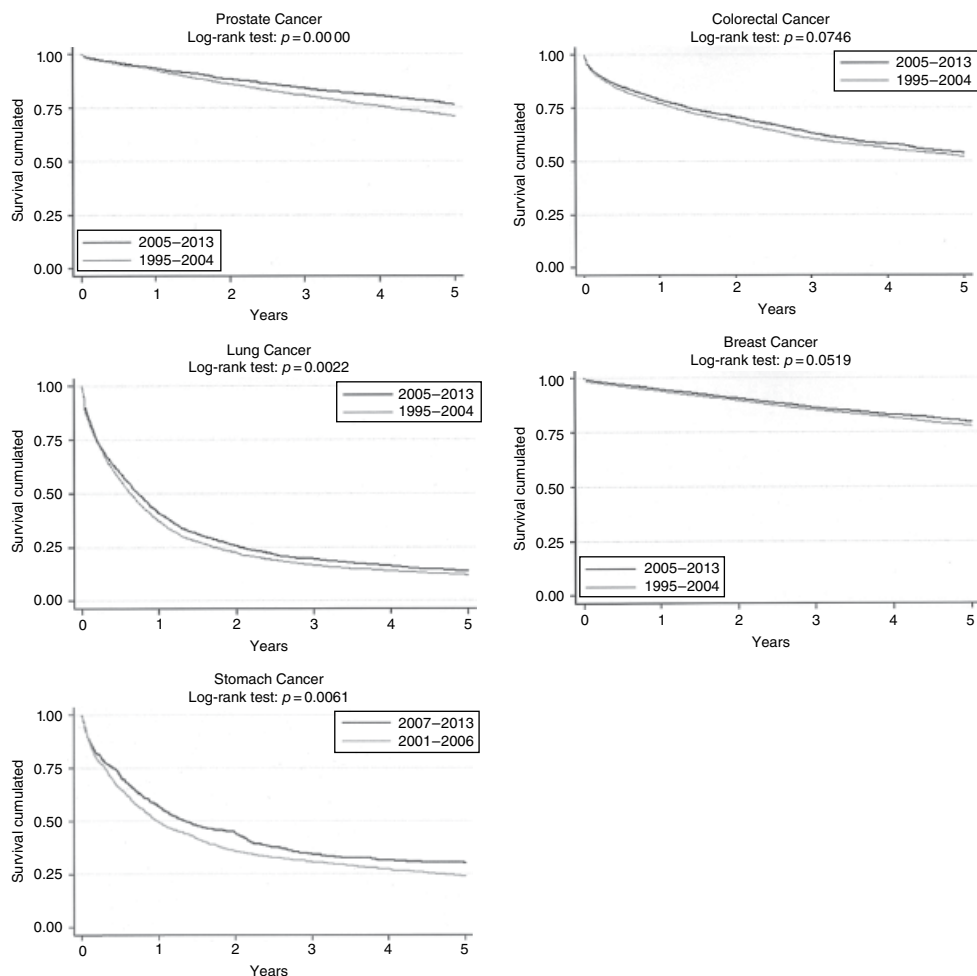


Figure 12.8 Survival rates for main types of cancer in Carinthia 1995–2013.

This analysis testifies success and that success could only be achieved through high quality of care. The numbers underpin the claim made above: the OCS became a highly effective health-care organization.

12.4 Insights, Teachings and Implications

What can be learnt from this case? Many insights and lessons have emerged throughout the sections of this chapter. As indicated at the outset, the purpose of this contribution is to explore an exemplar of a long-term process aimed at achieving a holistic system design for a patient-centred system of health care. In closing we shall try to condense our findings in a brief resumé, which cannot lay claim to being a full-fledged theory, being instead a set of crucial

aspects conducive to ongoing learning. As these aspects have been tried and tested extensively over a long period, we dare to switch, at times, from the descriptive mode to 'normative' propositions (i.e., suggestions of how things should be done).

- (a) *Ethos*. The focus should be on the patient, with his or her family included. This means placing the patients and their quality of life at the centre. Not only at the centre, but also in command; the patient is the authority responsible for his or her health. For the doctors, nurses and other employees, a culture of highest professional values, including unconditional commitment to patients, is the imperative to be adhered to. The principle of excellent care must pervade all activities. Goals have to be high, and leaders need to energize the organization to attain them.
- (b) *Systemic approach*. Systemic thinking is a way of dealing competently with complex wholes. It enables systemic design for better organizations. The proposed thinking at the levels of both content and context forms a braid that enables a systemic process reaching from modelling to assessment to design to change. Unorthodox thinking, as our case showed, can produce management innovations that, although unwelcome at the beginning, go on to breed (unexpected) positive results and are adopted by the organization. To initiate and manage these innovations, powerful change agents are a *sine qua non*.²⁰
- (c) *Theory and practice*. Practitioners are often theory-averse. Therefore, we pursued another path, operating on a strong theoretical (and methodological) orientation, combining it with pragmatic, flexible implementation and – most importantly – with enduring dedication to the issues of health. This alternative path proved to be at the core of the success of Oncology Carinthia. The combination of theoretical, conceptually driven design and reflexive, committed practice is mandatory for dealing effectively with complex organizational issues in a social system.
- (d) *Methodology*. We have tried to catalyse the dialectics of strategy and organization, proposing two methodologies (SD and VSM) that facilitate dealing with the complex issues under study. These are not the only methodologies available, but they appear to be mature devices on which one can rely in the face of complexity. And they are complementary. Much as with engineering, the methods chosen rely on the cyclic pair of reasoning and experimentation (Goldman, 2017).
- (e) *Holistic organization design*. The systemic approach provides highly effective heuristic devices and frameworks (e.g., VSM) for enhancing the viability and adaptiveness of organizations. Holistic design combines decentralization and centralization, as well as information flows from inside-out and outside-in, which is a better model than top-down and bottom-up. Structures can be nimble and robust at the same time, and a complex structure can be even more economical than a simplistic one. The systemic approach based on VSM and other cybernetics-based structural models not discussed here²¹ is very potent in putting networks and virtual organizations in place, which absorb complexity pervasively. This proves to be the case here in an organization that is above all humanistic.

²⁰ In the case under study both an internal and external change agent were active, and in harmony. This may have been an important prerequisite for the successful performance of Oncology Carinthia (Birkinshaw *et al.*, 2008).

²¹ For example, Team Syntegrity, a systemic protocol for the interaction in large groups (Beer, 1994; Schwaninger, 2003).

These are the answers to our research question posed at the outset: How must health-care systems be designed to provide holistic, patient-centred care, of excellent quality and at bearable cost? The main implication of our study is that these insights and teachings can also deliver value to other protagonists and ‘engineers’ of health-care systems. Even more, we trust that the organizational concepts discussed herein can convey lessons to organizers in any industry, showing them new paths of coping with complexity. As far as management scientists and students are concerned, the systemic approach – framework and methodology – documented in this reflexive case might potentially enhance their professional knowledge and repertoire.

All of the aspects synthesized above are becoming ever more important, as the complexity of systems grows. The immediate results secured by organizations are less important than their viability in the long run. We have relied on the VSM to structure the OCS because that model defines not only the necessary but also the sufficient preconditions for such viability. Therefore, the design we have proposed and implemented is not only successful, but also has great potential for some time to come.

There are limitations to both the case and this chapter. As far as the case is concerned, even though the OCS has bred remarkable results as we have reported, none the less Oncology Carinthia is not perfect; there is room for further improvement. For example, to date our successes at the preventive end are below our initial expectations.

As far as the chapter we have written is concerned, its chief limitation lies in the difficulty of capturing the richness of 30 years of experience in a short document. For example, we cannot account for all the scenarios, the various ‘what ifs’ and ‘so whats’ that emerged in the process. Also, little has been said about the relationships between Oncology Carinthia and its external stakeholders, etc. Although we could write a book, still a concise piece of work like this is more digestible.

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Appendix: Mathematical Representations for Figures 12.5, 12.6 and 12.7

A1: VSM, for any System-in-Focus (one level of recursion; ref. Figure 12.5)

$$S = f(B_1, \dots, B_n, C_1, \dots, C_5) \quad (\text{A.1})$$

The system as a whole (S) is made up of basic units B , the number of which can vary, and a set of five²² management components C , which are connected by a coupling function f .

²² Component 3* is subsumed under component 3.

A2: Recursive Structure of the VSM (ref. Figure 12.6)

$$R_z \subset R_y \subset R_x \subset R_w \quad (\text{A.2})$$

Viable systems are structured recursively. The sequence $R_{x,\dots,z}$ denotes levels of recursion ranging from x to z . Units of lower levels are embedded in units of higher levels:

$$R_z \sim R_y \sim R_x \sim R_w \quad (\text{A.3})$$

Viable systems are fractals (i.e., they are self-similar in that their basic structure repeats itself at different levels of recursion).

A3: Virtual Teams (ref. Figure 12.7)

The virtual teams are entities that form themselves flexibly: according to the issue at hand, different combinations of resources will be pooled together ad hoc. In the case of a tumour board (TB), representatives R of the oncology team of a main hospital OMH , oncology stations OS , specialized departments SD and therapy teams TT . We describe this with a vector:

$$TB = \begin{pmatrix} R(OMH_x) \\ R(OS_y) \\ R(SD_y) \\ R(TT_z) \end{pmatrix} \quad (\text{A.4})$$

A second vector specifies, in more detail, that several units $i = 1, \dots, n$ of each category (e.g., more than one oncology station) can be represented in one and the same tumour board:

$$TB = \begin{pmatrix} R_1(OMH_x) \\ \dots \\ R_{n1}(OMH_x) \\ R_1(OS_y) \\ \dots \\ R_{n2}(OS_y) \\ R_1(SD_y) \\ \dots \\ R_{n3}(SD_y) \\ R_1(TT_z) \\ \dots \\ R_{n4}(TT_z) \end{pmatrix} \quad (\text{A.5})$$

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