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Building towards organisational resilience and complexity leadership: a case study of impacts and changes in a Dutch blood establishment during COVID-19

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► Additional supplemental material is published online only. To view, please visit the journal online (<https://doi.org/10.1136/leader-2024-001008>).

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Received 14 February 2024

Accepted 1 July 2024

ABSTRACT

Objectives This study examined how one large blood-related establishment coped and adapted during the first 1.5 years of the pandemic by evaluating the impacts and changes on its resources, communication, collaborations, and monitoring and feedback. Furthermore, we explored whether elements of complexity leadership emerged during this time.

Design Duchek's organisational resilience framework was primarily used. We followed a three-step sequential approach: (1) a document analysis of over 150 intranet, internet and internal reports; (2) 31 semistructured interviews with employees and (3) four feedback sessions.

Setting Sanquin is known as the Dutch national blood bank and a large multidivisional expertise organisation in the Netherlands.

Results Sanquin coped well. Respondents accepted the crisis and catalysed many collaborations to implement solutions, which were communicated to the public. There were many positive aspects related to internal collaborations, yet challenges remained related to its historical siloed structure and culture. Sanquin adapted partially. Many respondents experienced the organisation becoming more connected and flexible during the pandemic. However, Sanquin was not permanently changed due to significant leadership changes and organisational restructuring occurring simultaneously. Respondents reflected on lessons learnt, including the need for continual collaboration and improvements in Sanquin's culture. An important driver in the successful coping was management's enabling attitude and the adaptations occurring within and through the collaborative groups.

Conclusions Sanquin improved its organisational resilience by exhibiting elements of adaptive spaces, enabling leadership and (temporary) emergence from complexity leadership. This illuminates how the organisation could continue benefiting from complexity leadership for non-crises and for future uncertainties.

INTRODUCTION

The COVID-19 pandemic is a 'wild card', a volatile disruptive event that severely affects the human condition and is beyond the scope of human control.¹ It can also be considered a 'creeping crisis' which occurs after a long incubation period and

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Healthcare organisations had to find a way to cope and adapt during the turbulence of COVID-19. Studies have highlighted the need for 'organisational resilience' and illuminated 'complexity leadership.'

WHAT THIS STUDY ADDS

⇒ This study ties both organisational resilience and complexity leadership by first assessing the specific ways a Dutch multi-expertise blood organisation coped and adapted. Findings show how the pandemic created an opportunity window for elements of complexity leadership to emerge and make the organisation successful during this time.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Implementing complexity leadership in an organisation may be worthwhile in building organisational resilience for times of crises and non-crises.

continues 'simmering' after the acute phase is over so that there 'a seemingly permanent, epochal character, generating regular outbursts without reaching closure'.² It is complex, due to the rich interconnectivity of things interacting and changing one another in unexpected and irreversible ways.³

Like a magnifying glass, the pandemic exposed the vulnerabilities of the healthcare sector and the need for resilience.⁴ Resilience is a multi-capability to anticipate, cope and adapt before, during and after crises. It comprises a multistep process that builds on a set of an organisation's inward capabilities and routines.⁵ Two of these steps are coping (accepting the situation and developing solutions) and adaptation (reflecting, learning and changing).⁵ While the need for resilience within healthcare is not new,⁶ there is a resurgent call for healthcare organisations and systems to become resilient during these uncertain times.^{7,8}

As part of the resilience process, complexity leadership is required. Complexity leadership theory (CLT) is a framework to understand how to enable the adaptability of people and organisations by assessing the social (and dynamic) interactions that



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To cite: Langi Sasongko PK, Janssen M, de Bruijne M. *BMJ Leader* Published Online First: [please include Day Month Year]. doi:10.1136/leader-2024-001008

occur within an organisation. As pressures occur, the system must change. There is an emphasis on ‘enabling’ leaders who foster adaptive spaces; adaptive spaces are where processes of conflict, connection and reintegration occur between those who have an ‘order’ response (operational leaders), and those who have an ‘adaptive’ response (entrepreneurial leaders). The role of complexity leaders is to keep the system from staying in order by enabling adaptive responses.^{3,9}

Prior to the pandemic, we became interested in organisational resilience related to what a traditionally run Dutch blood bank needed to do or become to thrive into future uncertainties within transfusion medicine and healthcare at large. We found that ‘disruptive events’ formed an important but highly uncertain topic that would impact blood demand.¹⁰ Therefore, when this organisation (the Sanquin Blood Supply Foundation) quickly began various initiatives in response to the pandemic, it was an opportunity to link our prior results to the present circumstances and conduct a one-and-a-half-year observational study of the impact of this disruptive event on the organisation and its resulting organisational changes.

Therefore, our research aims were to:

1. Examine how Sanquin coped and adapted during the pandemic as part of its organisational resilience process.
2. Evaluate whether and how elements of complexity leadership emerged during that time.

METHODS

Theoretical concepts and framework

Organisational resilience

Resilience is a meta-capability of an organisation, combining the abilities to anticipate potential threats and be prepared for, effectively cope with and adapt or learn from it. Duchek’s framework

outlines three stages of resilience, of which we focused on the second and third stages as they were appropriate to the current stage of research and current state of pandemic at that time. The second stage of coping occurs during the disruptive event and requires (1) accepting the situation at hand and all its uncertainties and (2) developing and implementing solutions using social resources as part of cognitive and behavioural actions. The third stage of adaptation occurs after the disruptive event and involves (1) reflection and learning and (2) change.⁵ Underlying these stages are the main antecedent (knowledge base) and drivers (resource availability, social resources, and power and responsibility) that affect all or some (figure 1).

Setting the scene

In the Netherlands, Sanquin has been known primarily as the national blood bank, the sole entity legally tasked to collect blood and produce products under the Dutch Blood Supply Act. Under the Sanquin Foundation, there are two distinct but interconnected entities: a not-for-profit side (consisting of the blood bank, research and lab services, and corporate staff and services) and a for-profit side (consisting of Sanquinnovate and Diagnostics). Hence, Sanquin is a multi-divisional, multi-expertise organisation that singularly and collaboratively carries out its public and private duties.¹¹

Methodology

A three-step, consecutive qualitative approach was conducted:

1. A document analysis of over 150 intranet, internet and internal Sanquin reports.
2. Semi-structured interviews (n=31) with Sanquin employees.
3. Four feedback sessions with Sanquin employees.

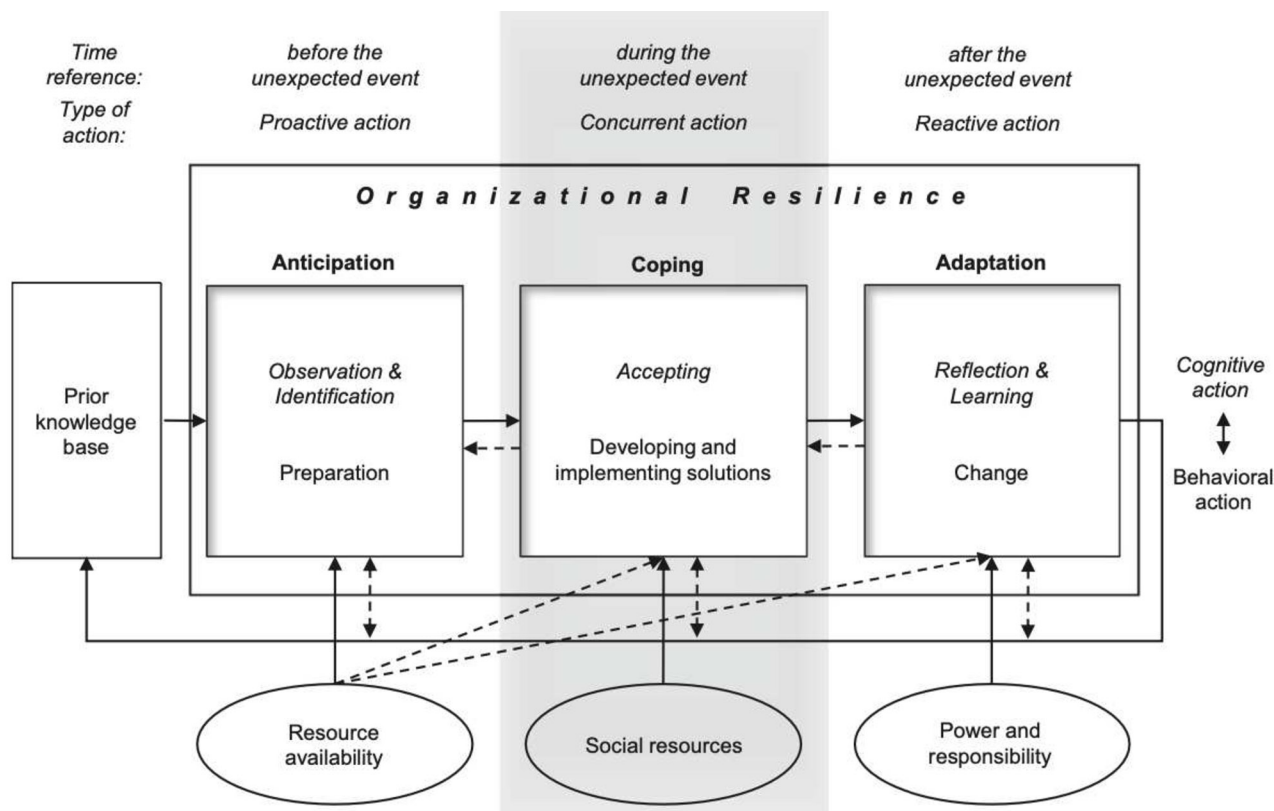


Figure 1 Duchek’s organisational resilience framework⁵ reproduced from a Creative Commons Attribution 4.0 Licence.

The document analysis was the first step. It began with assessing Intranet articles, posted by Sanquin's Communications Department under the 'coronavirus' tag during March 2020–April 2021. This time frame was chosen to gain knowledge of the events that happened within the first year of the pandemic and of the employees who were active therein. Some of these posts had links to external (public) articles of Sanquin, which were also reviewed. Internal reports voluntarily shared from employees interviewed in step 2 gave further information regarding initiative(s) and its outcomes.

From June 2020 to August 2021, interviews were done using purposeful sampling from the key employees found in step 1. Inclusion criteria were that they were a Sanquin employee for at least a year, had been involved in a COVID-19 initiative and were willing to communicate in English. An interview guide was created in line with the research questions, and a semistructured method was chosen to allow for additional probing and follow-up questions as appropriate.¹² All but one of the interviews occurred virtually or over the phone. Recording was done with consent and interview notes were kept for all. Respondents were free to recommend others to be interviewed. Interviews were done until saturation was reached.

As a last step, the results from steps 1 and 2 were analysed and shown back to respondents during four feedback sessions in January 2022 with differing the number of participants (n=1, 50, 7, 75). Two of these sessions (sessions 1 and 3) included only prior respondents while the other sessions included both prior and new respondents, which occurred during mandatory presentations for the research division. In all sessions, the first author presented the anonymised findings and invited open feedback from the audience.

Analysis

Interviews were transcribed verbatim if they had been recorded; if they were not, the meeting notes were analysed instead. Qualitative software (MAXQDA 20202, VERBI Software) was used to conduct first-cycle coding using a predetermined coding scheme based on the research aims as described by Saldaña.¹² Author PKLS and two external researchers assessed three transcripts independently, came together to discuss coding differences to the point of consensus and adjusted the coding framework. PKLS continued coding the remaining transcripts and then applied second-cycle coding, combining categories under emergent themes.¹² To validate findings, the document and interviews were used to cross-examine one another. Furthermore, the feedback sessions were intended for respondents to see the anonymised results thus far, correct them if necessary and allow for their insights and interpretations. Interview summaries and transcripts were discussed regularly with the authors of this paper.

Patient and public involvement

Patients were not involved in any process of this study.

RESULTS

Descriptives

From the document analysis, 165 documents were reviewed: 150 which came from the Intranet and 15 which came from internal reports shared by the respondents.

Thirty-one employees were interviewed: 70% of them had worked between 11 and 45 years at Sanquin, representing the major divisions within the organisation.

Coping

The elements of acceptance, developing and implementing solutions, and the underlying drivers of social and resource availability are described below.

Acceptance and momentum

From the document analysis and interviews, the most prominent theme was that respondents not only accepted the scenario but were compelled into unifying action as exemplified by this quote: *"And now, in the COVID-19 crisis, everybody had the opportunity to do a contribution. It created a common sense [of direction] of 'Let's do it. We can do a lot of important work, so let's move forward, and let's make it happen' [...] The magnitude of COVID-19 crisis created a platform we needed"* (Corporate staff1, 20 years). Even in the face of difficult circumstances (words like 'pressure,' 'intense' and 'urgency' were used), respondents stated that they focused on having 'common or clear goal.' This acceptance and commitment led them to developing and implementing solutions, which came in the form of collaborations, modified communication methods and monitoring and feedback.

Collaborations

The topic of collaborations was the most prominent theme found in the interviews and the document analysis. Approximately 30 internal and external initiatives were found, ranging from internal safety measures to national efforts like PCR testing and donor antibody monitoring and many international research projects. Respondents shared how some collaborations were pre-existing, but others were new, and collaborations were markedly increased through COVID-19. One key aspect at the beginning of the pandemic was the organic, bottom-up nature of the research collaborations. Overall, respondents stated how unique it was that employees quickly sought each other across the organisation: *"I collaborated with people that in the years before, [I] would never have collaborated with."* (Researcher7, 15 years).

One document reviewed the quality of these collaborations, from those that were 'more difficult' to 'excellent' (the majority were good excellent; only one was deemed unsuccessful). From interviews, respondents shared how research collaborations were particularly rewarding, with quick data acquisition and many publications. Both the document analysis and interviews emphasised how joint collaborations with the Dutch government were of particular importance and success. Both the document analysis and interviews concurred that Sanquin's multiexpertise knowledge base was the cornerstone as to why so many endeavours could successfully occur.

However, while there were many positive aspects, challenges remained (online supplemental table 1). Respondents shared how many of these challenges were rooted in the pre-existing structural and cultural organisational elements that came to the forefront as different departments worked together. Overall, while there was a clear, common goal and coordination, some groups still struggled with lack of governance and leadership issues, which caused delay and confusion.

Communication methods

Both the document analysis and interviews revealed how because most employees worked from home, communication patterns and venues were modified and increased. For internal purposes, respondents explained how this resulted in more frequent use of existing communication means while creating new ways of

communication, such as the Help Hotline which provided COVID-19 work advice from Sanquin physicians for employees at a response rate of within 2 hours. Respondents explained how the pandemic's uncertainty forced the organisation to continue communicating and 'communicate more' on both microlevels and macrolevels.

Externally, the organisation shared many of its initiatives with the public. The document analysis proved how Sanquin's initiatives were in the Dutch media spotlight on a weekly basis for consecutive months into the years. This boosted Sanquin's reputation, as seen in this quote: "*For the image of Sanquin, it's been a blessing.*" (*Corporate staff2, 13 years*).

Monitoring and feedback

As these initiatives were done, monitoring and feedback occurred in unique and expedited ways. The interviews and the document analysis showed how there was a group called the Corona Steering Committee comprised individuals from many of the ongoing initiatives who met regularly to provide updates about their initiative to seek or offer help and feedback as needed. This group also included personnel who were not directly involved in various initiatives directly (e.g., finance, communications) but could provide their expertise and gain insights to bring back to their own departments. Interview respondents who were part of this committee stated how helpful it was.

Externally, one initiative remained in the Dutch spotlight through the years and was a type of external monitoring that accommodated public feedback. The 'Finger on the Wrist' study measured COVID-19 antibodies within the donor population over time. The results were released regularly and directly to the public, instead of being published through scientific publication. This was the first large Sanquin study of its kind to be communicated in such a manner which allowed citizens to forward potential explanations for data fluctuations to the principal investigator.

Resources

All the COVID-19 initiatives were supported by the organisation's resource availability. The document analysis and interviews recorded how Sanquin received more financial resources during this time from the Ministry of Health and also acquired more external research grants. Furthermore, interview respondents explained that since most of the initiatives were done next to pre-pandemic functions, they experienced a shortage of time, supplies, skilled personnel and difficulties with outdated medical systems. These lacks forced employees to be creative in the interim, and all respondents reiterated the collective social strength throughout.

Adaptation

The elements of reflection, learning, change and the underlying driver of power and responsibility are analysed below.

Reflections

From interviews, respondents reflected on how the organisation was impacted by the pandemic by comparing how it was prior to, and during, the pandemic (table 1). Some even called this comparison the 'old' versus the 'new' Sanquin as they saw a traditional, siloed and slow organisation become more connected, flexible and adaptive. For the majority, this was the first time they had experienced such shifts, and the consensus was that it was enriching and empowering. However, two respondents

Table 1 Comparison of the organisation prior to and during the pandemic

Before the pandemic	During the pandemic
Mostly silos	Multi-departmental and inter-departmental and divisional collaborations occurred
Lack of efficiency	Too much to do and too little time; working overtime; increased efficiency due to improvisation
Backwardness of systems, procedures and processes	Digitalise and modernise; find workarounds as much as possible
Employee pride	Greater employee pride
Identity: Sanquin is not just a blood bank	Identity: Sanquin is a multi-expertise organisation comprised of multiple divisions that work together for the common good
Long history of internal and external collaborations and connections	These historical collaborations and connections continued, were strengthened or built on

mentioned how they had experienced this activated spirit once before, namely during the HIV pandemic in the 1980s/1990s.

However, while Sanquin was strongly impacted by the pandemic, it was not permanently changed. This was because there were significant leadership changes and organisational restructuring that were occurring simultaneously. These drivers were distinct from COVID-19 as they had begun before the pandemic, but through the interviews, it was found that some effects intertwined. These included how employees were overall more agreeable/cooperative in the processes of the restructuring and adjusting to new leadership ("*A pandemic kind of helps in the sense that crises often help to get people to cooperate.*" *Management1, 1 year*). One respondent pointed out that COVID's main effect on the organisation was to slow the process of separation. During feedback sessions, respondents agreed that the leadership changes and organisational restructuring were what was bringing significant and permanent organisational changes, not the pandemic.

Lessons learnt

Thus, interview respondents shared many lessons learnt, divided into themes of resources, culture/way of working, internal collaborations and communications, and external collaborations and communications (table 2). Many of these themes intertwined as the respondents pondered the elements of improving future collaborations and identified how to improve the culture/way of working both within collaborative groups but also within the organisation at large. These themes were mirrored within the document analysis, for example, as seen in the Corona Steering Committee's compilation of lessons learnt in their final report. Such cumulative reports were submitted to management but respondents did not know or experience any permanent changes or implementations thereafter. Collaborations had dissolved or were near dissolving by the end of 1.5 years, with a few initiatives that remained in Sanquin's organisational process. Therefore, interview respondents commented on how the organisation seemed to be shifting back to the 'old' Sanquin and suggested improvements (table 2).

Power and responsibility

From the interviews and document analysis, one significant aspect that occurred during the coping phase was top management's attitude and support of the collaborations. As many unfurled organically, management was compelled to enable and equip them as much as possible, aiding with major steps such as

Table 2 Lessons learnt with illustrative quotes

Theme	Lessons learnt	Illustrative quotes
External communication and external collaboration	<ul style="list-style-type: none"> ▶ How to engage with donors and the public ▶ Remain closely connected to important organisations and figureheads 	<p>'Meet the demand, feed the hunger' (Corporate staff3, 13 years)</p> <p>'Good public health relations are needed. During an outbreak, there must be short lines with public health authorities to be able to act quickly. Involve the stakeholders continuously in the project.' (Corona Steering Committee PowerPoint of lessons learned, slide 6)</p> <p>'What I'm trying to do is really implement this start-up where you always start, 'What is the problem? Where is the need?' instead of, 'We have this product. What can we do with this?' I think listening to potential customers is really helpful. And this is another way of thinking, I believe, if I compare it to what we did in the past and what kind of hurdles I experienced.' (Innovation, 4 years)</p>
Resources	<ul style="list-style-type: none"> ▶ Need for modern and capable IT infrastructure and digitalisation ▶ Right personnel in teams and within the organisation ▶ Legal representative, copyrighter, capable HR that can provide needed personnel quickly ▶ Someone with overview, who can create alignment and steer ▶ Recognising and including change agents 	<p>'IT software needed for databases with possibilities for a reliable link with eProgesa and any other software. This software must be GDPR proof. Start as soon as possible with setting up a database with registrations (new or former donation type) and the progress of the process. In order to be able to combine data from different departments, it is necessary that agreements are made about unambiguous recording of key variables within Sanquin. It is important to create a quick overview of what data is expected and how it is managed and how requests for data are handled.</p> <p>E-Progesa again proved too inflexible and too expensive to adapt. It is not possible to switch to another system, but investigate possibilities to build a flexible shell around eProgesa. (Corona Steering Committee summary report of lessons learned, p. 6)</p>
Culture/way of working	<ul style="list-style-type: none"> ▶ Have an improvisational, experimental culture: proactivity, flexibility, with elements of team improvisation ▶ Avoid going back to complacency ▶ Alignment/common focus and goal early on ▶ Mutual communication/ collaboration platform (eg, group) ▶ Embed reflection moments ▶ Work on projects that are directly useful/ applicable ▶ Have a shared vision/bigger picture, but individual responsibilities 	<p>Corona has shown us that we can do it. Once the crisis is there, we can act very quickly and very thoroughly. So I think the biggest bits to avoid would be going back into complacency... People need, I think, a little more commercial firmness. If we're not getting there with this crew or this way of working, then what do we do to change it? And do it. And this is Sanquin's soft spot. This is where Sanquin usually backs off and says, 'Never mind. Never mind. We'll just keep it as it is.' (Corporate staff3, 13 years)</p> <p>'We are not slaves to the system--workarounds are possible' (Researcher2, 37 years)</p>
Internal collaborations and communication	<ul style="list-style-type: none"> ▶ Continual improvement of relations between departments and divisions ▶ Build from historical collaborations into current and future opportunities ▶ Have groups with focus and elements of 'culture/ way of working' (previous theme) 	<p>'Everyone is hungry for that connection and collaboration' (Blood bank1, 5 years)</p> <p>'So my advice is we need coordination. We need commitment from the board of directors. But in the coordination, do not put only researchers, also put business developers for commercial parts and also persons who can deal good with the government, and make a team and create a communication part internally. So everybody is involved. Because I have the feeling that we are working very hard together, but we waste a lot of time because we are not updated enough.' (Management3, 28 years)</p>

GDPR, General data protection regulation; HR, Human Resources; IT, Information Technology.

ethical approval and funding: "We've tried to fund everything and to make all the initiatives make it to execution...But this was the culture at the management level: 'Let's make it happen.'" (Corporate Staff1, 20 years). In fact, several interview respondents stated that top management continued to support the growth of these initiatives giving so much freedom that respondents wished there had been more guidance from the top.

The document analyses highlighted specific persons who were either spearheading or involved within these initiatives; however, there was less emphasis on specific persons, but the groups they were part of, and how adaptation was occurring within and through these groups (i.e., new ideas, products, processes): "The way that different parts of the organization collaborated and participated in this one big project, that is unprecedented, I think. I was impressed by the speed and energy at which this was done." (Researcher5, 12 years).

However, 1.5 years later, in one feedback session, one respondent who is from the top management asked how to continue cultivating this organic collaborative spirit as it seemed to be disappearing.

DISCUSSION

This study examined how a multi-expertise blood-related organisation has coped and adapted during the first one-and-a-half years of the COVID-19 pandemic and whether complexity leadership elements emerged during that time.

Overall, Sanquin coped well. In line with Duchek's model,⁵ excellent coping was attributed to the abilities of the organisation to accept, have monetary and social resources (although staff was limited, staff was willing) and implement solutions. In fact, the pandemic was an opportunity window for the organisation to showcase its expertise and benefit publicly and financially; hence, COVID-19 could be considered a 'constructive crisis'¹³ for the organisation. As highlighted in the literature, the ability to accept and implement solutions requires bricolage, using existing resources towards new problems, and improvisation, the ability to act spontaneously and intuitively and ad hoc in an emergent manner.^{14–16}

Furthermore, coping links to the next stage of resilience, adaptation, as 'coping with crises builds the foundation for reflection, learning, and change'.⁵ Our study found that Sanquin partially

adapted, with many lessons learnt, which included how the organisation became more collaborative with a stronger collective identity than it was prior to the pandemic. However, organic collaborations stopped or were near stopping a year and a half into the pandemic. Respondents were lamenting the return to 'business as usual' and even top management wondered how to continue this activated spirit. Arguably, the organisation had to revert to a place of more 'normalcy,' as an organisation cannot be in a constant crisis mode, and the phase of the pandemic allowed for more stability.¹⁷ However, this 'business as usual' describes a return to the precrisis status, which respondents found wanting. Some healthcare studies describe how the pandemic created favourable conditions for improvisation and innovation^{7 8 18 19} and for some organisations, COVID-19 was a 'catalyst for change'.²⁰ For Sanquin, COVID-19's effects to 'catalyse change' were less significant than the leadership changes and organisational restructuring that were occurring simultaneously. This result highlights Duchek's framework, where power and responsibility are the driver for adaptation. Duchek describes the connection as such: 'While crises can open 'windows of opportunity' for adaptation processes, crises alone do not automatically lead to learning and overall change. Organisations often generate new knowledge ('lessons learnt') but fail to translate this knowledge into new behaviours. In this context, power and responsibility play an important role (Duchek, p. 237, emphasis mine).'⁵

Thus, through the lens of CLT, we realised that COVID-19's impact on Sanquin was to change the dynamics of power relationships, shifting organisational structure and culture during this time. COVID-19 was the external pressure that put Sanquin's system into disequilibrium, forcing the organisation to cope to find solutions.²¹ Here, the elements of adaptive process, adaptive spaces and enabling leadership occurred. The resulting collaborations were examples of adaptive spaces where Sanquin's entrepreneurial (innovative) persons were forced to work together with operational (stability and efficiency) persons to achieve their aims. Within these spaces, respondents experienced how to conflict and connect well (defined as finding ways to bridge differences to create adaptive solutions, or linking up ideas, information, resources in beneficial ways or a beneficial new order.²² Overall, these spaces enthused respondents because it was the first time that many of them experienced its fruitfulness. Additionally, the strong support and wide freedom from top management were novel and significant as it gave room for these adaptive spaces to continue. Furthermore, enabling leadership occurred through the presence of key persons (not necessarily managerial) who led these collaborations and/or fostered the adaptive process by using skill and creativity to unite people together.²² Lastly, the adaptive process was completed when the solutions within the adaptive spaces became incorporated into the operating system in the form of new order²¹ (e.g., new processes, new blood product, digitalisation of the donor registration form). However, as found by our respondents, and described in CLT, after a certain time, the opportunity window for adaptation closes and it becomes more difficult for adaptive spaces to occur unless CLT elements are built into the system.^{21 22}

With regard to leadership, the collective COVID-19 experiences have shown that for organisations to thrive in turbulent times, it is not and cannot be one person who is the sole driving force for survival and success, but an entire system composed of meaningful and effective interactions.^{7 8 22-26} Put simply, as CLT states, leadership is co-creation.²¹ Leadership studies from the pandemic period have similar overtones that leadership needs to be a sustainable, collaborative, changing mentality,^{20 27 28}

focusing more on purpose and relationships than outputs and/or outcomes^{20 21 27} so that there is a shift away from 'planned' to 'playful' change.²⁹ Complexity leaders are described as having attributes of deep conviction to take risks in creating adaptive spaces for others but humble enough so others can take the lead. They are willing to engage with tension and ambiguity and use it to propel forward action. They possess skillsets of brokering, connecting, facilitating and energising learning and growth. Complexity leaders share credit and work collaboratively as seeing people engaged and systems changing gives them deep fulfilment and fun.^{3 9} Uhl-Bien describes how healthcare systems, when faced with complexity, usually respond with traditional bureaucratic approaches. She advocates that instead of adding complexity leadership on top of traditional leadership, it is more effective to replace the latter with complexity leadership. This requires a multiprong approach that includes top management laying out the strategy, the willingness of operational, entrepreneurial and enabling leaders who support one another within the adaptive process, and a reduction in unproductive bureaucratic meetings or processes.²² This provides an opportunity for Sanquin to decide whether to implement CLT practices sparked during the pandemic for times of non-crises. Doing so would enable the organisation to become more adaptable, which is the heart of both resilience and CLT, and be a way forward with regard to future uncertainties regarding blood demand, transfusion medicine and healthcare at large.

To our knowledge, this is the first empirical study to assess the specific impacts on a Dutch blood establishment during the first 1.5 years of the pandemic. While it is limited to one setting, it portrays common challenges and opportunities faced in a crisis, thereby extending relevance to other healthcare organisations and, potentially, other healthcare crises.

CONCLUSION

Our results show how a traditional blood organisation was able to improve its resilience by displaying complexity leadership. Complexity leadership enabled the organisation to successfully cope during the pandemic, thereby illustrating its potential to continue to improve its resilience through a structural and cultural transformation.

Acknowledgements We wholeheartedly thank all the participants in this study, not only for their responses but for their passionate and committed efforts during the pandemic. The authors also thank J. Schröder for his help in the analyses and F.K. Boersma for his insightful guidance.

Contributors PKLS initiated the research idea, conducted the data collection, analysed the data and drafted and revised the paper. She is the guarantor. MJ and MdB supervised data collection and revised draft papers.

Funding This study was supported by an internal grant PPOC-L2245.

Competing interests None declared.

Patient consent for publication Not applicable.

Ethics approval Sanquin's Executive Board gave approval for this study, waiving it from needing further ethical approval by Sanquin's Research Board, due to its lack of obtaining confidential data or personal contact with donors, patients or vulnerable groups. Respondents gave written and verbal informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. The qualitative data are not publicly available due to the identifying nature of the transcripts and lack of consent from participants to publicly share this data.

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Supplementary Table 1: Elements of collaboration with supporting quotes

Positive elements	Challenging elements
<p>“Real collaboration” –dependence on one another, modifying and using each other’s work</p> <p><i>I enjoyed the fact that we were really collaborating with the people from a [sub-department] on a project together. And we did that before, but I think [this] was a different way because we depended on them. And in the end, they really, really collaborated quite intense[ly] with us to interpret the results and to think about how to put it in the right perspective, and that was really nice. (Researcher3, 8 years)</i></p> <p><i>It helped a lot, the collaboration between Blood Bank and Research because we really needed each other. And I think from both sides, we could see that there was a lot of benefit from the interaction between the two. (Management2, 17 years)</i></p>	<p>Some organizational barriers were relaxed, but not gone, so difficulties remained</p> <p><i>Interviewer: You mentioned the organisational barriers you've encountered. Could you reflect on if Sanquin as a whole changed in terms of its flexibility or its decisiveness?</i></p> <p><i>Respondent: No. I don't think it changed. And I think this was an exercise in showing that that flexibility could be organised a little bit better, but I also realise it's very difficult, especially with all the fail-safes that are in place... You need to ensure that the correct rules and procedures are followed. And often, that was a very-- and it's still often a big problem to actually do something meaningful. You stumble across those hurdles. (Researcher1, 16 years)</i></p>
<p>Greater awareness of each other’s situations</p> <p><i>During these projects there has been increasing understanding for each other's difficulties and possibilities. (Coronary Steering Committee summary report of lessons learned, p. 3)</i></p>	<p>Could have joined forces earlier and/or harmonize efforts better</p> <p><i>So we were kind of working in different corners. We have the Blood Bank and we have Research. We were working not completely as a synchronous team, but we could have... But I think we could have started earlier, had we just joined forces and decided...So we did it on an individual level instead of hierarchical level. (Researcher1, 16 years)</i></p>

<p>New project management style</p> <p><i>I don't say often that things were hard, but this was. Because I was really used to work Agile, Scrum. But Sanquin isn't Lean at all. So I tried to bring in some Agile mindset and way of working. And, actually, I am glad that I tried to because well, most of them succeeded. Some of them didn't work at all, especially in some departments, but we needed to-- at that time, we really needed to speed up in such a small timeframe that we needed to be pragmatic, change things quickly, not doing the bureaucratic decision-making things, but we needed to decide on the spot. And that was not how Sanquin was used to work. But, it was one of the reasons why we had success from the beginning, actually. (Blood Bank9, 1 year)</i></p>	<p>Overcoming siloed communication and behavior</p> <p><i>The problems that I was facing - and that was also getting more clear to me in these first weeks - is that these parts of the supply chain, these departments are not really speaking to each other that well. So they're not collaborating efficiently. Some does, some others not at all. So I really asked them to work together as a team and communicate things with each other, not via me...And in these first weeks, it was kind of hard for people to, yeah, well, speak not within their silo, but with others, right? So that was sometimes a bit confrontational. And yeah, but we needed to do that, so they were forced to do it. (Blood Bank9, 1 year)</i></p>
<p>Learning to communicate well in multi-disciplinary groups</p> <p><i>Researchers, the first thing what they are doing is organise meetings with other researchers and going into the technical details, which is very good. But they forget to [include] us, also, [in the conversations] a financial person, a commercial person, a business developer. And that's what we have learned [regarding communication], that they have to do that a little bit more. And put eight different researchers together and you have discussions for hours because there is no focus. (Management3, 28 years)</i></p>	<p>Lack of coordination and governance at times</p> <p><i>During a pandemic, an overarching project structure with clear shared objectives and responsibilities is required. Align governance structure to assignment and clarity about who will manage the team(s) and where the decision-making authority lies. It is also useful to inventory in advance which people are needed and whether they are also available. (Corona Steering Committee summary of lessons learned, pp. 4-5)</i></p>

<p>Strong collaborations with external partners</p> <p><i>Of external partners [such as the hospitals, municipal government, Ministry of Health] Sanquin has developed particularly good collaborations... There was a global collaboration with colleagues in many joint projects. The international collaboration with colleagues was particularly valuable, especially in the start-up phase of the collection of convalescent plasma project... We also collaborated with several pharmaceutical companies to supply materials from convalescent donors for research and development of vaccines and other therapies. (Summary from Corona Steering Committee lessons learned, p. 3)</i></p>	<p>Issues with external partners that caused delays for projects</p> <p><i>There were months and months of delay due to a lot of discussions of its use. Discussions with [an external partner] went wrong and they disagreed and disapproved of it. (Blood bank1, 5 years)</i></p>
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