

University of Wales Trinity Saint David

School of Engineering



Evaluating and Improving a SCADA Supplier
Relationship Within Welsh Water's Operational
Technology Environment

Final Year Project

ACMA6013

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1 Contents Page

1	Contents Page	2
1.1	Table of Figures.....	4
2	Introduction	5
3	Background.....	8
3.1	Welsh Water	8
3.2	SCADA Network Architecture	8
3.3	Operational Technology Review	9
3.4	SCADA Remediation Project	9
3.5	Supplier Performance Issues.....	9
3.6	Contributing Factors	10
4	Problem Definition and Research Aim.....	12
4.1	Problem Definition	12
4.2	Research Aim	12
4.2.1	Research Objectives.....	13
4.3	Intended Organisational Benefits.....	13
5	Literature Review: Supplier Relationship Management, Governance and Service Performance	14
5.1	Supplier Relationship Management and Strategic Dependency.....	14
5.2	Governance Mechanisms and Outsourcing Risk	14
5.3	Relationship Quality and Performance.....	15
5.4	Service Quality and Performance Evaluation (SERVQUAL)	16
5.5	Framework for Supplier Relationship Assessment.....	16
6	Analysis and Current Supplier Relationship Assessment	18
6.1	Governance Structures and SLA Effectiveness	19
6.2	Supplier Responsiveness, Service Delivery and Operational Performance.....	23
6.3	Relationship Quality, Trust and Collaboration	26
6.4	Strategic Dependency and Operational Risk	28
6.5	OT Governance and Cyber Resilience	32

6.6	Summary of Key Findings.....	34
7	Recommendations and Future Work.....	35
8	Conclusion	37
9	References	39
10	Appendices	42
10.1	Appendix A – Welsh Water Governance.....	42
10.2	Appendix B – Technical and Project Evidence.....	45

1.1 Table of Figures

Figure 1 - SCADA Supplier Faults - Fault Record Duration (adapted from Welsh Water, 2026b)	23
Figure 2 - SCADA Supplier Faults - Closed Records: Categories.....	24
Figure 3 - SCADA Supplier Fault Management System - Workaround.....	25
Figure 4 - Welsh Water Governance - PF09 Contract Management Risk Assessment Tool	42
Figure 5 - Welsh Water Governance - PF10 Contract Management Plan – Platinum Contract Page 1	43
Figure 6 - Welsh Water Governance - PF10 Contract Management Plan – Platinum Contract Page 2	44
Figure 7 - Extract of Open Jobs from SCADA Supplier Fault Records (Welsh Water, 2026b)	45

2 Introduction

Welsh Water relies on an enterprise supervisory control and data acquisition (SCADA) and telemetry solution across the operational technology (OT) environment to support the delivery of safe, reliable, and compliant water and wastewater services. The SCADA architecture spans across a Wide Area Network (WAN) using Multi-Protocol Label Switching (MPLS), enabling secure remote access to distributed site-level SCADA systems for real-time monitoring, alarm management and operational control. These systems support treatment works, pumping stations, reservoirs and remote operational assets that are essential to maintaining regulatory compliance, environmental protection and public health. As digital integration across critical infrastructure environments continues to increase, the availability, security and resilience of OT systems have become increasingly important to maintaining operational continuity (National Institute of Standards and Technology, 2023).

The water industry forms part of the United Kingdom's Critical National Infrastructure (CNI), where failures in operational technology systems may result in loss of service, environmental incidents, regulatory breaches, and wider risks to public safety. As information technology (IT) and operational technology become more connected, the cyber risk to industrial control systems increases, particularly where legacy systems, remote access and supplier dependencies are involved (National Institute of Standards and Technology, 2023). Industry guidance such as the National Institute of Standards and Technology Special Publication 800-82 and ISA/IEC 62443 emphasises the importance of secure lifecycle management, layered security strategies and effective governance of industrial automation and control systems (National Institute of Standards and Technology, 2023; International Society of Automation, 2021). This means SCADA systems should be viewed as critical operational and cyber assets, requiring ongoing security, support and lifecycle management rather than being viewed only as monitoring and control tools.

The Network and Information Systems (NIS) Directive and the UK NIS Regulations 2018 require Operators of Essential Services to apply proportionate controls to protect critical systems from compromise, disruption, or loss of operational integrity (European Parliament and Council of the European Union, 2016; UK Government, 2018). For Welsh Water, this means unsupported operating systems, unmanaged vulnerabilities and weak supplier support arrangements can create both cyber-security and operational resilience risks. Regulatory expectations therefore extend beyond boundary security and include asset lifecycle management, patching, vulnerability remediation, incident response, and the maintenance of supported platforms (National Cyber Security Centre, 2018).

This context is important because the existing SCADA platform was built on Scientific Linux,

a Red Hat Enterprise Linux variant that reached end-of-life in June 2024 (Scientific Linux, 2024). Without ongoing security updates or vendor support, the platform created increased cyber-risk exposure and a compliance challenge under the NIS Regulations. To address this, the supplier was requested to uplift the SCADA package from the previous “Mars Bar” tier to the newer “Quality Street” tier, which is built on AlmaLinux 8. AlmaLinux 8 provides a supported operating system platform that is more closely aligned with secure lifecycle management and long-term vulnerability remediation.

Although the migration was technically necessary, it also made existing supplier relationship issues more visible. During the remediation programme, weaknesses were identified in supplier communication, responsiveness, governance, technical documentation and service quality. These issues were significant because supplier performance can directly affect operational continuity, cyber compliance and confidence in long term platform support. The primary challenge examined within this dissertation is not the technicalities around the migration itself, but the quality of the supplier relationship and governance arrangements supporting a business critical OT platform.

Within OT environments, supplier relationships often extend beyond normal outsourcing arrangements and become long-term strategic dependencies. SCADA suppliers often hold specialist platform knowledge, control software updates and provide technical support that is difficult to replace quickly. This can create risks linked to supplier lock-in, reduced organisational control and imbalance in technical expertise (Pfeffer and Salancik, 1978; Williamson, 1985). Existing literature identifies that outsourcing relationships can fail where governance is weak, communication is poor, contracts are misaligned or relationship management processes are ineffective (Barthélemy, 2003). However, there is less research focused specifically on supplier governance within operational technology and critical infrastructure environments, particularly where cyber-security compliance and service quality are closely linked.

This dissertation therefore evaluates the SCADA supplier relationship within Welsh Water’s OT estate. It reviews literature on Supplier Relationship Management (SRM), outsourcing governance, relationship quality and SERVQUAL service quality (Monczka et al., 2020; Morgan and Hunt, 1994; Poppo and Zenger, 2002; Parasuraman, Zeithaml and Berry, 1988), then applies these frameworks to the current relationship. The analysis considers governance arrangements, communication, contractual alignment, operational support, service quality and the gap between expected and delivered supplier performance. The aim is to identify practical improvement actions that support the secure delivery, operation and long-term support of the OT estate and framework SCADA platform.

The aim of this dissertation is to critically evaluate the effectiveness of the current SCADA supplier relationship within Welsh Water's SCADA remediation project and determine strategies to improve governance, service quality and operational resilience.

The objectives of this dissertation are:

- To review literature relating to Supplier Relationship Management, outsourcing governance, relationship quality theory and SERVQUAL service quality dimensions.
- To analyse the current relationship between Welsh Water and the SCADA supplier during the platform migration programme.
- To identify operational, governance and service delivery weaknesses affecting project delivery and long-term support.
- To evaluate the impact of supplier performance on OT resilience, cybersecurity compliance and operational continuity.
- To recommend improvements that support effective collaboration, accountability and long-term operational support.

The report begins by setting out the technical, operational and regulatory background to the SCADA upgrade. It then reviews the relevant literature before analysing the supplier relationship using stakeholder interviews, fault records, performance reviews and governance evidence. The final sections identify the main findings, future improvement actions and overall conclusions.

3 Background

3.1 Welsh Water

Welsh Water operates under a not-for-profit model owned by Glas Cymru, a company limited by guarantee with no shareholders. Rather than distributing profits through dividends, financial surpluses are reinvested into maintaining and improving water and wastewater infrastructure across the organisation's operational area (Dŵr Cymru Welsh Water, n.d.).

Operational continuity and public health are critically important because Welsh Water supplies drinking water and wastewater services to approximately 1.4 million homes and businesses, serving around three million people across most of Wales, Herefordshire and parts of Deeside. As the sole provider within its region, the organisation must ensure that treatment works, network infrastructure and operational technology systems always operate reliably and securely. Maintaining continuous, high-quality service is therefore fundamental to regulatory compliance, environmental protection and customer confidence (Dŵr Cymru Welsh Water, n.d.).

Welsh Water operates more than 4,000 operational assets, including 62 water treatment works and 838 wastewater treatment works. Telemetry systems are deployed across the estate, with SCADA systems supporting all water treatment works and the majority of larger wastewater treatment sites. As a result, the reliability and supportability of the SCADA environment is operationally significant to the wider organisation, with delays in supplier support or fault resolution having the potential to affect a large operational area across Wales (Dŵr Cymru Welsh Water, n.d.).

3.2 SCADA Network Architecture

The organisation uses a third-party enterprise SCADA and telemetry solution that integrates operational data from geographically dispersed water and wastewater assets into a centralised monitoring platform. This architecture standardises the collection, management and presentation of operational data across the business, supporting both operational visibility and remote asset management.

SCADA systems are distributed across a wide-area MPLS network, enabling controlled and secure remote access to DCWW asset control systems. Through this infrastructure, engineers and operators are able to monitor live process data, acknowledge alarms and perform selected control functions without requiring physical attendance at site locations. This capability improves response times, supports out-of-hours operational activities and contributes to continuity of service.

Given the scale and geographical distribution of the organisation's operational assets, the

SCADA communications layer forms a critical component of day-to-day operations. Consequently, weaknesses within the SCADA platform, supporting infrastructure or supplier support model may directly affect operational continuity, incident response capability and regulatory compliance.

3.3 Operational Technology Review

As part of Welsh Water's compliance activities under the Network and Information Systems (NIS) Regulations, a review of the operational technology estate was undertaken to identify unsupported systems, cyber-risk exposure and lifecycle management concerns across critical infrastructure environments.

One of the principal issues identified during this review was the continued use of Scientific Linux-based SCADA servers that were no longer receiving vendor support or security updates. This exposed the organisation to increased cyber-security and compliance risk within operational environments.

In response, the organisation mandated the migration of the SCADA environment to AlmaLinux 8, a supported and actively maintained operating system platform aligned with current cyber-security and lifecycle management requirements. This migration formed part of the wider telemetry modernisation programme intended to improve the long-term security, supportability and resilience of the OT estate.

3.4 SCADA Remediation Project

The migration to AlmaLinux 8 extended beyond a conventional operating system upgrade and required the SCADA supplier to rebuild and repackage the existing SCADA application for compatibility with the new environment. The project objective was to replicate and transition existing SCADA functionality onto the upgraded platform while maintaining operational integrity and continuity of service.

A dedicated test environment was developed to validate the upgraded platform prior to wider deployment. However, during testing, multiple functional, configuration and stability-related issues were identified within the new environment. Several defects affected user access, control and system behaviour, creating concerns regarding platform readiness, software quality and operational suitability.

3.5 Supplier Performance Issues

Feedback from OT Operations and Maintenance Support teams identified recurring concerns surrounding supplier responsiveness, technical support effectiveness and overall

service quality. Reported software issues were frequently left unresolved for extended periods, with responses often indicating that defects would be addressed within future software releases rather than through immediate remediation activities. This reduced confidence in the supplier's ability to respond effectively to operationally critical issues.

Technical documentation was also considered insufficient, limiting the ability of engineers to diagnose faults, configure systems effectively and fully understand platform behaviour. In several cases, support teams relied upon internal knowledge and operational experience rather than supplier-provided guidance to maintain and troubleshoot systems.

Additionally, the fault-reporting platform lacked effective traceability, ownership and communication of issue status, reducing visibility of defect progression and delaying resolution activities. The absence of clear escalation pathways and structured feedback mechanisms further constrained communication between operational teams and the supplier.

As a result, OT support teams frequently implemented temporary workarounds to maintain operational continuity where defects, instability or missing functionality remained unresolved. Collectively, these issues demonstrated weaknesses in service delivery, support governance and supplier relationship management within an operationally critical environment.

3.6 Contributing Factors

Additional contributing factors relate to the historical structure of the supplier relationship and the way in which the third-party provider managed the telemetry and SCADA frameworks. Whilst the telemetry element benefited from stronger communication channels, collaborative engagement and continued development focus, the SCADA environment did not receive the same level of operational or strategic attention.

Over time, more effective working relationships and governance arrangements developed around telemetry activities, whereas SCADA-related issues were frequently deprioritised or remained unresolved for extended periods. This imbalance constrained the organisation's ability to progress SCADA improvements at the pace required to meet operational and regulatory expectations.

Contractual and governance misalignments further exacerbated these challenges. Existing service definitions, service level agreements (SLAs) and escalation mechanisms did not adequately reflect the operational criticality of the SCADA environment or the level of responsiveness required to support essential operational services. The absence of effective escalation mechanisms demonstrated a misalignment between supplier governance arrangements and the operational importance of the SCADA platform.

Collectively, regulatory pressure, cyber-security requirements, technical migration challenges and long-standing supplier relationship weaknesses established the context for this project. They demonstrate the need for a structured assessment of supplier governance, service quality and relationship management practices to support the delivery of a secure, compliant and operationally sustainable SCADA platform.

4 Problem Definition and Research Aim

4.1 Problem Definition

The background information demonstrates that the challenges experienced during the SCADA remediation programme were not solely technical in nature. Whilst the migration to AlmaLinux 8 was necessary to maintain platform supportability, cyber-security compliance and operational sustainability, it exposed broader weaknesses within the existing supplier relationship. Recurring concerns relating to supplier responsiveness, communication, governance, fault management and technical support reduced confidence in the supplier's ability to support an operationally critical platform effectively.

These weaknesses have implications beyond individual software defects or project delivery challenges. Within a critical national infrastructure environment, ineffective supplier support can affect operational resilience, delay issue resolution, increase organisational risk and limit the ability to respond to regulatory and cyber-security requirements. The scale of Welsh Water's operational estate further increases the importance of effective supplier governance, as delays in remediation or support activities have the potential to affect a large operational areas of Wales.

The evidence presented in Chapter 3 suggests that existing governance arrangements, service definitions, escalation mechanisms and performance management processes were not fully aligned with the operational criticality of the SCADA environment. Consequently, the primary challenge examined within this dissertation is the effectiveness of the supplier relationship and governance model supporting the SCADA platform.

Whilst Supplier Relationship Management (SRM), relationship quality theory and service quality frameworks are well established within wider supply chain and outsourcing literature, there is comparatively limited research examining their application within operational technology environments operating under cyber-security regulation. This project therefore addresses both an organisational need and a gap in the practical application of supplier relationship frameworks within critical water treatment OT infrastructure.

A structured assessment of the current supplier relationship is therefore required to evaluate governance effectiveness, supplier performance, communication quality and operational support arrangements. This assessment seeks to identify the underlying causes of current challenges and develop evidence-based recommendations that support the secure, compliant and sustainable operation of the upgraded SCADA platform.

4.2 Research Aim

The aim of this dissertation is to critically evaluate the effectiveness of the current SCADA

supplier relationship within Welsh Water's SCADA remediation project and determine strategies to improve governance, service quality and operational support within a critical national infrastructure environment.

4.2.1 Research Objectives

The objectives of this dissertation are:

- To critically review literature relating to Supplier Relationship Management (SRM), outsourcing governance, relationship quality theory and SERVQUAL service quality dimensions within operational technology environments.
- To evaluate the effectiveness of the current SCADA supplier relationship and associated supplier performance during the telemetry modernisation programme.
- To identify governance, communication, contractual and service delivery gaps affecting operational support, platform remediation activities and long-term maintainability.
- To assess the impact of supplier performance and governance arrangements on operational continuity, cyber-security compliance and organisational risk.
- To develop evidence-based recommendations that improve supplier accountability, communication effectiveness, escalation processes and long-term operational support arrangements for the SCADA environment.

4.3 Intended Organisational Benefits

Successful implementation of the recommendations developed within this dissertation may support reductions in operational and cyber-security risk whilst improving supplier accountability, responsiveness and communication effectiveness. Improved governance structures and escalation mechanisms may also strengthen the organisation's ability to manage operationally critical supplier relationships more effectively within future OT transformation programmes.

In the longer term, improvements to supplier relationship management and operational support arrangements may contribute to more reliable SCADA upgrades, improved service quality and increased confidence in the product, supportability and future of the enterprise SCADA and regional telemetry OT products.

5 Literature Review: Supplier Relationship Management, Governance and Service Performance

5.1 Supplier Relationship Management and Strategic Dependency

Supplier Relationship Management (SRM) provides a structured way of managing suppliers to improve value, reduce risk and support long-term performance (Monczka et al., 2020). A key part of SRM is supplier segmentation, where suppliers are managed differently depending on their importance to the organisation (Monczka et al., 2020; Kraljic, 1983). Strategic suppliers require closer management than transactional suppliers because their performance can have a greater impact on the organisation.

This is relevant to SCADA because the supplier relationship is not just a standard service contract. The supplier is embedded in the all aspects of how the platform is supported, upgraded and maintained. The supplier holds specialist system knowledge, controls software updates and provides support that is difficult to move away from. This means the relationship should be viewed as an operational dependency, not only a procurement arrangement.

The Resource-Based View helps explain this because it argues that organisations rely on resources that are valuable, rare and difficult to replace (Barney, 1991). In this case, the supplier's SCADA knowledge and technical capability can be seen as a critical resource. However, Resource Dependence Theory also highlights the risk of relying on an external organisation that controls important resources (Pfeffer and Salancik, 1978). In a SCADA environment, this can reduce organisational control and make the client more dependent on supplier responsiveness.

This demonstrates that supplier relationships supporting critical operational technology systems cannot be treated as normal outsourced service arrangements. Instead, they require robust governance, effective risk management and ongoing expert knowledge transfer to maintain operational resilience and regulatory compliance.

5.2 Governance Mechanisms and Outsourcing Risk

A key issue in supplier management is how the relationship is governed. Poppo and Zenger (2002) argue that formal contracts and relational governance should work together, with contracts providing structure, roles and accountability, while relational governance supports communication, flexibility and joint problem-solving. This is particularly relevant in outsourced technical environments where performance can be difficult to measure, and the supplier may hold greater technical knowledge than the client which can lead to an imbalance in power in the relationship.

This links closely with Transaction Cost Economics, which highlights risks associated with asset specificity, uncertainty and opportunism (Williamson, 1985). These risks apply to SCADA because the systems are specialised, difficult to replace and reliant on supplier knowledge. Outsourcing literature evidence reinforces this concern, with Barthélemy (2003) identifying failure risks linked to loss of control, poorly defined contracts, hidden costs and weak exit planning. In this OT environment, these risks are more significant because supplier performance can affect operational continuity, cyber resilience and future support.

OT environments also add a cyber-security dimension to supplier governance. The NCSC Cyber Assessment Framework, NIST SP 800-82 and ISA/IEC 62443 all highlight the need for secure lifecycle management, supported systems, clear supplier responsibilities and coordinated vulnerability remediation (NCSC, 2018; NIST, 2023; ISA, 2021). This means governance cannot focus only on commercial performance or SLA compliance. It also needs to support operational and cyber-security resilience.

In practice, this literature is relevant to the SCADA supplier relationship because formal governance can exist on paper but still fail to influence day-to-day supplier behaviour. SLAs may be misaligned with system criticality, while weak communication and limited collaboration can reduce the effectiveness of formal governance. The analysis therefore needs to consider not only whether governance mechanisms exist, but whether they make SCADA issues visible, prioritised and accountable in practice.

5.3 Relationship Quality and Performance

Supplier performance is also affected by the quality of the relationship. Morgan and Hunt (1994) identify trust and commitment as central to successful inter-organisational relationships. Trust supports communication and cooperation, while commitment shows that both parties are willing to invest in the relationship.

This matters in technical supplier relationships because the contract alone does not resolve the product issues. Where suppliers are responsive, transparent and proactive, trust is more likely to develop. Where they are slow to respond, provide limited explanation or fail to support the client properly, confidence is weakened.

Social Exchange Theory also helps explain this. Blau (1964) argues that relationships are sustained through a fair exchange of value. If Welsh Water stakeholders feel they are repeatedly chasing faults, accepting workarounds or carrying operational risk, the relationship may feel one-sided and collaboration can reduce.

Zaheer, McEvily and Perrone (1998) also suggest that trust affects communication quality and performance between organisations. This is particularly important in OT environments

because suppliers often hold specialist knowledge and access to equipment of operational importance.

This means trust, communication and collaboration should not be viewed as minor issues. In a SCADA environment, they affect how quickly issues are owned, escalated and resolved.

5.4 Service Quality and Performance Evaluation (SERVQUAL)

SRM and governance literature explain how supplier relationships should be managed, but they do not always provide a practical way to assess service quality. SERVQUAL addresses this by comparing customer expectations with perceived service performance (Parasuraman, Zeithaml and Berry, 1988).

The model identifies five dimensions of service quality: reliability, responsiveness, assurance, empathy and tangibles (Parasuraman, Zeithaml and Berry, 1988). These are useful for assessing the SCADA supplier relationship:

In SCADA environments, SERVQUAL offers a practical guide for identifying performance gaps across technical and relational dimensions:

- **Reliability:** system instability and recurring defects
- **Responsiveness:** delays in issue resolution and support
- **Assurance:** poor documentation and reduced confidence in capability
- **Empathy:** limited alignment with operational priorities
- **Tangibles:** inadequate technical deliverables and updates

However, SERVQUAL has limitations. Buttle (1996) argues that the model relies heavily on perception gaps and may not capture all aspects of service quality.

Cronin and Taylor (1992) also argue that performance should be assessed more directly. This matters in OT because supplier service quality cannot be judged only by perception as it also needs measurable evidence such as fault duration, repeat defects, documentation quality, cyber compliance and platform maintainability.

SERVQUAL is therefore useful for this project, but should not be used on its own. It helps explain stakeholder experience, but needs to be supported by fault records, performance reviews and governance evidence.

5.5 Framework for Supplier Relationship Assessment

The literature shows that no single theory is enough to explain supplier performance in an outsourced SCADA environment. SRM explains why the supplier should be treated as strategically important; RBV and Resource Dependence Theory explain dependency; TCE

and outsourcing literature highlight lock-in and loss of control; relationship quality theory explains trust and communication; and SERVQUAL provides a way to assess service quality.

This dissertation therefore uses an integrated framework based on:

- strategic importance and dependency
- governance effectiveness and outsourcing risk
- relationship quality, trust and collaboration
- service quality and performance evaluation
- OT resilience and cyber-security assurance

Using the theories together also avoids treating the problem as a single technical failure. The SCADA case involves service quality, supplier behaviour, dependency, cyber-risk and relationship quality at the same time, so the analysis needs to consider how these issues interact.

6 Analysis and Current Supplier Relationship Assessment

This section evaluates the effectiveness of the current SCADA supplier relationship within Welsh Water's operational technology environment. The analysis uses the literature framework developed in Section 5 and considers whether the current governance, service quality and support arrangements are suitable for a SCADA platform operating within a critical national infrastructure environment.

The analysis is based on a qualitative approach. Evidence was gathered from stakeholder interviews, SCADA fault-management records, quarterly SCADA performance reviews, governance documents and findings from the AlmaLinux remediation programme. This approach was used because the project needed to understand not only what performance issues existed, but how those issues affected operational teams, supplier confidence and long-term supportability.

Five semi-structured interviews were used to capture different views across contract management, OT engineering, operational support and framework system integration between 8 and 23 April 2026. Interviewees were anonymised by role to protect confidentiality. The interview gathered evidence around governance, responsiveness, communication, trust, accountability, technical dependency and operational risk. As the contract was sensitive it was not possible to access this for supporting evidence but SLA were provided from the OT Financial Governance and Contracts Manager.

Documentary evidence was then used to support and challenge the interview findings. This included SCADA-specific performance reviews, PF09 and PF10 governance evidence within the appendix Figure 4 - Welsh Water Governance - PF09 Contract Management Risk Assessment Tool and the SCADA supplier fault records. The fault records were reviewed to identify fault duration, closure categories, linked tickets, unresolved issues and examples where faults were closed and to be managed through workarounds.

Using these sources together allowed the analysis to compare stakeholder experience with documentary evidence. This avoided relying only on opinion, while also recognising that fault records alone do not fully explain the impact on trust, confidence or operational delivery.

There are some limitations to this approach. The research is based on a single supplier relationship within one organisation, so the findings may not apply directly to every OT supplier relationship. The interview evidence also reflects stakeholder views at a particular point in time. In addition, the fault-record review should not be treated as a full SLA audit. However, the combined evidence provides a strong basis for assessing the current relationship and identifying practical improvement actions.

These limitations were reduced by using more than one evidence source. Interview evidence was compared with fault records, performance reviews and governance documents so that stakeholder concerns could be checked against documentary evidence where available.

The section begins by reviewing governance arrangements, contract management maturity and SLA effectiveness. It then considers supplier responsiveness, service delivery, relationship quality, strategic dependency and operational risk. Finally, it assesses how supplier performance affects OT governance, cyber resilience and future SCADA supportability.

6.1 Governance Structures and SLA Effectiveness

The SCADA supplier relationship has a well-established and standardised governance structure in place. This reflects both the operational criticality of the contract and the importance of effectively managing a key supplier within Welsh Water's operational technology (OT) environment.

Interview evidence identified the appointment of a dedicated OT Financial Governance and Contracts Manager in April 2023 to oversee strategically important supplier contracts. The SCADA & Regional Telemetry contract was internally categorised as a 'Platinum' contract based on organisational risk and financial value, placing it amongst a limited number of strategically critical supplier relationships within Welsh Water (OT Financial Governance and Contracts Manager, interview, 2026). From a Supplier Relationship Management (SRM) perspective, this reflects Welsh Water's recognition that key suppliers require greater governance, closer engagement and more formal performance management arrangements (Monczka et al., 2020).

Governance was supported through defined contract management processes and documentation, including the PF09 and PF10 contract management frameworks shown in Appendix A. These set out review frequencies, escalation routes, quality management expectations and contract management responsibilities. Interview evidence also identified weekly technical reviews, weekly regional telemetry reviews, quarterly supplier performance reviews and six-monthly executive business reviews (OT Financial Governance and Contracts Manager, interview, 2026). Together, this shows that Welsh Water had a structured governance model for managing a strategically important supplier relationship.

In addition to the governance framework, supplier support expectations were formally defined through a Service Level Agreement (SLA), which established response and resolution targets based on fault severity as seen in table 1. For example, Priority 1 incidents required an initial response within one hour and restoration of service within four hours,

whilst Priority 2 incidents required restoration of service within 24 hours. These arrangements provided a contractual benchmark against which supplier responsiveness and fault management performance could be assessed. However, there isn't clear guidance on how a response is prioritised and with a Priority 4 response, information response within 7 days is a vague requirement which can be easily satisfied.

Priority	Response Requirement	Resolution Requirement
P1	1 Hour	Working System Restored within 4 Hours
P2	2 Hour	Working system restored within 24 hours
P3	4 Hour	Investigation within 7 working days
P4	7 Working Days	Information response

Table 1- Extract of Service Level Agreement Priority Responses (adapted from Welsh Water, 2026c).

Whilst the governance structure appeared robust, stakeholder feedback suggested that having governance processes in place did not always result in the desired operational outcomes. Formal escalation routes, review meetings and contract management processes existed, however historical concerns around responsiveness, accountability and ownership of issues still remained. As one stakeholder explained, “The governance structures were always there, but historically SCADA didn't have a strong voice within them. Since dedicated OT resource was introduced, there's been far more focus on SCADA issues, although getting timely action hasn't always been straightforward.” (OT Engineering Manager, interview, 2026)

This highlights that the issue was not a lack of governance, but whether the existing governance arrangements were effective in identifying, prioritising and resolving SCADA-related concerns. For a platinum-level OT supplier relationship, the expected outcome is not just regular meetings, but visible escalation, ownership and timely resolution of operationally significant issues. It also raises questions as to why the contract for two critical aspects of the OT estate, the regional telemetry system and site SCADA systems have been grouped into one contract.

A significant governance change was introduced in Q3 2025 when SCADA performance was separated from the wider regional telemetry performance assessment process. Prior to this, SCADA issues were often discussed alongside telemetry performance, making it difficult to

gain a clear view of how effectively the SCADA support model was performing. Interview evidence suggested that operational priorities within regional telemetry activities often took precedence, reducing visibility of SCADA concerns. “SCADA issues weren’t really being heard as regional telemetry took priority and masked some of the operational challenges we were experiencing.” (OT Financial Governance and Contracts Manager, interview, 2026)

The introduction of dedicated SCADA performance scoring, alongside regular SCADA improvement meetings, provided greater visibility of SCADA-specific issues and created a stronger governance focus on relationship performance and service delivery.

Evidence suggests that these changes contributed to improvement over time. Independently assessed SCADA performance scores increased from 54.3% in Q3 2025 to 56.2% in Q4 2025 and 79% in Q1 2026 (Welsh Water, 2025a; Welsh Water, 2025b; Welsh Water, 2026a). This shows measurable improvement, but not complete resolution. Concerns around technical documentation, defect resolution and right-first-time delivery remains an issue.

Interview evidence further suggested that the appointment of dedicated contract management resource strengthened governance effectiveness by providing clearer ownership of supplier performance and contractual obligations. “Having a dedicated and qualified contract manager gave the relationship a clear owner. It made it easier to challenge performance, hold the supplier accountable and ensure contractual processes were being followed.” (OT Financial Governance and Contracts Manager, interview, 2026)

Whilst the governance structure continued to improve, stakeholders acknowledged that its effectiveness remained dependent on active engagement from both Welsh Water and the supplier. Operational issues were not always raised through formal governance routes, reducing visibility of some relationship challenges and limiting opportunities for formal escalation.

Overall, the evidence indicates that Welsh Water has implemented a mature governance framework for managing the SCADA supplier relationship. However, the findings also demonstrate that governance structures alone do not guarantee effective operational outcomes. Instead, the effectiveness of the relationship depended on how those governance processes were applied in practice, how visible SCADA concerns were within the governance structure and the willingness of both Welsh Water and the supplier to engage with improvement actions. This supports the findings of Poppo and Zenger (2002), who argue that formal governance mechanisms are most effective when supported by active collaboration and strong working relationships.

6.2 Supplier Responsiveness, Service Delivery and Operational Performance

The effectiveness of the SCADA support model was assessed through stakeholder interviews, fault-management records and quarterly performance reviews. Whilst governance arrangements were in place, the evidence identified several historical challenges relating to fault resolution, accountability, availability of specialist technical expertise and the management of operationally significant defects. Together, these issues impacted confidence in the support being provided and shaped stakeholder views of the supplier relationship historically and through the AlmaLinux remediation programme.

One of the most consistent concerns raised by stakeholders was the time taken to resolve faults and implement fixes. This is supported by the fault record analysis in Figure 1, which shows several SCADA supplier fault records remaining open for extended periods. The age profile identified 11 closed records and five open records older than 181 days, including open records over 366 days. This was particularly challenging where faults delayed testing activities, prevented system integrators from progressing projects or introduced additional risk to delivery of the AlmaLinux remediation programme. One stakeholder explained, “Faults were often raised and then effectively sat there for long periods without fixes” (Regional OT Operations and Maintenance Manager, interview, 2026).

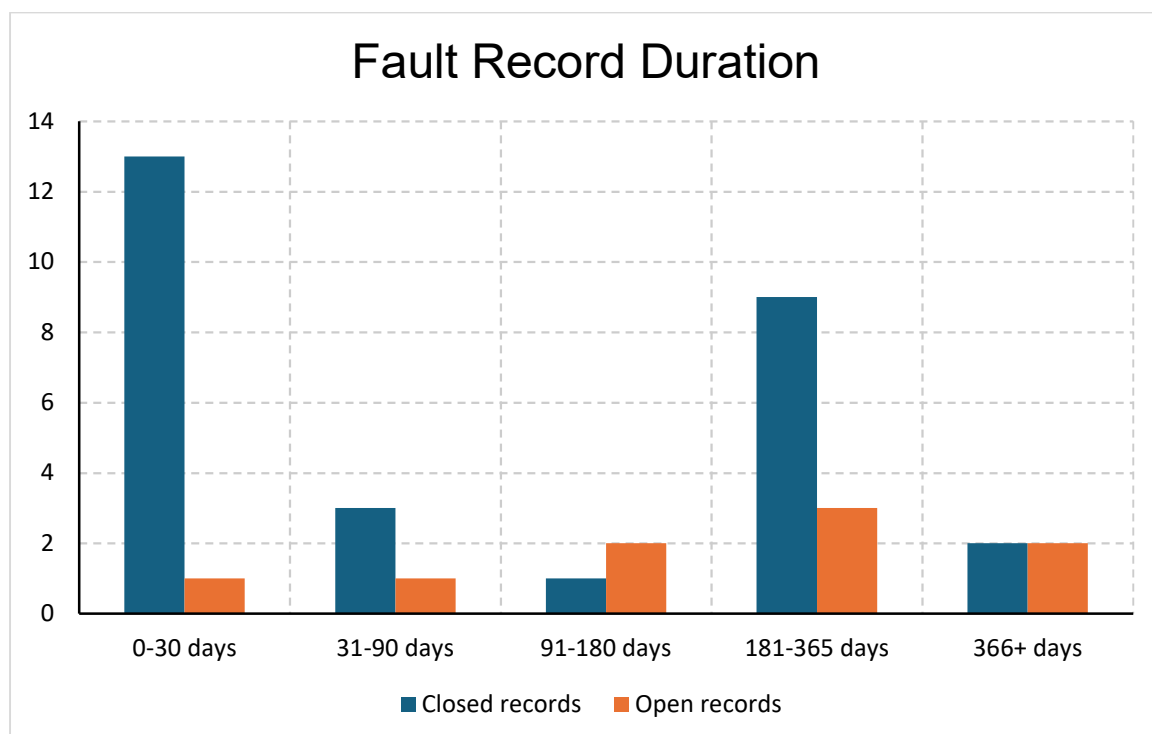


Figure 1 - SCADA Supplier Faults - Fault Record Duration (adapted from Welsh Water, 2026b)

However, stakeholder concerns were not limited to the length of time taken to resolve issues. Fault-management records and interview feedback suggested that confidence in the

support model was often reduced by a lack of understanding regarding why faults had occurred and what actions had been taken to prevent recurrence. Several fault records remained open for extended periods, were deferred into future software releases or were closed once the immediate symptom had disappeared without a clearly diagnosed root cause. This is reflected in the closed-record category analysis, which identified ten closed fault records with no resolution recorded, as shown in Figure 2. Operational stakeholders reported that faults could often be resolved through “a reset or workaround” (Regional OT Operations and Maintenance Manager, interview, 2026), restoring functionality but not necessarily providing assurance that the underlying issue had been permanently addressed.

This matters because a closed ticket does not necessarily mean the operational risk has been removed. Where closure records lack clear resolution detail, operational teams may still have limited assurance that the fault has been understood, corrected or prevented from recurring.

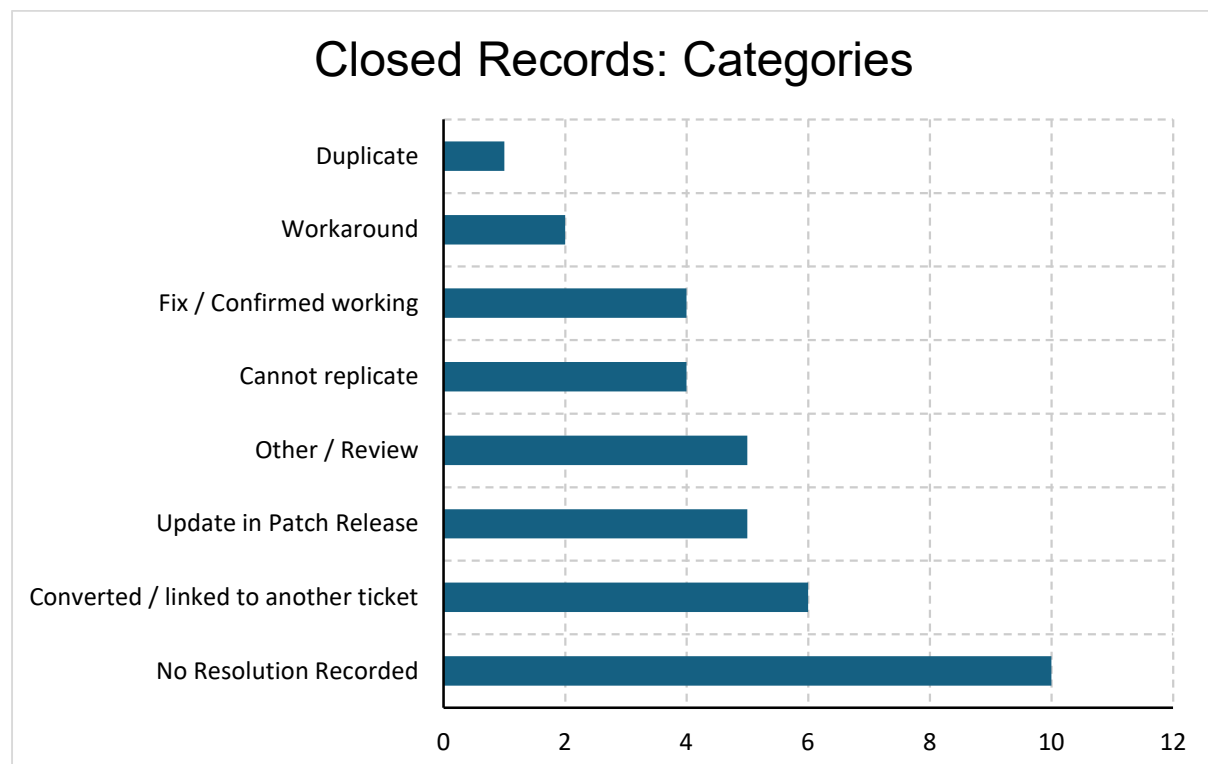


Figure 2 - SCADA Supplier Faults - Closed Records: Categories

This concern was also evident in the SCADA User Manager fault shown in Figure 3. Although the fault was diagnosed and a workaround was available, the supplier response did not show clear urgency to correct the underlying defect. Instead, the ticket response asked whether the issue should be promoted to development or whether Welsh Water was “happy” to continue using the workaround. This suggests that a known fault could be closed without a permanent fix, placing the decision to progress corrective action back onto Welsh Water.

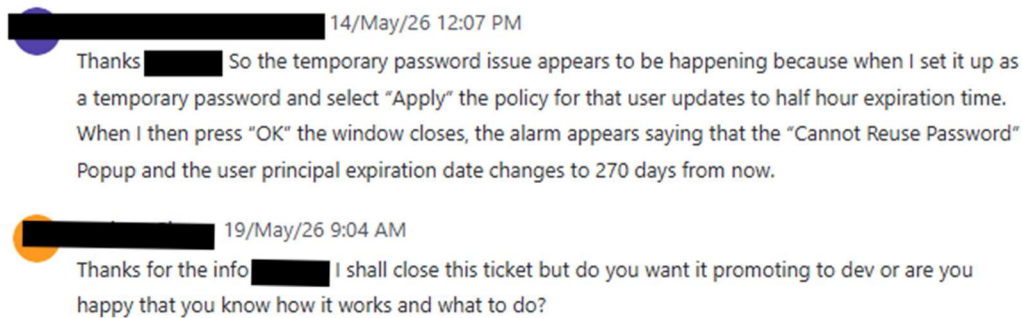


Figure 3 - SCADA Supplier Fault Management System - Workaround

A related, but slightly different, concern was raised where faults were restored through resets or temporary actions without the underlying cause being clearly identified. As one stakeholder explained, “Nobody really knew why the issue had happened or what was being done to stop it happening again” (Regional OT Operations and Maintenance Manager, interview, 2026). The important distinction between restoring service and resolving a fault. Within a critical operational technology environment, a reset or workaround may restore functionality, but it does not provide assurance that the issue has been fully diagnosed or prevented from reoccurring.

These concerns were further compounded by visibility and prioritisation issues. Prior to the introduction of independent SCADA performance scoring in Q3 2025, interview evidence suggested that development priorities were heavily influenced by regional telemetry requirements, reducing focus on SCADA concerns. As one stakeholder reflected, “SCADA issues weren’t a priority” (OT Financial Governance and Contracts Manager, interview, 2026). Operational stakeholders felt this contributed to issues being delayed, deferred into future Quality Street releases, or remaining open for extended periods.

Alongside prioritisation issues, stakeholders also raised concerns around fault ownership and progression. Once a fault had been raised, it was not always clear how it was being prioritised by the supplier, who owned the next action, or when a fix could realistically be expected. This appeared to be linked to gaps between the supplier’s project and development teams. As one stakeholder explained, “[SCADA Supplier] have a project team and development team which work independently of each other” (OT Engineering Manager, interview, 2026). This suggests that although Welsh Water could raise the priority of an issue, the supplier was not always able to give clear assurance that this priority was being carried through into development. This weakened confidence in remediation project deployment and made fault resolution feel less controlled.

The evidence also suggests that fault progression was affected by access to specialist technical resource. This was particularly clear with complex OPC and backend issues,

where progress appeared to depend on a one person with detailed platform knowledge. This was also recorded in the Q1 2026 performance review, which noted: “CONCERN: - OPC issue being delayed due to single resource” (Welsh Water, 2026a). This supports the interview evidence as the OT Engineering Manager explained, “Once an issue reached the right person, progress was usually made fairly quickly. The challenge was often getting access to the person with the specialist knowledge” (OT Engineering Manager, interview, 2026). This suggests the issue was not only technical, but also a weakness in supplier resource and resilience as fault resolution depended too heavily on limited specialist availability.

A similar theme emerged through discussions with framework system integrators. Stakeholders reported difficulties distinguishing between platform behaviour, configuration issues and software defects, particularly during the transition from the legacy Mars Bar build to the newer Quality Street build. This challenge was compounded by concerns regarding lack of technical documentation to support troubleshooting, configuration activities and independent fault diagnosis. As one system integrator explained, “One of the biggest challenges was the lack of clear technical documentation” (Framework System Integrator A, interview, 2026). The lack of documentation increased reliance on supplier expertise and further strengthened dependency on specialist knowledge.

6.3 Relationship Quality, Trust and Collaboration

Following the analysis of operational performance in Section 6.2, the findings suggest that service delivery issues had a direct impact on relationship quality, stakeholder confidence and collaborative working. Stakeholders generally accepted that complex technical faults would occur within a SCADA environment. However, confidence was affected by how those faults were managed, communicated and resolved. The issue was not only the presence of faults, but whether stakeholders felt the supplier was taking ownership, communicating clearly and preventing repeat issues.

Historically, the relationship was described as reactive rather than collaborative. Engagement was often driven by faults, escalation and service impact, rather than proactive planning, continuous improvement or strategic discussion. One stakeholder described the relationship as being focused on “responding to faults that better testing and deployment could have prevented” (OT Engineering Manager, interview, 2026). This links directly to the findings in Section 6.2, where unresolved faults, delayed fixes and workarounds meant many interactions with the supplier were problem resolutions instead of actual product improvements.

Trust emerged as one of the strongest themes in the interviews. Stakeholders did not expect

the system to be free of defects, but they did expect faults to be properly investigated, explained and closed with confidence. Where issues were reset, deferred into future releases, passed between teams or closed without clear evidence of root cause, stakeholders were less confident that the same issue would not return. As discussed in Section 6.2, this created a distinction between restoring service and restoring confidence. In a critical operational technology environment, both are important.

Accountability also influenced relationship quality. Stakeholders reported that responsibility for issues was not always clear, particularly where faults moved between support, project, development and specialist technical resources. One stakeholder noted that they often “just wanted to pick up the phone and speak to someone who understood the issue” (Regional OT Operations and Maintenance Manager, interview, 2026). Similarly, issues could sometimes be “passed around or closed because they couldn’t be replicated rather than genuinely resolved” (Regional OT Operations and Maintenance Manager, interview, 2026). Whilst there was no evidence that issues were intentionally avoided, repeated experiences of unclear ownership weakened confidence in both the support process and the wider supplier relationship.

A further factor affecting relationship quality was the historic imbalance between telemetry and SCADA engagement. Stakeholders acknowledged that the telemetry teams had built stronger working relationships with the supplier over many years, with more established communication routes and higher levels of familiarity. However, before SCADA specific performance scoring was introduced, several stakeholders felt that SCADA concerns had less visibility. This contributed to frustration, but it also showed an effective relationship with the supplier was possible under the right governance.

Despite these historical challenges, the evidence suggests that relationship quality improved during the latter stages of the AlmaLinux remediation programme. Stakeholders identified SCADA specific governance activities, dedicated improvement meetings and increased management engagement as important turning points. The separation of SCADA performance scoring from regional telemetry assessments appears to have been particularly important, as it gave Welsh Water a clearer mechanism to challenge performance, track improvement actions and hold the supplier accountable for SCADA-specific outcomes.

Interview evidence also suggested that dedicated contract management and service delivery resources improved communication between Welsh Water and the supplier. Stakeholders described meetings as more structured, escalation routes as clearer and accountability as more visible than had historically been the case. One stakeholder observed that “communication is better, meetings are more structured and I know who to contact if I need

something” (OT Engineering Manager, interview, 2026). This indicates that governance improvements were not only administrative but also improved stakeholder visibility and accessibility of the SCADA supplier.

Framework system integrators also described an improvement in collaboration during the Quality Street work. One noted that “communication was better and issues were picked up quicker” (Framework System Integrator A, interview, 2026). However, trust was still limited by the lack of clear technical documentation, with another explaining that “it was still difficult to resolve issues without relying on [SCADA supplier]” (Framework System Integrator B, interview, 2026). This suggests that collaboration had improved, but the relationship still depended heavily on supplier support and technical transparency.

Stakeholders also recognised that improved communication alone would not be enough to sustain long-term trust. Several participants felt that the relationship would ultimately be judged on whether the product worked reliably and whether issues were resolved correctly first time. As one stakeholder commented, whilst the relationship had “definitely improved”, it would ultimately depend on whether the supplier could deliver a stable product and resolve issues effectively (Regional OT Operations and Maintenance Manager, interview, 2026). This suggests that governance improvements had helped rebuild confidence, but that long-term trust remained dependent on sustained operational performance.

This highlights an important distinction within the relationship. Governance mechanisms can improve communication, visibility and collaboration, but trust is ultimately built through consistent delivery. These findings align with Morgan and Hunt’s (1994) Commitment-Trust Theory, which identifies trust and commitment as central to successful inter-organisational relationships. Within the SCADA supplier relationship, historical issues relating to responsiveness, accountability and technical assurance weakened trust over time. More recent governance and engagement improvements helped rebuild confidence, but the evidence suggests that the long-term strength of the relationship will depend on continued delivery of a reliable product with technical solutions and measurable service improvement.

6.4 Strategic Dependency and Operational Risk

The findings identified a significant level of dependency on the SCADA supplier across several areas of the operational technology environment. This was most visible during fault resolution, software remediation and the AlmaLinux migration programme, where progress often depended upon access to supplier knowledge, specialist resources and developer specific expertise. Whilst a level of dependency is to be expected with a complex SCADA environment, questions remain on whether the current level of reliance created additional operational risk should supplier performance decline.

Interview evidence suggested that this dependency was not only contractual, but also technical and operational. Internal teams and framework system integrators frequently relied on the supplier to explain platform behaviour, diagnose complex issues and progress remediation activities. As discussed in Section 6.2, this was particularly evident where OPC communications, backend configuration or platform-specific functionality were involved. In practice, this meant that the speed and effectiveness of issue resolution could be influenced by access to supplier expertise rather than Welsh Water's own internal capability.

Several stakeholders highlighted the extent of this reliance. One stakeholder described Welsh Water as being "100% contractually dependent" on the supplier for specialist support and software-related activities (OT Financial Governance and Contracts Manager, interview, 2026). This concern was reinforced by another stakeholder who stated that "an issue is that we do not have a backup plan" (OT Engineering Manager, interview, 2026). These comments suggest that the risk present with limited availability of practical alternatives if specialist support was delayed or unavailable.

The significance of this dependency becomes clearer when considered against the operational importance of the SCADA platform. As shown in Figure 4, the PF09 Contract Management Risk Assessment Tool categorises the contract as "Platinum Level", reflecting its business criticality. As a result, prolonged supplier underperformance, loss of key supplier resources or deterioration in service quality could affect Welsh Water's ability to maintain and support the service effectively.

Dependency was also evident through the experiences of framework system integrators. Participants reported difficulties understanding platform behaviour and independently troubleshooting issues due to limited technical documentation and differences between the legacy Mars Bar environment and the newer Quality Street architecture. One system integrator described "a knowledge gap" between the two environments (Framework System Integrator A, interview, 2026), while another stated that the migration involved "a fairly steep learning curve because in several areas we effectively had to work things out ourselves" (Framework System Integrator B, interview, 2026). This suggests that technical knowledge was not evenly shared between Welsh Water, its framework partners and the supplier.

This created a level of knowledge disparity, where understanding of platform behaviour, software configuration and fault diagnosis remained concentrated within the supplier organisation. The operational risk is that Welsh Water and its delivery partners could become dependent on supplier input for activities that should ideally

be supported by clear documentation, knowledge transfer and repeatable processes.

Stakeholders also highlighted concerns around organisational flexibility. Interview evidence suggested that the existing contractual arrangements limited Welsh Water's ability to quickly engage alternative suppliers or specialist support providers. While replacing the SCADA platform was considered technically achievable, stakeholders recognised that any transition would be complex, resource intensive and operationally risky. One stakeholder estimated that a procurement and transition process would likely require at least twelve months to complete (OT Financial Governance and Contracts Manager, interview, 2026). This indicates a potential lock-in risk, where Welsh Water may have limited short-term options if supplier performance became unacceptable.

It is important to note that dependency was not viewed as entirely negative. Supplier continuity provided benefits, including retained platform knowledge, consistency of support and familiarity with Welsh Water's operational requirements. The concern was therefore not the existence of supplier dependency itself, but the extent to which operational resilience relied on a single supplier relationship. In this context, the risk arises from the absence of sufficient alternatives, documented knowledge and internal capability should supplier support become unavailable or ineffective.

This distinction makes the dependency finding more balanced. The supplier's retained knowledge is valuable, but it becomes a risk where that knowledge is not documented, transferred or supported by realistic alternative arrangements and fundamentally relies on the supplier holding onto its key employees.

These findings align with outsourcing risks identified by Barthélemy (2003), particularly supplier lock-in, knowledge imbalance and reduced organisational flexibility. They also reflect Monczka et al.'s (2020) view that strategically important suppliers often create higher levels of dependency because of the specialist capabilities and knowledge they provide. Within the SCADA supplier relationship, the evidence suggests that dependency is present through operational support, fault resolution and platform lifecycle management.

There was evidence that Welsh Water had begun recognising these risks. Stakeholders identified ongoing discussions around greater framework system integrator involvement, improved documentation, enhanced knowledge sharing and the potential future separation of SCADA and telemetry contractual arrangements. However, these actions remained at an early stage and had not yet significantly reduced reliance on supplier expertise.

Overall, the findings suggest that strategic dependency represents a notable operational risk within the current supplier relationship. Supplier continuity and specialist expertise provide clear benefits, but Welsh Water remains heavily reliant on supplier knowledge. Reducing this dependency is unlikely to be achievable in the short term but can be greatly improved with knowledge transfer, stronger documentation, increased internal capability and targeted training.

6.5 OT Governance and Cyber Resilience

Within Welsh Water's operational technology environment, supplier performance directly influences the organisation's ability to maintain secure, resilient and supportable systems. As a result, many of the challenges identified throughout this section should be viewed as operational resilience and cyber-security risks on top of supplier management issues.

The AlmaLinux remediation programme provided a practical example of this relationship. The migration from Scientific Linux to AlmaLinux 8 was driven by the end-of-life status of the legacy operating system and the requirement to maintain a supported and secure platform. For an organisation operating critical national infrastructure, continuing to operate unsupported systems would have increased cyber-security, supportability and compliance risks. Successful delivery of the migration therefore relied not only on technical upgrade activities, but also on the supplier's ability to provide timely support, resolve defects and support the transition to a fully supported platform.

Interview evidence indicated that both Welsh Water and the supplier recognised the significance of the migration. Operational technology environments were subject to external cyber and resilience assurance activities during the remediation period, with supplier assurance forming part of this wider governance process (OT Financial Governance and Contracts Manager, interview, 2026). This demonstrates that supplier performance was considered an important component of operational assurance rather than an isolated support function.

The findings from Sections 6.2, 6.3 and 6.4 indicate that supplier performance was linked to the cyber resilience. Historical challenges relating to fault resolution, technical visibility and specialist resource availability introduced additional uncertainty during the SCADA remediation project. Several stakeholders highlighted concerns regarding delayed fixes, unresolved defects and reliance on specialist supplier knowledge, particularly where faults affected migration activities or testing. Whilst these issues did not result in significant operational disruption, they reduced confidence in remediation timescales and migration readiness.

One stakeholder reflected that "when you're trying to migrate something operationally critical, long delays or uncertainty around fixes become difficult because you're balancing cyber risk against operational confidence" (OT Engineering Manager, interview, 2026). This highlights a common challenge within operational technology environments, where security improvements must be implemented without compromising operational continuity. In practice, delays to remediation activities can extend reliance on legacy systems and increase uncertainty around deployment and alignment with security standards.

The findings also suggest that resilience risks were influenced by the level of dependency identified within the supplier relationship. As discussed in Section 6.4, progression of several complex faults depended upon access to specialist supplier knowledge, whilst framework system integrators reported difficulties independently diagnosing issues due to documentation limitations. This created a situation where operational resilience remained wholly dependent on continued access to supplier expertise.

The governance improvements introduced during the remediation programme appear to have reduced some of these risks. The introduction of SCADA-specific performance reviews, dedicated improvement meetings and increased management oversight improved visibility of issues, strengthened accountability and created clearer escalation routes. As discussed in Sections 6.1 and 6.3, these changes were associated with improved supplier performance scores, stronger communication and increased stakeholder confidence. This suggests that governance maturity contributed not only to improved relationship performance, but also to improved resilience by increasing visibility, accountability and management control.

This finding aligns with operational technology guidance such as NIST SP 800-82 and ISA/IEC 62443, which recognise that resilience depends upon governance, lifecycle management and supplier assurance as well as technical controls.

Overall governance effectiveness, technical capability, supplier responsiveness and organisational dependency all influence Welsh Water's ability to maintain resilient and supportable operational technology systems. Whilst the AlmaLinux remediation programme aimed to reduced immediate end-of-life risks, the longer-term resilience of the platform will continue to depend upon effective supplier governance, strong technical support and ongoing efforts to reduce the dependency risks identified throughout this section. The ongoing project is taking longer than forecast, and with the ever-progressing threat of cyber risks the relationship needs to be able to react and adapt quicker to the risk developments.

6.6 Summary of Key Findings

The findings show that the SCADA supplier relationship has improved but still contains important structural challenges. Welsh Water has a well-established governance framework, supported by dedicated contract management resource, formal review meetings, escalation routes and performance review mechanisms. The introduction of independent SCADA-specific performance scoring in Q3 2025 was a key improvement because it gave SCADA issues greater visibility and created a stronger focus on supplier accountability.

A key finding is that governance existed but did not always deliver the operational outcomes required. Earlier phases of the AlmaLinux remediation programme highlighted concerns around fault resolution, accountability, specialist resource availability and issue ownership. Fault records and stakeholder feedback identified long-running faults, deferred fixes, workarounds and reduced confidence where issues were closed or progressed without clear root-cause investigation.

The relationship was also affected by these service delivery issues. Historically, communication was often driven by faults and operational problems rather than proactive planning or continuous improvement. More recent evidence shows improvement through more dedicated SCADA governance, dedicated and improvement meetings and clearer communication, although long-term trust remains dependent on consistent technical performance and right-first-time delivery.

The analysis also identified significant dependency on supplier knowledge and support capability. This was evident through reliance on specialist technical resource, limited documentation, difficulty independently diagnosing faults and the lack of alternative support arrangements which creates operational risk if supplier performance or specialist availability deteriorates.

Overall, the supplier relationship is moving in a positive direction, with measurable improvements in governance, communication and responsiveness. However, long-term effectiveness will depend on continued progress in fault resolution, technical accountability, knowledge sharing, documentation quality and reduced dependency.

7 Recommendations and Future Work

The findings show that the SCADA supplier relationship has improved, but further work is needed to embed those improvements into normal working practice. The priority should be to ensure existing governance leads to clearer ownership, faster fault resolution, stronger technical assurance and reduced operational risk.

The first area is continued development of dedicated SCADA governance. Separating SCADA performance from regional telemetry performance has improved visibility and should continue so that faults, risks and improvement actions are not lost within wider telemetry discussions. SLAs, KPIs and escalation routes should also be reviewed against the operational importance of the SCADA platform and service level agreements priority selection should follow a clear flowchart to identify which priority is required.

Service quality should also be measured more consistently. A SERVQUAL-style assessment should be used with OT Operations and Maintenance teams, OT Engineering and framework system integrators to test whether supplier performance is meeting expectations across responsiveness, communication, ownership, confidence/trust and documentation. The results could then be used to prioritise improvement actions and track progress as exemplified in table 2.

Area	OT O&M Score	OT Engineering / Projects Score	System Integrators Score	Findings
Responsiveness	2	1	5	Fault responses inconsistent across stakeholders
Communication	4	5	4	Satisfactory scores from structured meetings
Ownership	1	4	4	O&M do not feel understand who is owning their faults, alignment required
Confidence	2	2	2	Fixes implemented require revisits
Documentation	2	1	2	Documentation still not suitable

Table 2 - SERVQUAL-Style Stakeholder Performance Review Example

Relationship quality should remain a focus. Communication and collaboration have

improved, but long-term trust will depend on the supplier consistently delivering reliable fixes and resolving issues correctly first time. Relationship reviews should therefore consider communication, ownership, escalation effectiveness and stakeholder confidence, not only performance scores.

Another key area is reducing dependency on supplier knowledge. Welsh Water should develop a structured knowledge-transfer plan with the supplier, including improved technical documentation, clearer configuration guidance, lessons learned from the AlmaLinux migration and greater involvement of framework system integrators. This would not remove the need for supplier support but would reduce reliance on specific supplier specialists.

Welsh Water should also review its longer-term outsourcing and exit-risk position. Replacing the SCADA supplier would be complex and high risk, but the organisation should understand what alternative support options exist, what internal skills would be needed and what a future transition might involve. Welsh Water could also carry out a feasibility study using an alternative off-the-shelf SCADA package to better understand cost, timescale, skills requirements and transition risk.

Finally, improvement actions should be managed through a formal supplier improvement plan with clear owners, timescales and measurable outcomes. Lessons from the AlmaLinux remediation programme should also be built into future OT supplier management processes, particularly where supplier performance affects cyber resilience, operational continuity and long-term supportability.

Overall, future work should move the relationship from improved communication to sustained operational performance. The relationship is in a better position than it was historically, but further work is needed to improve technical accountability, reduce dependency and ensure governance delivers practical operational benefits. These must be measurable to track improvement.

8 Conclusion

This project evaluated the current SCADA supplier relationship within Welsh Water's Operational Technology stakeholders. The aim was to understand whether existing governance, service quality and support arrangements were suitable for a SCADA platform operating within a critical national infrastructure environment. Overall, the relationship has improved, but important weaknesses remain.

The literature review showed that supplier relationships in complex technical environments cannot be managed by contracts alone. Formal governance is important, but it needs to be supported by clear communication, trust, accountability, service quality and effective performance management. This was reflected in the SCADA supplier relationship. Welsh Water had governance structures in place, but these did not always result in the operational outcomes needed by OT teams.

The analysis found that Welsh Water has a mature governance framework for managing the supplier, including contract management processes, review meetings, escalation routes and performance scoring. The introduction of dedicated SCADA performance scoring in Q3 2025 was a key improvement because it gave SCADA issues clearer visibility, rather than allowing them to be masked by the more positive regional telemetry relationship and performance score. The evidence was then used to drive action and improvement from the supplier.

Supplier responsiveness and service delivery remained the main areas of concern. Fault records and interview evidence showed that several issues remained open for long periods, were deferred into future releases, or were closed without clear evidence of root cause analysis and resolution. Workarounds and resets could restore functionality but reduced confidence that the issue had been properly understood or prevented from recurring.

These service delivery issues also affected the quality of the relationship. Historically, the relationship was often reactive, with engagement driven by faults, escalation and operational problems rather than proactive improvement. Trust was weakened where issues lacked ownership, were passed between teams or were not progressed with urgency. More recent evidence shows that the relationship has improved through dedicated SCADA governance, better communication and clearer escalation routes. However, long-term trust will depend on consistent technical delivery, not governance activity alone.

A further key finding was the level of dependency on the supplier. Some dependency is expected with a complex SCADA platform, especially where specialist software and supplier knowledge are involved. However, the evidence suggests that Welsh Water's reliance on the supplier extended beyond normal support arrangements. Internal teams and framework

system integrators relied on supplier knowledge to understand platform behaviour, diagnose faults and progress remediation work. This created operational risk, particularly where documentation was limited or access to specialist supplier resource was delayed.

The AlmaLinux remediation programme also showed that supplier performance is directly linked to OT resilience and cyber-security. The migration was needed to move away from unsupported operating systems, but successful delivery depended on supplier responsiveness, technical capability and effective issue resolution. This means the supplier relationship is not just a contract management issue; it directly affects Welsh Water's ability to maintain secure and resilient OT systems.

Overall, the SCADA supplier relationship is moving in the right direction, but it is not yet at a level to remove the risks identified in this project. Governance, communication and visibility have improved, and there is evidence that the relationship has become more structured and collaborative. However, weaknesses remain around fault resolution, technical documentation, trust, specialist resource dependency and supplier reliance.

On that basis, the relationship can be considered partly effective rather than ineffective. It has improved structurally and relationally, but the evidence does not yet show that the remaining service delivery and dependency risks have been fully controlled.

The project therefore concludes that Welsh Water should continue to develop the supplier relationship, but with a stronger focus on measurable operational outcomes. The next stage should be to strengthen dedicated SCADA governance, improve service quality measurement, formalise improvement actions, increase knowledge transfer and reduce reliance on individual supplier specialists.

This would help ensure that the improvements identified in this project are sustained beyond the current remediation programme.

9 References

- Barney, J. (1991) 'Firm resources and sustained competitive advantage', *Journal of Management*, 17(1), pp. 99–120. Available at: https://josephmahoney.web.illinois.edu/BA545_Fall%202022/Barney%20%281991%29.pdf (Accessed: 28 April 2026).
- Barthélemy, J. (2003) 'The seven deadly sins of outsourcing', *Academy of Management Executive*, 17(2), pp. 87–98.
- Blau, P.M. (1964) *Exchange and power in social life*. New York: Wiley. Available at: https://ia801700.us.archive.org/6/items/in.ernet.dli.2015.118920/2015.118920.Exchange-And-Power-In-Social-Life_text (Accessed: 28 April 2026).
- Buttle, F. (1996) 'SERVQUAL: review, critique, research agenda', *European Journal of Marketing*, 30(1), pp. 8–32.
- Cronin, J.J. and Taylor, S.A. (1992) 'Measuring service quality: a re-examination and extension', *Journal of Marketing*, 56(3), pp. 55–68.
- Dŵr Cymru Welsh Water (n.d.) *Home*. Available at: <https://www.dwrcymru.com/> (Accessed: 8 April 2026).
- European Parliament and Council of the European Union (2016) Directive (EU) 2016/1148 concerning measures for a high common level of security of network and information systems across the Union. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32016L1148> (Accessed: 6 May 2026).
- Framework System Integrator A (2026) Semi structured interview regarding SCADA supplier performance and OT system integration. Interviewed by A. Madelin, 23 April [Confidential].
- Framework System Integrator B (2026) Semi structured interview regarding SCADA supplier performance and OT system integration. Interviewed by A. Madelin, 22 April [Confidential].
- <https://scientificlinux.org/>
- International Society of Automation (2021) ISA/IEC 62443 series of standards. Available at: <https://www.isa.org/standards-and-publications/isa-standards/isa-iec-62443-series-of-standards> (Accessed: 6 May 2026).
- Kraljic, P. (1983) 'Purchasing must become supply management', *Harvard Business Review*, 61(5), pp. 109–117.
- Monczka, R.M., Handfield, R.B., Giunipero, L.C. and Patterson, J.L. (2020) Purchasing and

supply chain management. 7th edn. Cengage Learning.

Morgan, R.M. and Hunt, S.D. (1994) 'The commitment–trust theory of relationship marketing', *Journal of Marketing*, 58(3), pp. 20–38. Available at: <https://www.jstor.org/stable/1252308> (Accessed: 28 April 2026).

National Cyber Security Centre (2018) The cyber assessment framework (CAF): guidance for organisations. Available at: <https://www.ncsc.gov.uk/collection/caf/caf-principles-and-guidance> (Accessed: 6 May 2026).

National Institute of Standards and Technology (2023) Guide to operational technology (OT) security. NIST Special Publication 800-82 Revision 3. Available at: <https://csrc.nist.gov/publications/detail/sp/800-82/rev-3/final> (Accessed: 6 May 2026).

OT Engineering Manager (2026) Semi structured interview regarding SCADA supplier performance and operational support. Interviewed by A. Madelin, 08 April [Confidential].

OT Financial Governance and Contracts Manager (2026) Semi structured interview regarding SCADA supplier governance and contract management. Interviewed by A. Madelin, 16 April [Confidential].

Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988) 'SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality', *Journal of Retailing*, 64(1), pp. 12–40. Available at: https://www.researchgate.net/publication/225083802_SERVQUAL_A_multiple-Item_Scale_for_measuring_consumer_perceptions_of_service_quality (Accessed: 28 April 2026)

Pfeffer, J. and Salancik, G.R. (1978) *The external control of organizations: A resource dependence perspective*. New York: Harper & Row. Available at: <https://archive.org/details/externalcontrolo0000pfef> (Accessed: 28 April 2026)

Poppo, L. and Zenger, T. (2002) 'Do formal contracts and relational governance function as substitutes or complements?', *Strategic Management Journal*, 23(8), pp. 707–725. Available at: <https://www.jstor.org/stable/3094289> (Accessed: 28 April 2026).

Regional OT Operation and Maintenance Manager (2026) Semi structured interview regarding SCADA supplier performance and operational impacts. Interviewed by A. Madelin, 08 April [Confidential].

Scientific Linux (2024) *Scientific Linux end of life*. Available at: <https://scientificlinux.org/> (Accessed: 1 May 2026).

UK Government (2018) The Network and Information Systems Regulations 2018. SI 2018/506. Available at: <https://www.legislation.gov.uk/ukxi/2018/506/contents/made> (Accessed: 6 May 2026).

Welsh Water (2025a) [SCADA supplier] Q3 2025 SCADA specific performance review. Welsh Water. Unpublished.

Welsh Water (2025b) [SCADA supplier] Q4 2025 SCADA specific performance review. Welsh Water. Unpublished.

Welsh Water (2026a) [SCADA supplier] Q1 2026 SCADA specific performance review. Welsh Water. Unpublished.

Welsh Water (2026b) [SCADA supplier] SCADA faults record - May 2026. Welsh Water. Unpublished.

Welsh Water (2026c) [SCADA supplier] *SCADA support service level agreement*. Welsh Water. Unpublished.

Williamson, O.E. (1985) *The economic institutions of capitalism*. New York: Free Press. Available at: <https://archive.org/details/economicinstitut0000will> (Accessed: 28 April 2026)

Zaheer, A., McEvily, B. and Perrone, V. (1998) 'Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance,' *Organization Science*, 9(2), pp. 141–159.

10 Appendices

10.1 Appendix A – Welsh Water Governance

 PF9 Contract Management Risk Assessment Tool (CMRAT)									
Project/ Contract Title:			Please complete						
Ref	Criteria	Question	Assessment (Double click to select) Please ensure you 'enable content' in Excel			Guidance for Assessment			
			Low	Medium	High				
1	Customer Impact	The potential impact of poor contract performance to DCWW's customers is			✓	L: DCWW customers would suffer minimal disruption	M: DCWW customers would suffer moderate disruption	H: DCWW customers would be subject to significant and immediate disruption	
2	Business Impact	The potential impact of poor contract performance on continuity of DCWW's services is			✓	L: DCWW services would suffer minimal disruption	M: The ability of DCWW to provide certain services is jeopardised in the short term	H: Potential for major and immediate disruption to DCWW services	
3	Reputation	The potential impact of poor contract performance on DCWW's reputation is			✓	L: DCWW would suffer minimal reputational damage	M: DCWW would suffer moderate reputational damage	H: DCWW would suffer significant reputational damage	
4	Alternative Suppliers	The time, effort and complexity of switching to alternative suppliers if the contract does not perform is			✓	L: Minimum difficulty of switching suppliers	M: Moderate difficulty of switching suppliers	H: High/ very high difficulty of switching suppliers	
5	Contract value	The contract value is likely to be			✓	L: Contract anticipated annual value < £0.3m	M: Contract anticipated annual value £0.3m - £1.0m	H: Contract anticipated annual value > £1.0m	
6	Modern Slavery	The likelihood of modern slavery in the direct delivery of the contract is			✓	L: The contract provision is at moderate risk of modern slavery/ labour exploitation	M: The contract provision is at moderate risk of modern slavery/ labour exploitation	H: The contract provision is at high risk of modern slavery/ labour exploitation	
7	Cyber Security	The level of access to DCWW systems required by the contract is			✓	L: The contract requires no/ minimal interface to DCWW systems or access to data	M: The contract requires some access to DCWW systems and confidential data	H: The contract requires a high level of access to DCWW systems and confidential data	
8	Data Protection	The level of personal or sensitive data that is gathered, held or accessed in the contract is			✓	L: Processing of personal or sensitive data is not required or minimal access involved	M: Processing of personal or sensitive data on an infrequent basis or with limited access involved	H: Processing of personal or sensitive data is on a frequent basis or with widespread access involved	
CONTRACT CLASSIFICATION			PLATINUM			BCP REQUIRED		YES	
AMENDED RISK LEVEL									

Figure 4 - Welsh Water Governance - PF09 Contract Management Risk Assessment Tool

PF10 Contract Management Plan – Platinum Contract

Key Contract Information (Please amend this section to include information that will be beneficial to you as Contract Manager of the Contract – suggestions below)			
Contract Reference and Title:		Contract Manager Details:	
Key Dates:	PF10 Creation: Contract Start Date: Contract End Date: Optional Extensions:	Contractual elements:	Pricing: Inflation/ Indices: Service Levels: Key Performance Indicators: Lead Times:
Key Contacts:	DCWW contact(s): DCWW escalation point(s): Supplier contact(s): Supplier escalation point(s):	Other Relevant Information:	e.g., Notice period, termination rights, approach to change control, call off procedure

Contract Area	Activity	Guidance Areas to consider	Contract Manager's Plan	Platinum Frequency
Health and Safety	Works, goods or services meet the required level of safety performance	Please refer to the Management of Contractors Procedures		Refer to the Management of Contractors Procedures
Cost	Review price paid accords with the contract rates and prices	Confirm how the receipting/ payment approval process will be undertaken and what action will be taken to review rates paid accord with the Contract. Confirm who will carry out this function and how it will be recorded		Monthly
Quality	Review goods, services or works are in accordance with the contract scope and specification/ KPIs	Identify how KPIs and any other relevant standards and requirements will be monitored and what information will be received from the supplier e.g., monthly reporting, performance, customer satisfaction		Monthly
Time	Review that goods, services or works have been delivered as per the timings/ programme set out in the contract	Define the Service levels set out in the Contract and outline how performance will be measured Define the programme to be achieved and outline how performance will be measured		Monthly

Page 1 of 2

Figure 5 - Welsh Water Governance - PF10 Contract Management Plan – Platinum Contract Page 1

Contract Area	Activity	Guidance Areas to consider	Contract Manager's Plan	Platinum Frequency
Business Continuity Plan	Review Supplier Business Continuity plans	Define the detailed plan to mitigate the risk of the supplier being unable to continue providing the service. Set out the scenario testing and frequency		Quarterly
Modern Slavery	Where Modern Slavery is identified as a potential high risk, validate Supplier's adherence with its Modern Slavery Statement through checks and audit where required	Consider risks and checks and audit as appropriate		Annually
Information Security	Where Information Security is identified as a potential high risk, validate Supplier's adherence with its Information Security Policy and any conditions as set out in the contract, including accreditations	Include appropriate measures to monitor areas of Information Security risk identified within the Contract		Annually
Data Protection	Where Data Protection is identified as a potential high risk, validate the Supplier's adherence with any conditions as set out in the contract	Include appropriate measures to monitor areas of Data Protection risk identified within the Contract		Annually
Sustainable Procurement	Where Sustainability risks and/or opportunities have been identified, validate the Supplier's adherence to any mandatory scope requirements and/or Key Performance Indicators (KPI) as set out in the contract	Include appropriate measures to monitor the implementation of Sustainability risk and/or opportunity key performance indicators identified within the Contract		Where specified in Contract, review as per defined frequency
Tender Commitments	Where tender commitments have been identified by the supplier, validate the supplier's adherence to these as set out in the contract	Include appropriate measures to monitor the delivery of tender commitments		Where specified in Contract, review as per defined frequency

10.2 Appendix B – Technical and Project Evidence

[illegible]

Figure 7 - Extract of Open Jobs from SCADA Supplier Fault Records (Welsh Water, 2026b)