HSLU Hochschule Luzern

Technik & Architektur

Master of Science in Engineering

From Product Ownership to Ventilation-as-a-Service:

A Comparative Criteria Framework for Building Owners and Service Providers

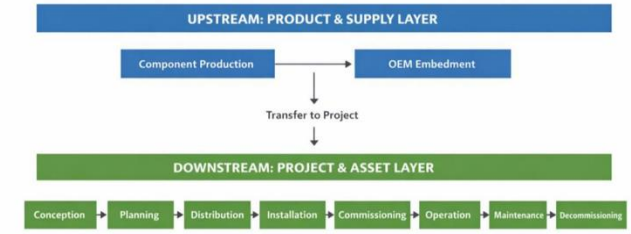

Figure 1: Current product-ownership-based ventilation lifecycle [Own illustration]

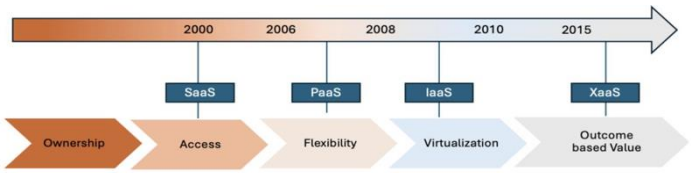

Figure 2: Evolution from SaaS to XaaS - shift in value logic [Own illustration]

Condition group	Conditions favoring VaaS	Conditions favoring ownership
Building and use profile	Ventilation is critical, measurable, linked to IAQ, comfort, or compliance; demand is reasonably predictable and scalable.	Demand is low, simple, or infrequent; installation is highly customized; demand volatility is too high.
Technical readiness	Sensors, controls, BMS access, and data continuity are available; performance can be verified transparently.	Data access is weak, control interfaces are fragmented, or performance cannot be measured clearly.
Organizational readiness	Owner values lower coordination burden, predictable service, and external technical competence.	Owner has strong internal engineering or FM capability and prefers direct asset ownership.
Financial and contractual context	Customer values cost predictability; provider can estimate demand and service effort; responsibilities can be clearly specified.	Risk premiums are high, legal boundaries are unclear, or uncertainty is too broad.
Regulatory context	Requirements are stable enough to support measurable service obligations and reporting.	Legal obligations make transfer of accountability too complex or risky.

Table 1: Suitability conditions for Ventilation-as-a-Service [Own illustration]

Problem Statement

The building technology sector is shifting from traditional product ownership toward outcome-based service models. In ventilation systems, measurable outcomes such as indoor air quality, energy efficiency, compliance, and operational reliability create strong potential for Ventilation-as-a-Service (VaaS). However, adoption remains difficult because building owners and OEMs/service providers lack a structured decision framework for comparing ownership and service models. Service providers face uncertainties in risk allocation, cost calculation, and digital integration, while building owners struggle with KPI definition, willingness to pay, contractual transparency, and lifecycle accountability. This thesis addresses that gap by developing a comparative criteria framework that supports both stakeholder groups in evaluating when VaaS is more suitable than the traditional ownership model.

Methodology

The research applies a mixed-method approach that combines desk research and field research. The desk research includes literature on servitization, Product-Service Systems, XaaS, HVAC, and building automation, as well as industry benchmarking and lifecycle analysis. The current ownership-based HVAC lifecycle was mapped across component production, OEM embedment, conception, planning, installation, commissioning, operation, maintenance, and decommissioning. Benchmarking of adjacent service models, including Energy-as-a-Service and Cooling-as-a-Service, was used to identify success factors and barriers. In addition, six semi-structured expert interviews were conducted with service-provider-side and building-owner-related stakeholders, and the results were coded systematically. The developed concept was then refined and validated through expert feedback and a verification workshop.

Solution

The thesis develops a comparative criteria framework for deciding when Ventilation-as-a-Service is preferable to the traditional ownership model.

The findings show that VaaS is most suitable when ventilation performance is measurable, operationally important, digitally monitorable, and linked to lifecycle value such as energy efficiency, compliance, business continuity, or sustainability. It is further favored when provider capabilities are strong, service responsibilities can be defined clearly and building owners value lower coordination burden and performance continuity. Traditional ownership remains more suitable when systems are outdated, data access is weak, demand is simple or highly uncertain, contractual risks are difficult to price, or the owner has strong internal lifecycle-management capability. The thesis therefore recommends a selective and stepwise implementation of VaaS, starting with pilot cases in standardized building portfolios or performance-critical environments.

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