Software as a Service's Role in Sustainable Business

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Abstract

Environmental legislation places ever greater and occasionally forceful pressure on companies to comply with norms that can be disruptive to business and profitability. Digitalization is a first step towards more agile operations and more environmentally friendly practices, supply chains, and decisions. The data-driven company can more easily comply with new environmental requirements, however, digitalization can itself be a burden on a company's finances, particularly if it is in its early stages, and, just as critically, IT infrastructure can represent a significant portion of a company's footprint. Datacenter power consumption has been extensively analyzed by legislative bodies and private companies and has been determined to be a significant element of total worldwide power consumption and operating a datacenter can be detrimental to a company's carbon footprint goals. Datacenter location, proximity to renewable power sources, and infrastructure optimum utilization cannot be controlled in an independent establishment operated by a company who operates is a totally different business than IT. The article explores studies, reports, and material and addresses how Software as a Service helps mitigate environmental concerns around digitalization, by allowing companies to consume IT resources (infrastructure, software, human capital) in the most scalable and sustainable manner possible. The paper concludes that digitalization is a key step towards sustainability, that data driven organizations will gain a competitive advantage, and that Software as a Service is the most appropriate path to sustainable digitalization.

Keywords

Sustainability, datacenter, Software as a Service, carbon footprint, efficiency

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Introduction

Sustainable development represents a mix of environmental goals but also values, as described by Pătărlăgeanu et al. (2020) who also delve into the fact that scientific literature and the focus on sustainability were very extremely rare in the 1960s and 1970s, with all of that changing beginning with the 1980s. However, as pointed out by Dinu et al. (2020), companies and individuals have focused on "Green Procurement" in order to align with environmental and sustainability goals, a commendable effort, one which, however, one that addresses punctual issues for the most part rather than systemic ones.

Jora et al. (2022) elaborates on the increased legislative pressure applied in recent years, particularly by European legislative bodies, for companies and governments to embrace sustainability objectives. As these are more and more optimistic, they can impede companies' ability to compete effectively. Furthermore, companies face the challenges of operating in a modern, digital world, while at the same time doing so within the strict boundaries of legislation. While companies view digitalization to achieve sustainability objectives, they approach the process gradually due to limiting factors in their budgets or expertise.

This paper explores the competitive edge, the agility, and the adaptability a data-driven company will display and how these characteristics are interlinked with sustainability goals. It goes on to describe the nature of the challenges digitalization can present and how digitalization efforts can, depending on the

approach, be detrimental to sustainability targets such as carbon footprint. Additionally, the aim is to underline how delayed digitalization can itself represent a major issue, as it requires a full IT overhaul of a company. Further details are offered about the challenges that operating a complex IT environment can present and the impact, both financial and environmental, that datacenters can represent.

The purpose of the paper is to describe a solution for companies that seek accelerated digitalization and who are faced with the legislative constraints of meeting environmental goals or seek to do so as part of their core values. This is in the form of Software as a Service, a more modern means of 'consuming' IT resources in the 21st century, taking advantage of the proximity of the data center to renewable power sources, the efficiencies brought about by standardization between multiple customers, data security, and economies of scale. The paper describes how Software as a Service addresses numerous issues, particularly in sustainability, in a manner that allows economic operators to focus on their core business while simultaneously reducing their carbon footprint.

1. Sustainability driven by legislation and enabled by digitalization

In the context of the European Green Deal (EU Commission, 2019), we observe a tendency to accelerate, even force, a change in the structural components of economic sectors aimed at achieving a more “green” and “sustainable” economy before a deadline.

Jora et al. (2020) reflect on the relationship between law and legislation and the sometimes difficult to achieve balance between the two. When existing norms and legislation either force digitalization or transition towards a green economy, the authors conclude that unforeseen consequences can affect participants in an economy. A legislative framework that is both restrictive and overly optimistic will inevitably limit the potential turnover and will result in exposure to problems generated by segments of the economy that have been artificially inflated and prioritized (for example, electronic 'waste', obsolete batteries for electric vehicles, unexpected energy expenditures, supply chains that are inadequate for increased volumes).

Sustainability, viewed as the efficient and economic use of resources, is based on decisional factors in any economic activity. Appropriate allocation of resources, anticipating the use of those resources and their consumption, and efficient cost structures are just examples of constant challenges facing management teams across all industries today. Competition has traditionally been the main catalyst towards an increased focus on these factors. An economic operator who has been able to reduce cost, who could increase productivity, and ultimately obtain a superior profit margin, can implicitly face an overcome his competitors in the market. The fight over market share has often occurred in the field of efficiency and agility in business (Marshall et al., 2019).

In the context of the green economy, legislation can deviate from traditional views on efficiency, and ambitious goals our society strives for can occasionally go against the current structure of our industry and economy. An example cited by Jora et al. (2020) is that of electric vehicles. These comply with existing legislation and “green” objectives; however, their very feasibility as a replacement for internal combustion-based vehicles remains exclusively a result of government intervention (incentives for purchase by the population, tax deductions and credits for manufacturers, government investment in charging infrastructure and not private investment).

Agility and supply chain adaptability to the most recent norms becomes critical, the decisions that form the basis of any change process will be the most appropriate ones only when they are based on accurate and abundant data. Immediate availability of data is a practical consequence of digitalization. It concludes that companies are increasingly viewing digitalization as a means to achieve sustainability objectives and that management teams view digitalization as a critical milestone. However, the approach to digitalization is gradual, limited by the in-house expertise within companies, the need to invest in additional skills, and the prohibitive nature of a full IT overhaul. Reflecting on the unforeseen consequences of sustainability efforts, the cost of digitalization and ultimately operating in a modern digital manner can exclude a large component of local economies from keeping up with competition.

Turkeș, Stăncioiu and Băltescu (2021) conclude that, for enterprises, digitalization represents a complex process that ultimately allows the implementation of the necessary means to generate a profound and sustainable change at the level of the entire business model and work activity itself. Digitalization will be a determining factor in companies' ability to generate increased cash flow, therefore equipping them financially to adapt to newer, more strict environmental legislation and adapt their supply chains in an agile fashion.

Data-driven organizations can take proactive steps to influence their reputation positively, actually leveraging environmental goals to their advantage. They can and will factor in reputation risk in their decision-making process, aggregating multifaceted data available to identify the fine balance between sustainable development, positive marketing, and margin objectives. Ultimately, they will enjoy wider support from their customers, legislative bodies and the market, therefore gaining a competitive advantage as concluded by Tăchiciu et al. (2020) when reviewing reputational risk, particularly in the financial industry in Romania.

These early pioneers are companies that have the mechanisms, often digital, necessary to transfer the added cost of sustainable business to their customers. This is often achieved through marketing campaigns fueled by sentiment data, rapid analysis, and subtle trends in the market, which they are able to anticipate and adapt to.

I shall offer a solution to a challenge that many currently non-digital operators are facing today in order for them to be able to walk the fine line between achieving digital objectives in order to remain competitive and remaining compliant with existing sustainability-focused legislation. This challenge is the massive allocation of capital required to address the delayed digitalization of a company while at the same time balancing digitalization with sustainability and environmental goals.

2. Impact of the datacenter on the carbon footprint, colocation, and Software as a Service

Paradoxically, digitalization of a company, while increasing agility and responsiveness to business conditions and environmental legislation, will likely increase its carbon footprint through the need to operate IT infrastructure and build a datacenter of its own. Datacenters are capital-intensive, energy-intensive establishment, which place a massive human resource burden on companies undertaking their journey to the digital world.

Building a datacenter and operating the hardware and software infrastructure required to digitalize the company's operations will require capital investment at a scale that most medium-sized operators will not be able to sustain. Furthermore, the operation of the data center and the maintenance of daily operations can, depending on the primary activity of the company, represent the most negative impacts on its carbon footprint in its day-to-day operations.

Bouley (2020) concludes that datacenters can be up to 40 times more energy intensive than an office building and are designed around different parameters than buildings meant to house workers. As the main consideration for a datacenter room would be ensuring integrity of the systems it houses, a company is less likely to be able to use existing space due to humidity, ventilation, cooling, and energy requirements. Failover considerations must also be taken into account, which usually leads to increased investments in locations and infrastructure to ensure business continuity.

The proximity to sustainable power sources is also difficult, if not impossible, for individual companies to ensure. Their business, offices, and personnel locations will be dependent on their primary activity. Easy access to sustainable power sources or more appropriate climate conditions is very rarely an option for individual operators; therefore, power consumption can increase to compensate for weather that is less ideal, regardless of the type of power sources used.

In recent years, companies have resorted to taking advantage of the real estate of datacenter operators to house their infrastructure. The model is known as colocation and provides access, for a fee of course, to more appropriate locations. Furthermore, colocation datacenters can achieve proximity to sustainable power sources such as hydroelectric power plants or wind farms and climate-controlled rooms. Those facilities average lower per-unit costs of operation due to economies of scale. However, the model retains numerous limitations, listed below:

- Maintenance and replacement of obsolete equipment remain the responsibility of the tenant.
- Software maintenance activities require system administrators, developers and consume human capital resources in quantities that differ little from hosting the equipment in-house
- Geographic considerations remain a factor due to the inherent nature of maintenance activities, and companies are still required to have resources available for on-site activities.
- Several restrictions are applied by the datacenter operator to the equipment housed in their facilities, such as standardized rack sizes, renting rack space in increments that sometimes do not reflect the owner's requirements, leading to unused space that is still paid for.

- Equipment depreciation, maintaining infrastructure modern, and ensuring security remain the responsibility of the tenant

The model only answers part of the problem for organizations looking to transform into digital, environmentally friendly, and sustainable companies. In the Datacenters and Decarbonization Report (Bloomberg NEF, 2021) published in October 2021 jointly by Bloomberg NEF, Statkraft and Eaton Corporation, it is concluded that large data centers in the UK, Germany, Ireland, Norway and the Netherlands are projected to draw 5.4GW (gigawatts) in 'live IT power' demand in 2030, up from 3GW at present. This is exacerbated by inefficiencies in most of the client's operating independent segregated IT infrastructure within major datacenters, adding to the already inefficient operation of 'on location' datacenters and datacenter rooms that are still widely present at the European level.

Economic operators will find it increasingly difficult to meet optimistic environmental and carbon footprint goals set out by legislative bodies, ensure rapid and sustained digitalization meant to obtain or retain a competitive advantage, and hire the right resources to operate in a digital-first environment. The paper aims to analyze an increasingly popular alternative approach that brings benefits in all areas of concern addressed so far, namely Software as a Service. In essence, this represents consuming the entirety of an IT infrastructure as a service, compared to developing in-house IT infrastructure from the ground up by each individual company, as well as maintaining that newly developed infrastructure current.

This approach answers several challenges that both legislative constraints may pose as well as financial one related to the initial capital investment that modernizing and maintaining an independently operated IT infrastructure can bring.

- Significant capital expense related to hardware and software licenses or software development (Rodrigues, Ruivo and Oliveira, 2021)

- Significant recurring expenses related to human resources, among the most expensive in the market and presenting one of the highest turnover rates (Williams Towers Watson, 2021).

- A significant increase in the energy consumption footprint of the individual company only partially offset by colocation models (Gholamhosseinian and Khalifeh, 2012).

- Elasticity and flexibility within the IT infrastructure space are limited to whatever investment and 'room to maneuver' has been built into the initial project.

- Operating a frequently non-homogenous IT environment, often a patchwork of independently developed applications which gather and process data depending on limitations of a single IT team. (Gholamhosseinian and Khalifeh, 2012)

- Innovation and market data are limited to the company’s own investment capabilities and research, essentially driven solely by the company’s available budget.

Software as a Service can address these factors, increasing competitive advantages for economic operators while at the same time ensuring sustainable operations, thus contributing positively to the company’s carbon footprint. (IDC Corp., 2021). To begin with, SaaS requires comparatively very little in terms of capital expenses; it is for the most part an operational expense incurred on a consumption basis. The SaaS ecosystem will allow for IT consumption without the need to operate a datacenter and ensure appropriate conditions, purchase expensive equipment which depreciates rapidly in value, or perform hardware maintenance. The SaaS vendor is in charge of maintaining the hardware and the software, part of the connectivity, hosting the data, and addressing ever-evolving security requirements (Gholamhosseinian and Khalifeh, 2012).

Energy expenditure is also minimized, mainly due to the SaaS vendor’s ability to take advantage of the same factors that colocation providers are able to leverage. Proximity to renewable power sources is possible for large-scale operations, as investments in those areas can make sense when the core business is operating IT infrastructure and datacenters (Anderson et al., 2021).

One of the largest Software as a Service vendors in the world (Oracle Corp., 2021), offering a portfolio that spans the entirety of Enterprise Applications, the company clearly outlines how this model of consuming IT can leverage all the benefits listed above in their 2025 Sustainability objective:

- 100% renewable energy for Oracle Cloud

- 100% renewable energy use for Oracle Real Estate and Facilities

- 25% reduction in air travel emissions for employees

A study conducted by Accenture for Microsoft referenced in Data Center Efficiency, Renewable Energy and Carbon Offset Investment Best Practices (Costello et al., 2021), compared the environmental impacts of providing three of Microsoft's business applications, Exchange, SharePoint and Dynamic CRM, through customer data centers and Microsoft cloud data centers. The study found that Microsoft cloud-based operations reduced carbon emissions by an average of:

- 90% or more for small operations (per ~100 users)
- 60% to 90% for medium-sized operations (per ~1,000 users)
- 30% to 60% for large operations (per ~10,000 users)

Accenture Corp. (2020) presents in the graph below, the incremental levels of carbon reduction that can be achieved with the greatest savings shown by moving workloads to the Public Cloud, such as is the case with Software as a Service.

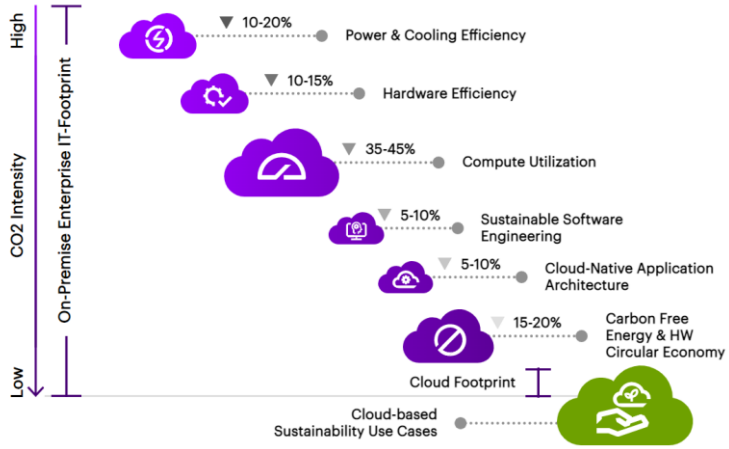

Figure no. 1. Carbon reduction savings by category of actions implemented
Source Accenture, 2020

Power consumption can be further reduced by large-scale upgrades and process adjustments that have a direct and measurable impact on the vendor's bottom line if successful. Economies of scale play a role and are a determining factor, and measurable improvements in the carbon footprint can be achieved by performing upgrades that leverage increased negotiation power with a SaaS vendor's own suppliers (Gholamhosseinian and Khalifeh, 2012).

Elasticity of a company's own product demand can influence IT resource consumption; however, in a capex model there is very little elasticity possible. Less revenue and margin can mean operating a static environment, which can represent an ever-larger percentage of the cost of a company. SaaS environments are inherently elastic and can scale up or down rapidly, there is no previously incurred cost of infrastructure that is no longer user at capacity due to a temporary decrease in sales, decrease in usage, and compute requirements. Servers in idle mode consume between 70 and 80 percent of the power consumed when fully operational (Costello et al., 2012) and in a company's datacenter, servers cannot be easily repurposed because there is no constant incoming workload, so it is worth noting the impact of carbon footprint of underutilized equipment, something SAAS vendors manage quite effectively due to a large and ever-expanding customer base.

Additionally, features developed for the software being sold as a service are driven by industry trends, and vendors are able to assess those trends and react accordingly. Therefore, their clients can benefit from features being introduced that would otherwise have required extensive and expensive in-house development efforts. Companies can remain 'leading edge' from a software perspective with minimal or no additional investment as a result (Rodrigues, Ruivo and Oliveira, 2021).

Data itself is inherently owned by the client in a SaaS model. However, data models and industry trends are used to further develop the technology, thus benefiting all. In a sense, SaaS can be a great equalizer in an environment that has generally benefitted companies with sufficient capital to invest in digitalization efforts and that has excluded companies that have historically found this level of innovation cost prohibitive. The vendor will build and develop their technology based on an aggregate of industry requirements, and nimble, if not large, organizations can suddenly obtain an edge that would otherwise not have been available to them.

Software as a Service (SaaS) presents numerous advantages to economic operators struggling to meet the requirements being set forth by both the market, consumer preferences, and, very importantly, the legislative framework within which they need to operate. This model of consuming technology is the most recent leverage companies have to ensure sustainable business practices of their own that comply with the evolving global environment.

Conclusions

The sustainability of a business and an industry has become a critical factor in conducting operations in recent years. Ideally, there would have been a natural evolution of business and business practices towards sustainability, driven by natural undercurrents in the market.

However, sustainability, the 'green economy' and environmental protection can be seen as having displayed fluctuations in the level of focus they have received in recent decades. Consequently, despite the ideals of capitalism and an open and free market, sustainability has begun to be brought into the forefront of conducting business through government involvement. As a result, economic operators will need to continue their activity at the intersection between the sovereignty of the individual (law) and the sovereignty of the legislative bodies (legislation). Legislation in particular is evolving to incorporate sustainability guidelines and practices enthusiastically, potentially disrupting natural innovation in certain areas, and artificially shifting the direction of the market and the consumer.

Further exacerbating the effects on independent operators and the economy, governments are driving the direction of business and, in some instances, generating unforeseen consequences. In order to prepare for these unforeseen consequences as well as conduct efficient and profitable business in a newly, more regulated environment, business have to become more flexible, more agile, able to react to elasticity of demand, and able to respond efficiently to changes in the marketplace, regardless of the changes being induces by legislation or shifting market dynamics or consumer preferences.

In order for businesses to achieve this, they need to become digital, and data driven, a status historically reserved for the largest companies, most willing and able to invest in costly and complex IT infrastructure that has provided an edge in the past. These same companies are the most equipped to respond to new legislative requirements aimed at increasing sustainability, furthering the advantage they have on industries and companies that have delayed digitalization.

An IT overhaul in today's market will represent a massive project and a massive capital investment for companies just beginning this journey due to initial costs, IT staff requirements, and more recently the increased carbon footprint of modern datacenter. Of the available options, the most appropriate solution for companies that have embarked on their digital journey is the Software as a Service model. This allows an economic operator to benefit from the most recent technology, in a scalable and elastic fashion, while minimizing the financial impact and environmental impact of them going digital.

Software as a Service provides an edge to companies looking to modernize, comply with the latest requirements in terms of sustainability, and remain relevant in today's business environment. It by no means reduces the need to diversify supply chains and develop sustainable business operations, however, it allows for environmentally responsible digitalization and leveraging economies of scale in IT.

Software as a service will continue to take advantage of sustainability advantages, such as the proximity of data centers to renewable energy sources. It will also allow for large scale overhauls of IT infrastructure that leverage the most recent, most sustainability-oriented technology with the smallest per/user financial impact to their customers and to consumers, therefore centralizing the complex activities required to maintain an IT ecosystem. Ultimately, Software as a Service will continue to allow companies to focus on their core activity, streamlining costs, and directing resources to achieving further goals individual to themselves, in a legislative environment that will continue to place an increasing emphasis on eco-friendly sustainable practices.

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