SUSTAINABILITY AS FOUNDATION FOR PRACTICAL APPLICATION. CONSIDERATIONS FROM AND FOR INFORMATION TECHNOLOGY SECTOR

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Abstract
The thoughts about the term sustainability as tool for attracting shareholders, customers and partners create a wide and deep range of application areas. Despite all efforts to reduce the used resources and money, the sector of information technology grows. The objective of the paper is to identify the elements that form the foundation of sustainability in the IT domain. Methodology used involves a case study on the example of one typical IT business.
The results shows that measurement and monitoring on technical and managerial levels can lead to best practice in replacement of hardware in datacentres and maximizing the utility of resources, considering all determining aspects. By using a big datacentre as reference, the several categories of steerable parameters considering sustainability lay out the complex challenges in a company. The authors also show that datacentres as source and engine for data and information processing face several aspects of sustainability. All of them can be handled separately, but interferences and dependability will reduce the effects. Finally, the study indicates that observation, measurement and monitoring on technical and managerial levels can lead to best practice in replacement of hardware in a datacenter and maximizing the utility of resources, considering all determining aspects.

Keywords
Sustainability, interest conflicts, technology, interest dissent, replacement factors

JEL Classification
M10

Introduction

The digitization of business is one of the current concerns and determines at the same time new opportunities for learn new successful business models (Weille, 2015; Tornjanski et al., 2015). Sustainable management can be regarded as the intentional activity regarding

and accepting the main principles of Corporate Citizenship (CC), Corporate Sustainability (CS) and Corporate Social Responsibility (CSR), (Schaltegger, 2001). All in common is to leave the focussed business strategic and operative decisions to favour societal and environmental concerns and expectations. Combining diffuse interests of shareholders and stakeholders, which have their individual expectations to the organization, with abstract needs of society and economy is the most challenging part, focussing to sustainable development. Millon mentioned that the interests of shareholders and non-shareholders are not unavoidable in conflict to each other (Millon, 2011). The following article enlightens on operational level the complex structures within an organization, using only one fragment of information technology. Replacement of basic services contents itself several layer influencing responsible decisions. By using exemplary data from a mid-size data centre shows the influence factors. To draw a holistic picture or at least a line as orientation for decision-maker the preparation has to cope with numerous adjustments screws.

Methodology

The following case study will display and discuss the several influence factors for a decision-maker. Age, performance indicators, contracts, used resources and recycling options dominate the decision, beneath economic thoughts. The articles enlightens the information-technology (IT)-infrastructure in general, in particular the replacement of servers. Showing the dependency of the aspects creates a complex decision matrix for date and kind of replacement. Secondary, the exemplary age structure of the complete infrastructure urges decisions continuously. Used data are provisioned by the datacentre and are representative as benchmarks worked out. This case study leaves the abstract rhetoric discussion about sustainability and shows challenges by transmission in operations.

Theoretical aspects

1. Different fields of sustainability

According to some authors, sustainability is defined as development that meets the needs in the present without compromising the ability of future generations to meet their own needs. (Verjel A.M. et al., 2015). The sustainable development should be considered as an integrated system of economic, ecological, social and institutional perspective according with Ciegis et al. (2009).

Regularly sustainability contents of the three sectors of social sustainability, ecological sustainability, and economical sustainability. All of the three are combined by the intention to “a form development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, as Hauff pointed out already in 1987 (p.46). Some of the several possible dimensions and their measurable parameters can create an intersection, as to see in Fig. no. 1, between a) ecologic sustainability (dimension: planet, region); b) economic sustainability (dimension: profit, market shares); social sustainability (dimension: people, welfare).

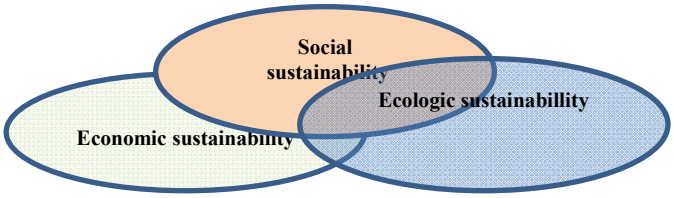

Figure no. 1: Components of sustainability (3-P-Model of CSR)
Source: authors, Hauff (1987)

Caroll (2003) suggested four fields for corporate responsibility, the responsibility a corporation or organization has to keep in focus: a) economic; b) legal; c) ethical; d) philanthropic areas.
The first three ones are necessary to produce the charitable or philanthropic area; measurement of the first two is comparatively easy; the latter ones are hard to measure, especially a reference number or a set of numbers. Measurement will be accompanied by valid statistics for evaluation and judgements taken by government, private corporations, or associations.
Gabler Lexikon (2006) defined the four columns of sustainability as follows:

- Regenerative resources are to use in the same scale as they are reproduced
- Non-regenerative resources should be used in the extent as they are substituted by other c resources, comparable in function and consistency
- The net extract from ecosystem has to be zero; no more resources have to be taken than are reproduced by the nature.
- Nature has to cope all changes initiated by mankind.

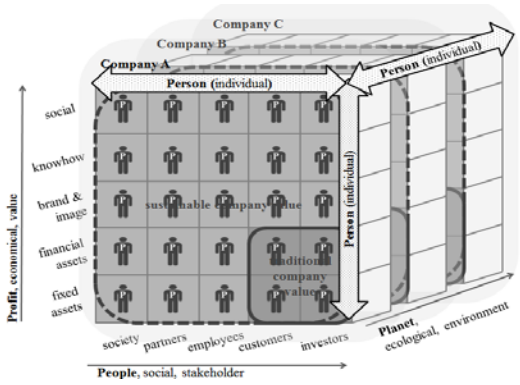

Figure no. 2: The "4-P"Model of ISR for an organisation
Source: Weber, 2017

Weber (2017) supplements the aforementioned 3-P Model of CSR to the 4-P-Model of ISR (ecoistics) by adding the dimension of "person" = "individual", as individuals per se are an integral element in the sustainability discussion. Any organization consists of individuals with demands and wishes, which at the end are the ones representing and living a CSR strategy and therewith the sustainability strategy of the national economy.

The most challenging remains the question of weighing of interests, based on a specialized scale. In the case of overruling prioritization of shareholder interests, based on short term results, non-shareholder-interests will be mitigated. More complex will be the forecasts of decisions or activities concerning local or regional societal status (Bodemann & Olaru, 2014). Thereby definitions and discussion lead unavoidably to the term of public value or welfare. In 1995 Moore introduced public value as term to describe holistic generally accepted values in society which can be changed by each player in a society.

2. Forecasts of activities from a business and a public view

Generally a company focussed to maximizing profit in favour to increase the shareholder value and secure the durability. By adjusting the report periods from long to short results are judged in shorter periods, long-lasting product or service cycles were replaced by decrease of renovation cycles and broader widespan of products. The automotive industry is a good example for the changed focus: The former product range was extended during the last 20 years, the intervals of renewals of types are reduced, but in several examples at the cost of quality and durability. The wingspan and depth of the product spectrum reveal the market shares and fulfilled the more and more individualised interests of customers. Different levels concerning sustainable development can be applied in every organization. The following figure shows their transition between micro- and macro views of the ramifications an organization produces.

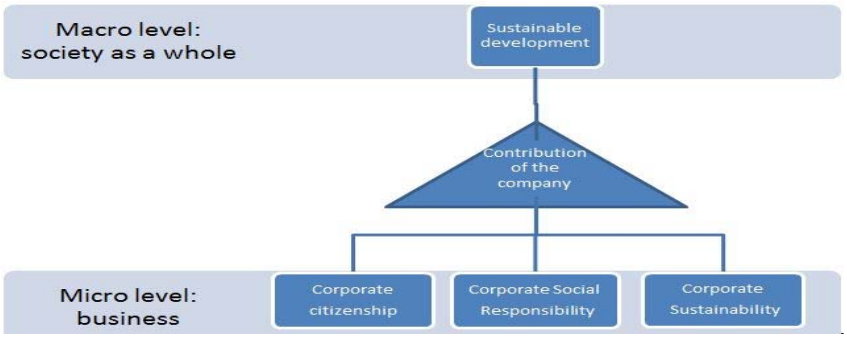

Figure no. 3: The relationship between CSR, CC and sustainable corporate governance and sustainable development
Source: Loew, T., Ankele, K., Braun, S., Clausen, K., 2004

3. Complex structures of products, their origin and their impact for corporations and the affected environment

Regarding the roots and intention of CSR and the perspective to combine the concepts of sustainable development started from a business view (Loew at al., 2004). Durability and pay-offs for share- and stakeholders are regarded as priority. The social matters became secondary. The following findings about products and service tend to focus the continuous provision, secondary the implications to society and environment. Loew at al. (2004) or Millon (2011) complain about the combination of an obsessed and exclusively profit oriented community with quarterly expectations. He also admits that policies that are

designed to serve the non-shareholder constituency are assumed to work adversely to shareholder's expectations and interests, expressed by reduced short term profits. As consequence, shareholders will express their interests more fiercely. Especially investors will look at the business behaviour and the short-term pay-off expectations. Prioritizing that kind of entrepreneurship will contradict the idea of corporate social responsibility. Core idea of a product is the assumed and later realised value of a product. Determining factor is the value of the product, resulting from a personal or technical cost-benefit-analysis.

Every modern enterprise is equipped with own or rented IT-infrastructure. From remote robots to workflows preparing a strategic board decision, virtually every step is rebuilt by flow of electrons. The transformation process contains big data, virtualization or cloud technologies. Small computers support the steering and handling of a car, bigger datacentres provide several applications for managing and monitoring of processes, administration and production processes. Modern datacentres architectures allow to steer, to control, and to adjust several processes, identifying troubles and allowing better forecast, for example for just in time orders and provide a planning tool for availability of necessary resources. High performance computers are able to learn languages, analyse letters of complaints or diagnose the source of diseases by comparing several parameter of a patient's data and history (IBM.com/Watson).

Cheap servers, as one example from IT, can be some kind of effective and efficient than more expensive ones. Some vendors claim that they can guarantee a steady performance of a server over the pre-planned lifespan; others claim that they are more compatible with operations systems or applications. All of them is in common that by ordering an already existing server the used technology and material are overtaken by others, also the performance is expected to double in two years, regarding Moore's law.

Practical approaches

4. Depth and width of screws for sustainability for IT-infrastructure

Physical deployment and removal of servers, which are the working horses in an IT-environment, enlightens the difficile situation a decision-maker has to cope with. In the following example conventional servers are in focus. Leaving the abstract model about action and reaction to the several layers of the environment, replacing a server shows the complex structure of consequences.

5. Technologic sustainability

We will introduce in the sector of physical IT, in contrast to virtual IT, other fields of information for decisions to be considered for more differentiation in a decision situation when and by what a server or equivalent has to be replaced. For better planning and to create a steady line of provided hardware and/or virtual machines, the regular estimated time in service of servers is 4-6 years. During that time the vendor guarantees to take care for a compatibility of operation systems, several parts of the server, for example controllers, switches, network cartridges and the compatibility to other interfaces, on physical or logical level. Programming languages are subject for a steady evolution. Recoverability of data of contained data has to be guaranteed and changes to be identified.

Fig. no. 4 shows the deployment year (20XX) and the inherent number of servers. Regularly maintenance-contracts last 5 years; some of the servers are replaced earlier, some are removed planned or unplanned. Big datacentres have to consider the compatibility of

servers if they are changing the vendor, running an application on different hardware platforms can inflict some serious failures.

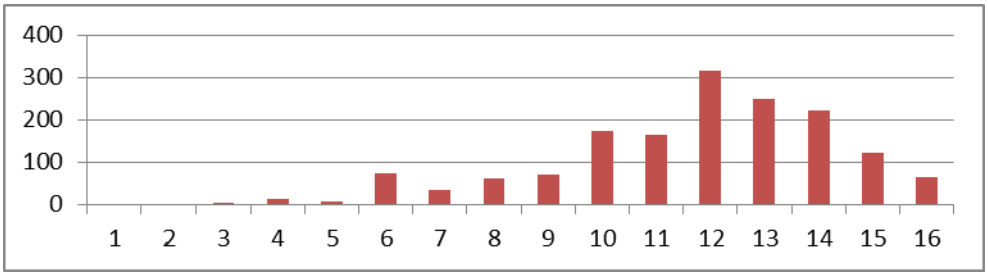

Figure no. 4: Example of age structure of servers
Source: Based on the data centre of the state of North-Rhine-Westphalia, Germany

Another aspect is to weighing up the production or provision process and the extension and kind of applied resources. Technology progress is almost ever accompanied with reduction of labour force, transferred to automatically executed processes. One result was during the industrial age the drove of unemployed farmhands from the rural regions to major cities, to get jobs that did not exist (Ford, 2015). For IT a dynamic field of action is a consequence.

6. Ecologic sustainability

Although a current main effort is develop and produce engines with less power consumption combined with better output, the standard operations of data centres have direct influence to the near environment. Cooling fans, reducing the humidity, empowering the processors etc. need energy and produce industrial waste heat. In the specification of each server the manufacturer determined the number of revolutions and the combined air flows at a certain status. Further rare resources are used to produce the components. For a sustainable development in the sense of protecting the environment the exploitation of the earth, especially the production of rare resources has to be considered in a situation to replace a server. Calculating the best combination of applications running on a server is a very complex process. While monitoring the CPU over a period of time, spikes or peaks will occur. Further the balance between maximum workload and maximum lifespan with a certain performance is hard to forecast.

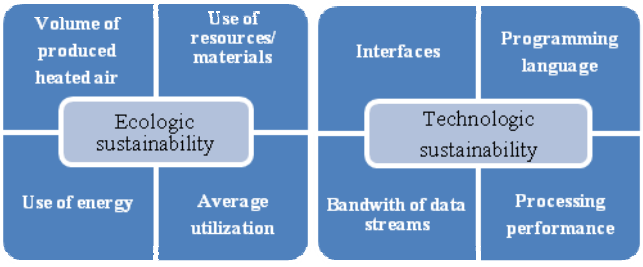

Figure no. 5: Technologic and ecologic sustainability and their facets
Source: authors

7. Compliance sustainability

For the IT-business, several compliance regulation have to be fulfilled and maintained during a internal or external contract. Safety regulations, data protection, audit-proof storage and processing are amplified by individual or general Service Level Agreements (SLA). Internal or external customers are guarenteed specific performance services and have to be provided during a certain period. Not complying services are subject of fines or cancelling the contract. The external legal framework is therefore extended by internal rules and regulations. For a decision, how to deal with the question of optimizing the live-span, statistics about fails or broken server, their specifications or their place and function in an digital network, have to be considered.

8. Economic sustainability

Speed and focus to new trends dominate the IT-Sector. New technologies like cloud-computing, big data-analysis, and virtualization are only a few to name. To follow each trend a company has to invest in knowledge and physical assets. But the value of these assets will be reached after a certain period of time. Regularly support contracts are make for five years. Within these periods the functionality, performance indicators, and compatibility with other vendors on physical and logical level are guaranteed. But the economic challenge is to process of essential data to determine the perfect replace period or date. Further to identify all technologies and hard- and software that fits best in the requirements in the company. By analytics tools the average utilization can be measured by several parameters. The more data from the past, the more precise forecast will be presented in the case of a management decision.

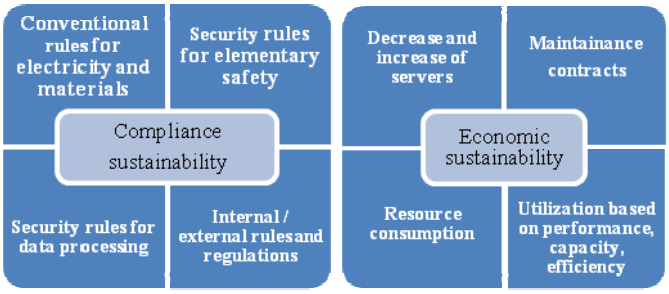

Figure no. 6: Compliance and economic sustainability and their facets
Source: authors

Conclusion

On an abstract level the aggregation of actions and their consequences for the corporation, the direct social and ecological environment, for society and public value, sustainability is an impressive challenge. As to see in the case study on operative level a model of parameter let emerge several layer. All of them can and will influence the grade of applied sustainability thoughts. The chosen example of decision to replace a server enlightens the complex indicators for the decision. Company's short-term goals and shareholder's interests can be given more weight to set priorities; economic indicators can be set a main focus. But the interdependencies between the four sustainable fields, technologic, ecologic,

economic, and compliance shows the challenge for data processing and presenting in a decision-situation. But the IT-department is in most cases only a supplier for services. Analysing the production processes, the research- and development departments and their direct influence to strategic decision opens a wider and deeper range of aspects to be considered in a decision situation. The given data allows only a limited view. Holistic analyses of the fields of sustainability can support better decisions; balancing of shareholder and stakeholder interests and their priority in the strategic planning amplifies the management tasks.

Sustainability and the different streams will influence the future generations, preparing a stringent and balancing strategy is the most challenging tasks for managers, especially because results are not visible with the quarterly reporting periods.

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