Appendix

Can We Leverage Process Data from ERP Systems for Business Process Sustainability Analyses?

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Abstract. Sustainability is an increasingly important issue, which organizations need to take into account when assessing and improving their business processes. Doing so can contribute to enhancing an organisation's overall sustainability. *Green Business Process Management* is a line of research concerned with supporting organisations to integrate a sustainability perspective into their processes. However, existing approaches that assess sustainability on activity and process levels using, for instance, *Life-Cycle Assessment* (LCA) are often time-consuming and complex. Therefore, this work explores whether *Key Ecological Indicators* (KEIs) used to assess the sustainability of a business process can be calculated using data already available within an organisation. Following a case study methodology, we analyse nine real-world datasets extracted from a business process analysis system of a large enterprise software vendor. Results indicate that current data availability is insufficient for exact assessments. To address this issue, we introduce a high-level conceptual model and provide recommendations for action based on the observations of the case study.

Key words: Sustainability, Green Business Process Management, Key Ecological Indicators, Process Data Analysis

1 Appendix

This appendix includes three tables presented in two sections. Section 1.1 presents two tables outlining the results of the two synonym searches conducted. Section 1.2 outlines one table representing the complete search protocol.

1.1 Synonyms

Synonyms were sought not only for the three final KEIs (*Energy Consumption, Emissions, and Material Use & Waste Generation*) used in the original paper but for the six initial KEIs (*Energy Consumption, GHG Emissions, Emissions, CO_2 Footprint, and Material Use & Waste Generation*) identified in the literature and listed in Table 1 of the original paper, from which the three final KEIs were derived. This was done to broaden the search and capture as many synonyms as possible. Table 1 lists the synonyms identified for each individual word (e.g., *Energy* and *Consumption*) that collectively form the six initial KEIs (e.g., *Energy Consumption*) mentioned above. Table 2 presents the results of the synonym search for the compound terms of the initial six KEIs (e.g., *Energy Consumption*).

In both Tables 1 and 2, the first column displays the final KEI for which synonyms were searched. The second column assigns each entry a unique identifier, representing all synonyms in that entry. For example, the code *S1* represents all synonyms *Energy, dynamism, electricity, heat, potential, service, strength and power*. The third column represents the term, for which synonyms were searched. In Table 1, these terms are derived by considering each individual word that constitutes the original six KEIs. In Table 2, these terms are obtained by considering the initial KEIs as compound terms, with abbreviations both written out and not written out. The fourth and fifth columns contain in both tables the synonyms found for the term respectively searched in [1] and [2].

KEI	Code	Keyword	Synonyms [1]	Synonyms [2]
Energy Consumption	S1	Energy	dynamism, electricity, heat, potential, service, strength	Power
	S2	Consumption	drinking, expenditure, utilization	using up, use, loss, waste, drain, consuming, expenditure, exhaustion, depletion, utilization, dissipation
Emissions	S3	Greenhouse	arboretum, conservatory, nursery	glasshouse, conservatory, hothouse
	S4	Gas	smoke, vapor	fumes, vapour, mist, fog, haze, smoke, breath, steam, fumes, dampness, miasma, exhalation
	S5	Emission	discharge, radiation	giving off, giving out, release, shedding, leak, radiation, discharge, transmission, venting, issue, diffusion, utterance, ejaculation, outflow, issuance, ejection, exhalation, emanation, exudation
	S6	Carbon	graphite, soot	-
	S7	Dioxide	-	-
	S8	Footprint	footstep, impression, imprint	impression, mark, track, trace, outline, imprint, indentation
Material Use & Waste Generation	S9	Material	cloth, component, element, equipment, goods, ingredient, machinery, object, stuff, substance, supply, textile	substance, body, matter, stuff, elements, constituents
	S10	Use	adopt, apply, employ, handle, manage, operate, practice, run, spend, utilize, wield, work	consume, go through, exhaust, spend, waste, get through, run through, deplete, squander, dissipate, expend, fritter away
	S11	Waste	debris, rubbish, scrap, trash	rubbish, refuse, debris, sweepings, scrap, litter, garbage, trash, leftovers, offal, dross, dregs, leavings, offscourings
	S12	Generation	bearing, breeding, formation, genesis, origination, procreation, propagation, reproduction	production, manufacture, manufacturing, creation, formation, origination, production, breeding, creation, formation, reproduction, genesis, propagation, begetting, procreation, origination, engenderment

Table 1. Synonyms for every word forming each KEI

KEI	Code	Keyword	Synonyms [1]	Synonyms [2]
Energy Consumption	S13	Energy Consumption	-	-
Emissions	S14	Greenhouse Gas	-	-
	S15	Greenhouse Gas Emissions	-	-
	S16	GHG Emission	-	-
	S17	Carbon Dioxide	carbonic acid, carbonic acid gas, CO2	-
	S18	Carbon Dioxide Footprint	-	-
	S19	CO2 Footprint	-	-
Material Use &	S20	Material Use	-	-
Waste Generation	S21	Waste Generation	-	-

Table 2. Synonyms for each compound KEI

1.2 Search Protocol

A detailed explanation of this search protocol is found in the original paper.

Nr.	KEI	Code	Example	[#]
1	**Energy Consumption**	S1	"Energy"	29
2		S2	"Consumption"	62
3		S1 x S2	"Energy" x "Consumption"	0
4		S13	"Energy Consumption"	0
5	**Emissions**	S3	"Greenhouse"	0
6		S4	"Gas"	0
7		S5	"Emission"	30
8		S6	"Carbon"	0
9		S7	"Dioxide"	0
10		S8	"Footprint"	0
11		S3 x S4	"Greenhouse" x "Gas"	0
12		S3 x S4 x S5	"Greenhouse" x "Gas" x "Emission"	0
13		S6 x S7	"Carbon" x "Dioxide"	0
14		S6 x S7 x S8	"Carbon" x "Dioxide" x "Footprint"	0
15		S14	"Greenhouse Gas"	0
16		S15	"Greenhouse Gas Emission"	0
17		S16	"GHG Emission"	0
18		S17	"Carbon Dioxide"	0
19		S18	"Carbon Dioxide Footprint"	0
20		S19	"CO2 Footprint"	0
21	**Material Use & Waste Generation**	S9	"Material"	142
22		S10	"Use"	74
23		S11	"Waste"	4
24		S12	"Generation"	52
25		S9 x S10	"Material" x "Use"	2
26		S11 x S12	"Waste" x "Generation"	0
27		S20	"Material Use"	1
28		S21	"Waste Generation"	0

Table 3. Search Protocol

References

[1] Dictionary.com (LLC). URL: https://www.thesaurus.com/ (visited on 08/21/2024).
[2] HarperCollins Publishers Limited. URL: https://www.collinsdictionary.com/dictionary/english-thesaurus (visited on 08/21/2024).