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Optimizing Human Resources for Efficiency and Sustainability through Business Process Modelling with Large Language Models

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In today's business situations, effective use of human resources is critical to organisational performance and long-term growth. Employees frequently squander important time on monotonous jobs that take up their time. This problem negatively affects not only business efficiency but also labour market satisfaction and economic growth, contrary to the goals of Sustainable Development Goals (SDGs) 8 (Decent work and economic growth) and 9 (Industry, innovation and infrastructure). The aim of the research was to see how large language models (LLM) can help to optimise human resources by automating less skill-intensive, time-consuming tasks. For the analysis, a case study was conducted using the methodology of business process modelling (BPM) to compare the efficiency of a project management task ('reporting') with and without the use of ChatGPT technology. The model was used to analyse quantitative data such as process duration, labour costs, overhead costs and overhead volume. The research shows that LLM can significantly reduce the time workers spend on routine tasks, allowing them to focus on higher-value jobs that match their skills. In the case where ChatGPT was used by the participants to prepare the report, the whole process took 455.5 h less. The time savings contributed to a reduction in wage costs and overheads, which in total represents a saving of € 8,046.30. Based on the results, it is believed that LLMs have the potential to increase efficiency and sustainability.

1. Introduction

Promoting sustainability today is a cross-cutting issue and changes are needed in many areas to achieve sustainability ambitions. Several initiatives have been taken in the European Union and the United Nations to define and promote sustainability goals. The UN 2030 Agenda for Sustainable Development was adopted in 2015. The Agenda sets out 17 Sustainable Development Goals (SDGs) and 169 targets. The challenge now for national policymakers is to try to achieve the targets and make progress on the three dimensions of sustainable development (economic, social and environmental) worldwide (Breuer et al., 2019). A UN report published in 2017 examines the nature of relations between SDGs. The report assumes that a scientific analysis of the interactions between SDG-areas can support more effective decision-making and better facilitate the monitoring of progress (Griggs et al., 2017). The desire for progress is one of the most important characteristics of human societies (Li et al., 2021). In addition to SDGs, ESG (Environmental, social, and governance) is an indicator technique that is linked to a company or organization's performance in various areas of social responsibility. These processes have a direct impact on business operations, as companies have recently become increasingly focused on lower carbon and more sustainable operations (Au et al., 2023). In relation to these sustainability initiatives, companies also have reporting obligations, the most common framework for these reports is the Global Reporting Initiative (GRI), which allows stakeholders to communicate transparently about their performance against a set of guidelines (Luque-Vílchez et al., 2023). Sustainability reporting is already essential in all industries, for example, Tóth and Suta (2021) investigated how eXtensible Business Reporting Language (XBRL) can be used for sustainability reporting in the automotive industry. Interdisciplinary collaboration and knowledge production committed to co-production values are essential to achieving the SDGs. LLMs are models that learn to predict and infer how given texts fit together. This is an iterative process, as these models are

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constantly learning and can provide increasingly accurate answers over time. Navabi (2024) highlighted that these models can also help researchers to work more efficiently and effectively, improving communication and Helping to achieve sustainability goals. Researchers can use language models in different processes during the research process, such as evaluating literature or identifying critical and gap areas (Liu et al., 2023). The field of medicine is already using LLMs in various applications such as accelerating drug discovery or optimising vaccine design. Navabi (2024) investigated the potential benefits of LLM models in the preparation of sustainability reports, highlighting the threats and challenges. Taking advantage of these benefits, these models have been used in several cases to interpret and simplify huge amounts of text and information (Ni et al., 2023). LLMs can create new avenues for knowledge co-creation, knowledge sharing, advancing communication and making multilingual translations available, also facilitating and accelerating sustainability goals (Messerli et al., 2019). A business process is a sequence of activities within a business. The logical sequence and dependencies of these activities using BPM can be defined, which can contribute to the achievement of the company's objectives and the improvement of the process (Aguilar-Savén, 2004). BPM enables to define the actors, activities and workflows of a process. Well-constructed process models can help to improve processes and reduce costs. To achieve a company's business objectives, BPM is essential to understand and redesign activities (de Oca et al., 2015). BPM can be classified into two categories: (1) Event-driven process chain (EPC) and (2) Petri net (Recker et al., 2019). Graphical modelling techniques such as EPC are more commonly used to understand processes and discuss process improvement initiatives. In contrast, the other categories, such as Petri nets, are based on rigorous mathematical paradigms and can facilitate the simulation of process scenarios (Recker et al., 2019). Eisinger and Buics (2024) applied the methodologies of BPM, Service Blueprinting, Process Chain Network and P-graph to investigate how to improve the efficiency and sustainability of the university enrolment process. Al Mamun and Buics (2023) focused on improving sustainability using the BPM method to investigate ways to reduce waste in textile manufacturing processes in Bangladesh, resulting in a reduction of almost 75 % in fabric loss during sewing. In the present study, the BPM model is used to optimize the report generation process with ChatGPT, which allows the identification of the working hours associated with the tasks. The use of ChatGPT, like other LLMS, has the potential of not only minimising CO_2 emissions but can also address other sustainability issues. In this regard, Rane (2023a) argues that they improve the efficiency of research on green power and eco-friendly power sources. LLMs can be used to analyse vast datasets at high speed which speeds up innovation in technology used for green energy production as well as encouraging invention. According to Rane (2023b), LLMs contribute to the realisation of UN Sustainable Development Goals (SDGs). The use of LLMs for the automation of administrative duties and data analytics allows for more effective decision-making in organisations. The purpose of the current study is to determine whether incorporating a broad language model into a process can support sustainability objectives through a case study investigation. This area is considered relatively less researched, but it is believed that by improving efficiency and reducing working hours, sustainability can be increased. Studies that have addressed the efficiency gains (Raj et al., 2023), benefits and challenges of ChatGPT (Haleem et al., 2022) have sought to explore and identify areas where this technology can be effectively applied (Arman and Lamiyar, 2023). However, as a further reflection of these studies, the aim of this paper is to explore whether the application of an LLM model, in addition to its ability to increase efficiency, can help to achieve sustainability goals. The novelty of the article lies in the fact that it uses the BPM model to show how LLMs such as ChatGPT can be used to optimise human resources, and the results are concretised in terms of costs and overhead components. SDG 8 (Decent work and Economic Growth) is worth highlighting in the context of the study, as it aims to promote sustainable economic growth, full and productive employment and decent work. It potentially relates to SDG 9 (Industry, Innovation, and Infrastructure), as the use of AI tools can support industrial innovation by introducing new methods into work processes.

2. Methodology

To determine whether the use of LLMs in a process can increase efficiency, reduce costs and contribute to sustainability goals, BPM methodology was applied, and sustainability calculations were performed. Figure 1 shows the structure of the methodology used to investigate the relationship between sustainability and LLMs in a reporting process.

2.1 Expert interviews and modeling

Expert interviews were carried out to build the BPM model and determine the flowchart and the associated working hours for the preparation of a project report. First, the project manager was interviewed to define the tasks in the process. In the present case study, a case involving a project manager, twelve professional managers and one hundred and twenty research engineers was considered. In addition to the project manager, the professional managers and the research engineers were interviewed to determine the duration of their tasks.

The working hours were averaged, and the duration of each process was obtained. It is important to note that these data vary according to each project and report.

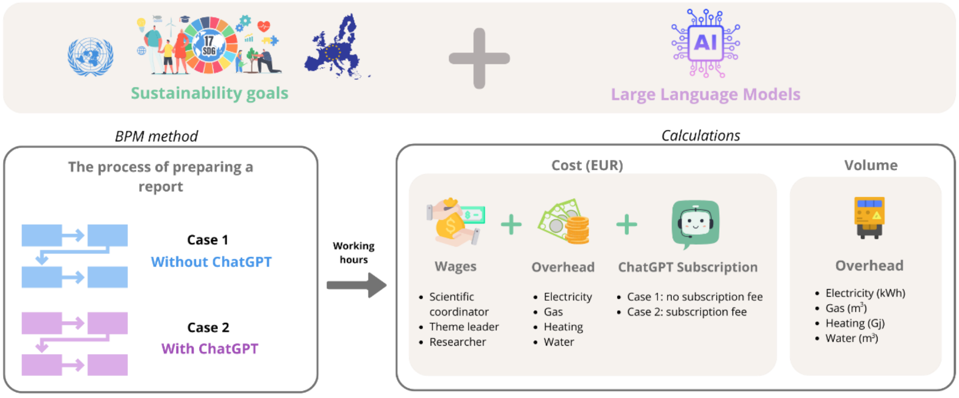

Figure 1: Methodology

2.2 Cost and volume calculations

Using the BPM model, a flowchart was first created to show the steps of the process under study and the steps to create a report. In the model, the duration was assigned to each step, which has a fundamental impact on the calculation of efficiency and cost-effectiveness. This step was performed both in the version without ChatGPT and in the version with ChatGPT. ChatGPT was used in tasks that involved summarising text rather than generating and checking text. The sustainability calculations were based on the duration of each process, from which the values of four items were determined: (1) Electricity, (2) Gas energy, (3) District heating and hot water service charges, (4) Water and sewerage charges. In the present case study, the general ledger accounts of an organisation were used to obtain the costs for the year 2022 in these four categories, as well as the number of staff in the organisation. With these two data, the hourly cost of work per person in the four categories under study was determined. The values were calculated in HUF and then converted into EUR at the exchange rate of 394 HUF/EUR on 19.04.2024. The overhead cost (gas, heating, water, electricity) should be substituted for the unit price. The following formula was used to calculate the Overhead Cost per person per h:

Cost per person per h calculations:

Overhead cost per person per h

$$C_{o,p/h} = \left(\frac{C_{o,y}}{12\times160}\right) \div N_e \qquad (1)$$

To calculate the consumption quantities per person per h of work, the costs associated with a given overhead cost had to be divided by the unit price to obtain the consumption quantity.

Consumption per person per h:

Overhead consumption per person per h

$$O_{o,p/h} = \frac{C_{o,p/h}}{P_o} \qquad (2)$$

In the case where ChatGPT was also used for the preparation of the report, the costs were also calculated based on the subscription fee of 35.78 EUR as of 2024.04.17. Since participants can use ChatGPT for other tasks, the cost per h based on the subscription fee (monthly fee divided by days and h) was first calculated and then multiply this amount by the number of hours spent on the task.

Hourly breakdown of ChatGPT subscription cost

$$C_{GPT,h} = \frac{C_{GPT,m}}{30\times24} \qquad (3)$$

Where:

- $C_{o,p/h}$: Overhead cost per person per h
- $C_{o,y}$: Annual cost of overhead
- N_e: Number of employees
- $O_{o,p/h}$: Overhead Consumption per person per h
- P_o: Price per unit of overhead
- $C_{GPT,h}$: Hourly breakdown of ChatGPT subscription cost
- $C_{GPT,m}$: Monthly cost of ChatGPT subscription

3. Results

Based on the results of the expert interviews, a process flowchart was developed, which outlines the main steps of the preparation of the report. In this process, a request is made from the management to the Scientific coordinator, who involves the Theme leaders and the researchers in the process. In the present case study, there is one Scientific coordinator and 12 research teams, each with one Theme leader and ten researchers. The participants, who took part in the preparation of the report, attended a training course on the basics of generative artificial intelligence and its use cases. Figure 2 illustrates the BPM of the report compilation process.

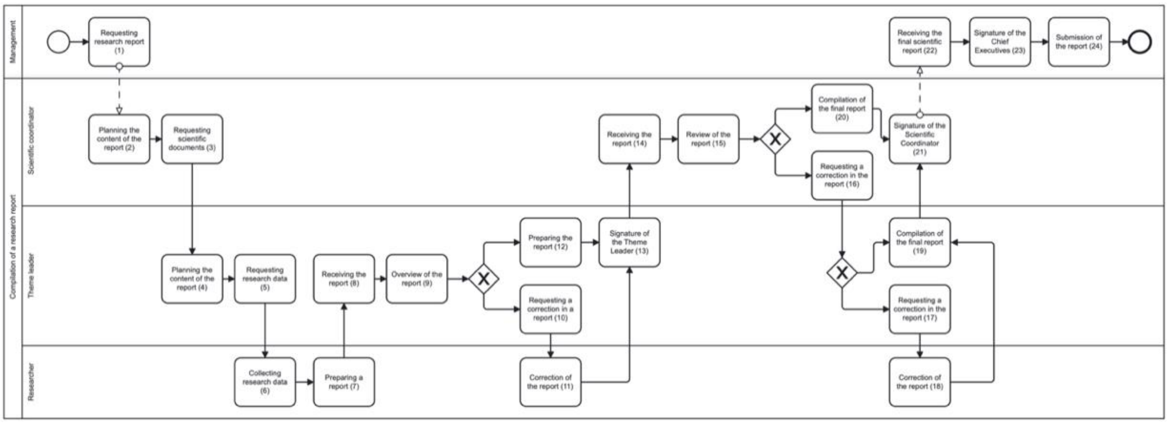

Figure 2: Compilation of a report using Business Process Modelling

Table 1: Work time and wage costs related to the reporting process

Stakeholder	Task	h		Gross wages (EUR)	
		Case 1	Case 2	Case 1	Case 2
Scientific coordinator	2	3.00	2.00	79.80	53.20
	3	1.00	0.50	26.60	13.30
	15	6.00	6.00	159.60	159.60
	16	1.00	0.50	26.60	13.30
	20	1.00	0.50	26.60	13.30
SUM (1 person)		**12.00**	**9.50**	**319.20**	**252.70**
Theme leader	4	3.00	2.00	63.21	42.14
	5	0.50	0.25	10.54	5.27
	9	4.00	4.00	84.28	84.28
	10	0.50	0.25	10.54	5.27
	12	1.00	0.50	21.07	10.54
	17	0.50	0.25	10.54	5.27
	19	1.00	0.50	21.07	10.54
SUM (12 people)		**10.5x12=126.00**	**7.75x12=93.00**	**221.25x12=2,655.00**	**163.31x12=1,959.72**
Researcher	6	3.00	1.5.	57.06	28.53
	7	5.00	3.00	95.10	57.06
	11	1.00	1.00	19.02	19.02
	18	1.00	1.00	19.02	19.02
SUM (120 people)		**10x120=1,200.00**	**6.5x120=780.00**	**190.20x120=22,824.00**	**123.63x120=14,835.60**
SUM		**1,338.00**	**882.50**	**25,798.20**	**17,048.02**

After defining the steps in the process, two cases were examined, and working hours were assigned with the help of interviews. Participants were asked to estimate how much time each task would take without using ChatGPT (case 1) and with ChatGPT (case 2). The first table shows the time (h) and the participants' wage cost (EUR) associated with each task, which were determined based on the data from the KSH (KSH, 2023). In Table 1, only the process tasks to which time and wage data were assigned are shown, so, for example, the process steps of signing a document or receiving a document are not shown in the table but are illustrated in Figure 2. In the first table, it is seen that the whole process takes 1,338 h for Case 1 and 882.5 h for Case 2, which means that up to 455.5 h using ChatGPT for Case 2 can be gained. Not all of the reporting tasks shown in the second figure had participants use ChatGPT to perform the tasks. Examples of the use of ChatGPT could be compiling the structure of the report content, providing a short summary of the technical material compiled by the researchers or generating emails to request data from the researchers.

Consumption was also calculated in relation to hours worked. For overheads, four items were identified, whose unit prices, including VAT, were as follows for the organisation under study: gas energy (0.79 €/m^3), Heating (46.69 €/GJ), Electricity (0.19 €/kWh), Water and sewerage (2.17 €/m^3). As a result of the calculations, 201.76 m^3 of gas, 8.24 GJ heating, 1,367.16 kWh of electricity and 35.16 m^3 of water can be saved in case 2. The total difference between the two cases is 880.17 EUR for the process under consideration.

Table 2: Overhead cost and volume related to the reporting process

	Amount				Cost (EUR)			
	Gas (m^3)	Heating (GJ)	Electricity (kWh)	Water (m^3)	Gas	Heating	Electricity	Water
Case 1	592.65	24.21	4,015.94	103.30	468.19	1,130.36	763.03	224.16
Case 2	390.89	15.97	2,648.78	68.14	308.80	745.64	503.27	147.86
Difference	201.76	8.24	1,367.16	35.16	159.39	384.72	259.76	76.30

Table 3 shows the total costs for overheads, wages and ChatGPT subscription for the two cases. Case 2 (with ChatGPT) would save the organisation € 8,046.30, most of which is made up of wage costs. These values are based on real data but are partly assumptions. However, if considered on a larger scale, for more tasks and organisations, consumption could be reduced, making the organisation more sustainable.

Table 3: Aggregated costs related to the reporting process

Cost (EUR)	Case 1	Case 2	Difference
Overhead	2,591.75	1,709.43	882.32
Wages	25,798.89	17,048.42	8,750.47
ChatGPT subscription	0.00	1,586.48	-1,586.48
SUM	28,390.64	20,344.34	8,046.30

To achieve the sustainability goals, it is necessary in each area to consider how individual processes can be improved to contribute to reaching the goals. The current study's findings match Raj et al. (2023) research, which discovered that using ChatGPT makes business operations better and cuts time on usual tasks. Haleem et al. (2022) also found similar things, saying LLMs make data processing better and less expensive. Liu et al. (2023) also agree, showing LLMs help different businesses. These show that LLMs can save a lot of time and help meet sustainable goals.

4. Conclusion

In this study, observations have been made on how LLM models can contribute to the promotion of sustainability in the case of a professional reporting process (SDG7, SDG8, SDG9). To this end, a case study has been used to examine how the working hours of each task in the process can be reduced by using ChatGPT. The aim of the research was to present a methodology to measure the effectiveness of these models, including overhead costs, labour costs and overhead volumes. This methodology can be further adapted to the specific activity and company or organisational culture. Without using ChatGPT, the process takes a total of 1,338 h, compared to 882.5 h with ChatGPT. To the hours worked, wage costs were added, with overhead costs adjusted by the ChatGPT subscription fee. Based on the results of the case study, in the present case, a cost of 8,046.30 could be saved. Overall, the use of LLM models can increase the efficiency of the work, saving costs and energy, which in turn can reduce CO_2 emissions. In addition to emissions, worker well-being and satisfaction are sustainability goals that can be improved through LLM models, as faster and more efficient execution of routine tasks can free up time for tasks that are more valuable to workers and can also benefit the economy. The social acceptance of these models may raise further questions about how people who reject new technologies altogether may find it more difficult to incorporate these models into their daily work processes. In addition to this, however, it is also important to consider the legal aspects of what type of tasks these AI models can be used for and how they can be used. However, this field is developing at such a rapid pace that regulations are not yet developed, and there are no precise guidelines. The textual outputs generated by such technologies should always be reviewed by a competent professional, as these models can be incorrect. In the future, the methodology could be further improved by detecting CO_2 values broken down into energy mixes, and it may be worthwhile to investigate the effectiveness of LLM models in different areas. One of the main limitations of the research carried out is that it presents a case study, which means that the results cannot be generalised to all reporting processes and organisations. A further limitation is that energy and its associated consumption and cost could only be reduced to a measurable extent if the technology were to be incorporated into the daily processes of many members of the organisation. Overall, based on the results, we believe that LLMs and generative AI may be able to contribute to sustainability goals, increase efficiency and reduce costs, but that expert review is required when using them.

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