

Calculer l'impact environnemental net de l'utilisation des TIC pour l'optimisation ou la substitution d'un processus

Projet de recherche

Problématique

Potentiel de réduction de

1,168 à 8,711

MtCO₂

d'ici 2030

WWF - 2008

*Substitution
Optimisation
Information*

IT FOR GREEN



4%

des GES mondial

Shift Project - 2019

*Extraction
Fabrication
Utilisation
Transports
Fin de vie*

Objectifs

1

Référencer les
méthodologies

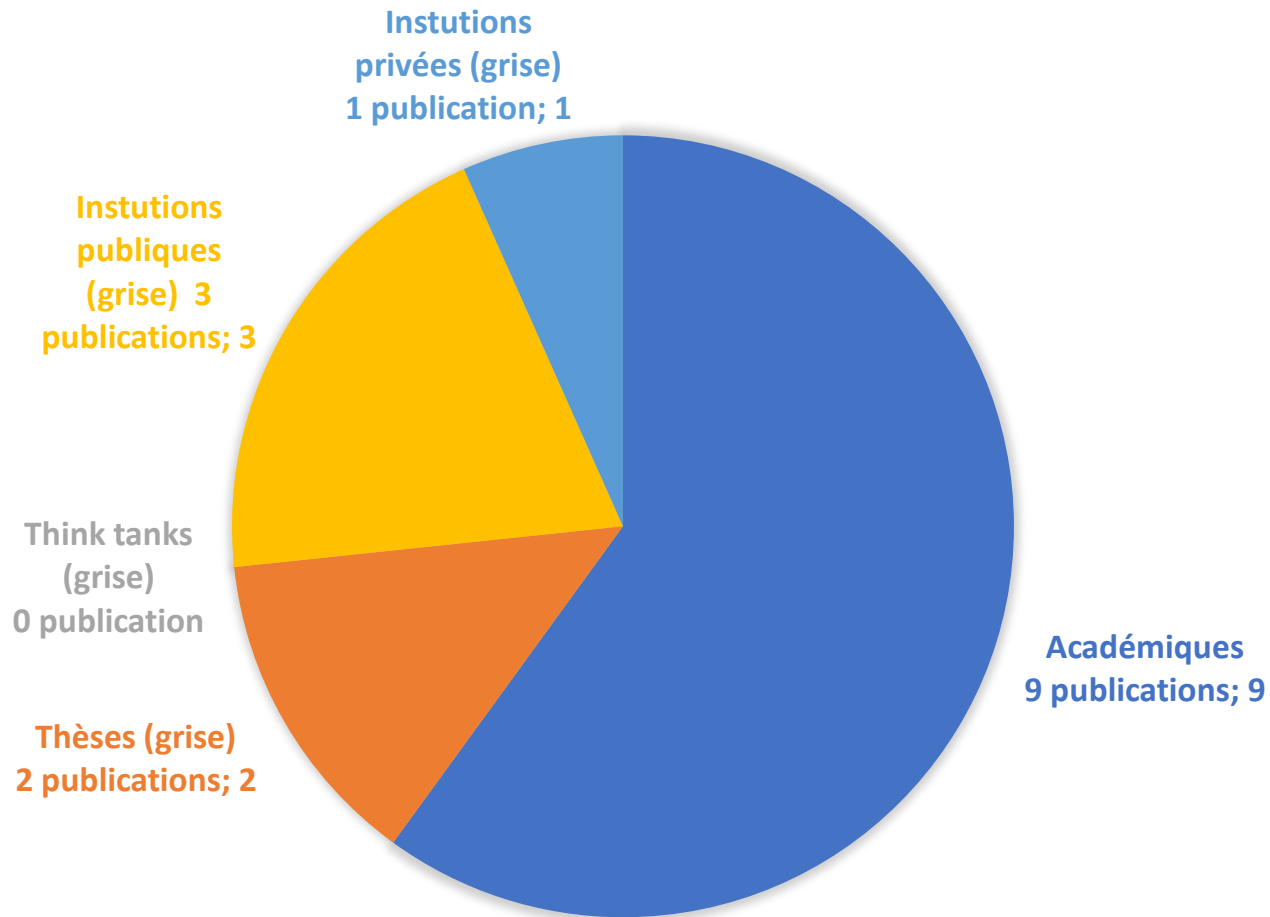
2

Identifier les limites
et les futurs
développements

3

Aide au choix
méthodologique

Méthodologie de recherche



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Guidelines for including grey literature and conducting multivocal literature reviews in software engineering

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Grey literature
Guidelines
Systematic literature review
Systematic mapping study
Literature study
Feedback-based software engineering

ABSTRACT

Context: A Multivocal Literature Review (MLR) is a form of a Systematic Literature Review (SLR) which includes the grey literature (e.g., blog posts, videos and white papers) in addition to the published (formal) literature (e.g., journal and conference papers). MLRs are useful for both researchers and practitioners since they provide summaries both the state-of-the-art and –practice in a given area. MLRs are popular in other fields and have recently started to appear in software engineering (SE). As more MLR studies are conducted and reported, it is important to have a set of guidelines to ensure high quality of MLR processes and their results.

Objective: There are several guidelines to conduct SLR studies in SE. However, several phases of MLRs differ from those of traditional SLRs, for instance with respect to the search process and source quality assessment. Therefore, SLR guidelines are only partially useful for conducting MLR studies. Our goal in this paper is to present guidelines on how to conduct MLR studies in SE.

Method: To develop the MLR guidelines, we benefit from several inputs: (1) existing SLR guidelines in SE, (2), a literature survey of MLR guidelines and experience papers in other fields, and (3) our own experiences in conducting several MLRs in SE. We took the popular SLR guidelines of Richey and Charters as the baseline and extended/adopted them to conduct MLR studies in SE. All derived guidelines are discussed in the context of an already-published MLR in SE as the running example.

Results: The resulting guidelines cover all phases of conducting and reporting MLRs in SE from the planning phase, over conducting the review to the final reporting of the review. In particular, we believe that incorporating and adopting a vast set of experience based recommendations from MLR guidelines and experience papers in other fields have enabled us to propose a set of guidelines with solid foundation.

Conclusion: Having been developed on the basis of several types of experience and evidence, the provided MLR guidelines will support researchers to effectively and efficiently conduct new MLRs in any area of SE. The authors recommend the researchers to utilize these guidelines in their MLR studies and then share their lessons learned and experiences.

1. Introduction

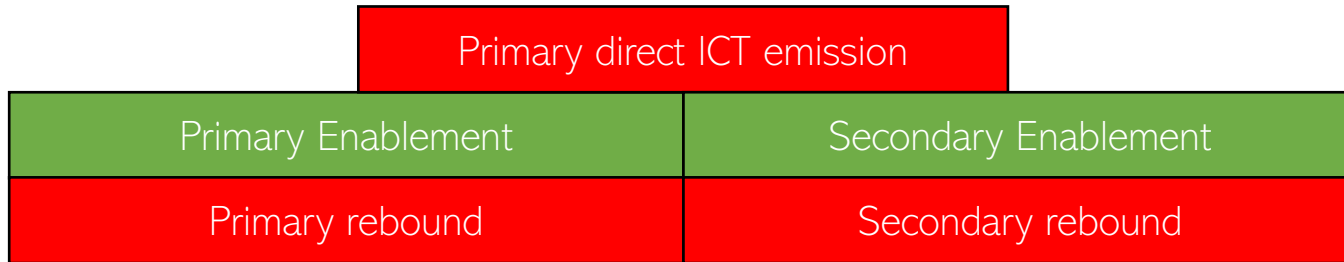
Systematic Literature Reviews (SLR) and Systematic Mapping (SM) studies were adopted from medical sciences in mid-2000's [1], and since then numerous SLR studies have been published in software engineering (SE) [2, 3]. SLRs are valuable as they help practitioners and researchers by indexing evidence and gaps of a particular research area, which may consist of several hundreds of papers [4–9]. Unfortunately, SLRs fall short in providing full benefits since they typically review the formally published literature only while excluding the large bodies of the “grey” literature (GL), which are constantly produced by SE practitioners outside of academic forums [10]. As SE is a practitioner-oriented and an application-oriented field [11] the role of GL should be formally recognized, as has been done for example in educational research [12, 13] and health sciences [14–16], and management [17]. We think that GL can enable a rigorous identification of emerging research topics in SE as many research topics already stem from software industry. SLRs which include both the academic and the GL were termed as Multivocal Literature Reviews (MLR) in educational research [12, 13], in the early 1990's. The main difference between an MLR and an SLR is

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Résultats partiels

Les types d'impacts

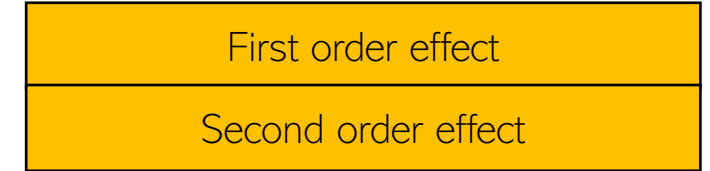
GESI



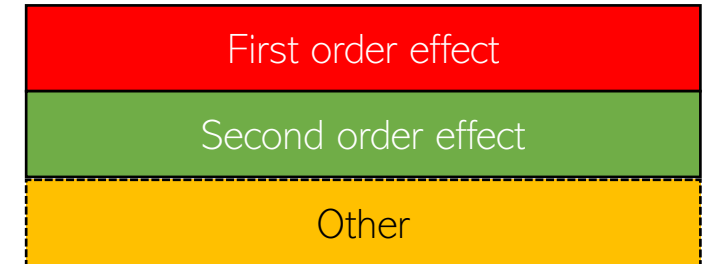
MOHAMMAD AHMADI ACHACHLOUEI - Doctoral thesis



Börjesson Rivera, M., et al.,



ETSI/ITU



Vlad C. Coroamă & al.



Effets négatifs des TIC sur l'environnement



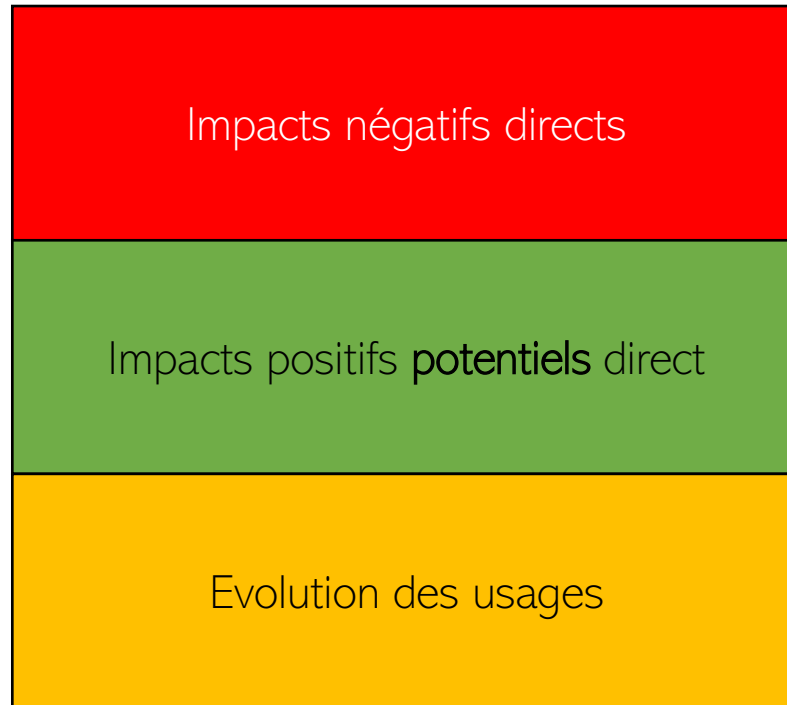
Effets potentiels positifs des TIC sur l'empreinte environnementale d'un autre secteur



Effets positifs et/ou négatifs des TIC

Plusieurs méthodologie sont nécessaires pour différents types d'impacts

Proposition



1 – Analyse d'impact sur le cycle de vie

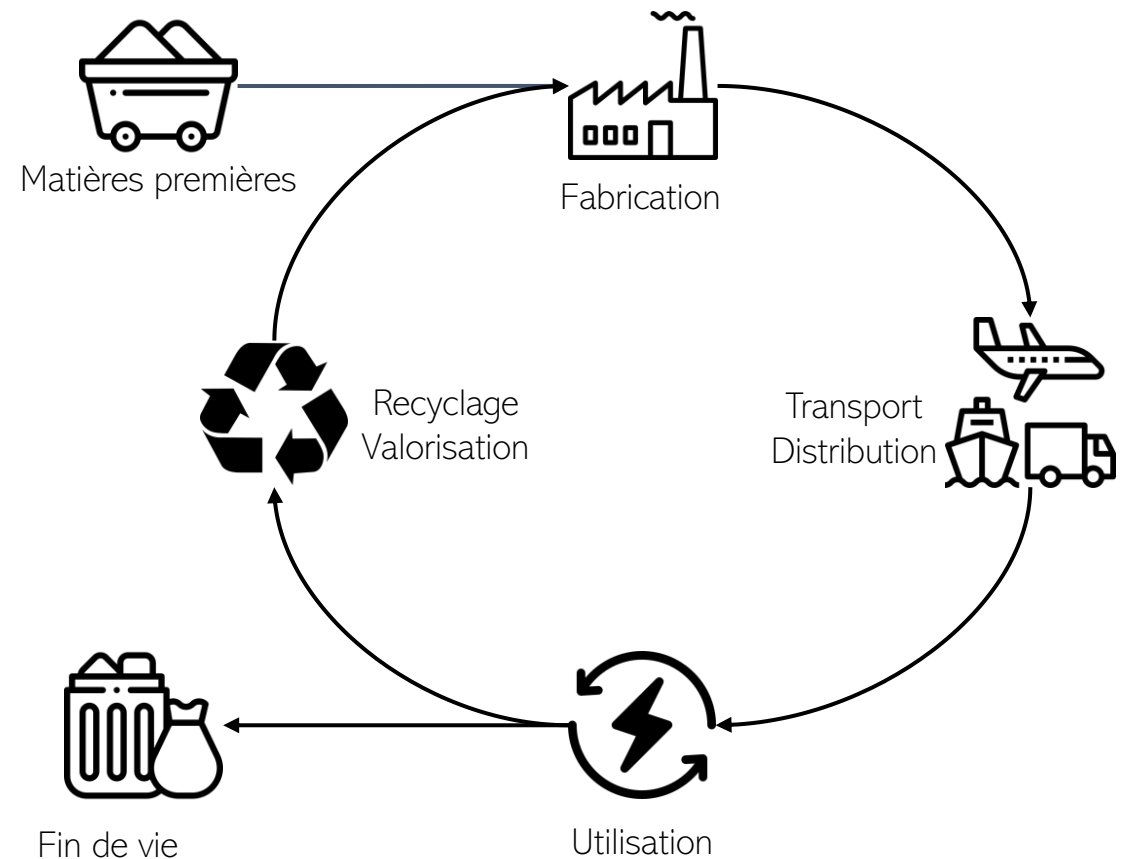
Impacts négatifs directs

ACV – Analyse du cycle de vie

100%

Des publications
utilisent l'ACV

ISO 14044



Cycle de vie d'un produit

L'ACV dans le cadre d'un service numérique

1. Hardware
2. Software
3. Consommables et produits de support
4. Infrastructures (bâtiments)
5. Environnement de travail
6. Transport de biens
7. Transports de personnes
8. Stockages de biens

Manque de données

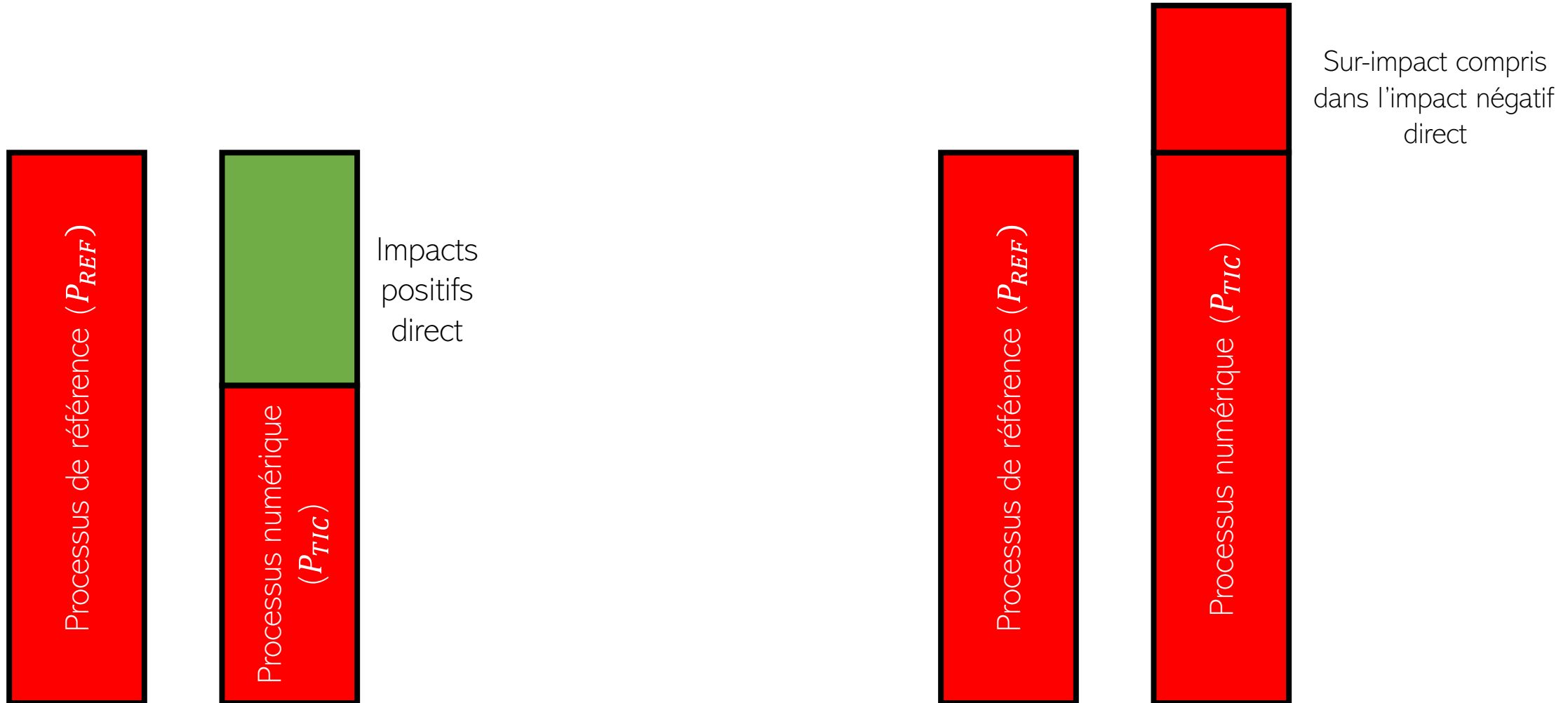
2 – Framework de comparaison

Impacts positifs potentiels direct

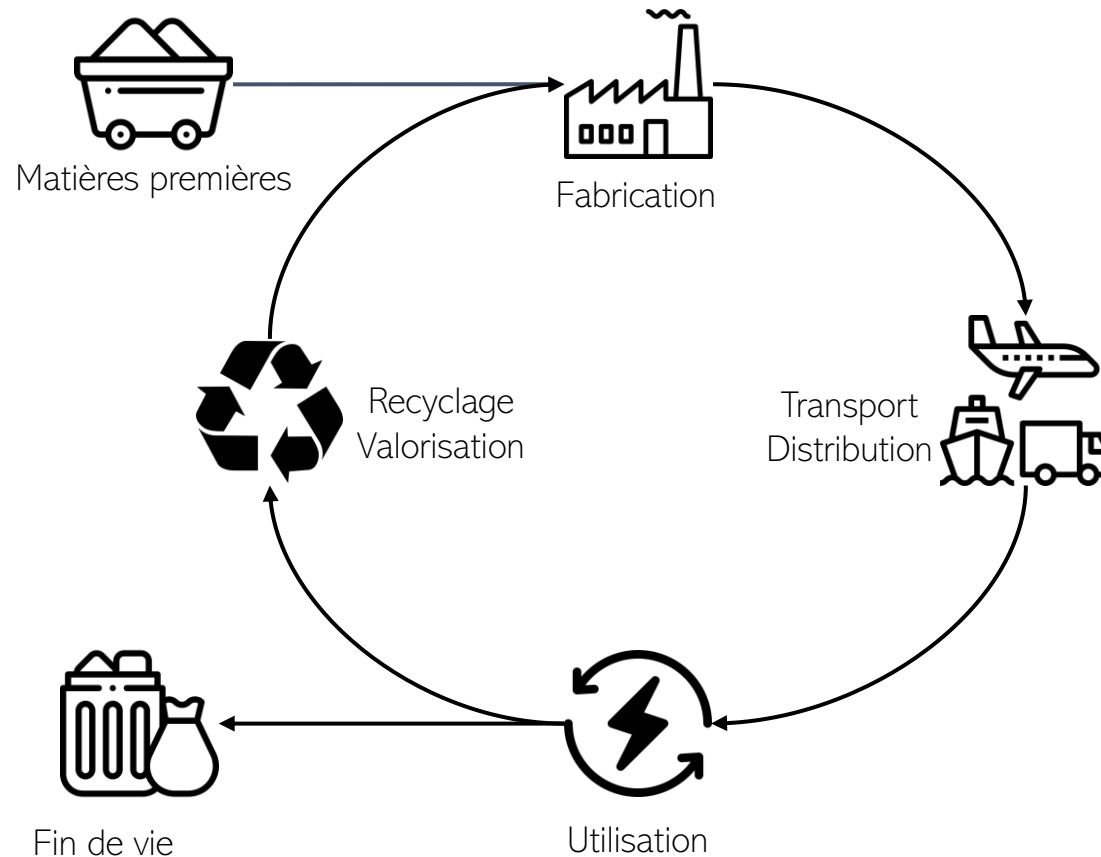
Des impacts positifs potentiels

P_{REF} = Processus avant l'utilisation des TIC

P_{TIC} = Processus utilisant les TIC



Mesurer l'impact du système de référence



Cycle de vie d'un produit

Utiliser a minima

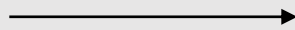
ISO 14044

avec les recommandations du
secteur d'activité

Calculer la différence « Naïf »

Processus : Envoyer une information de 10 Mo

Substitution de la
lettre par le mail



Impact d'une lettre

-



Impact d'un mail

$$\textit{PotentialEnablement} = \textit{DirectImpact}(P_{REF}) - \textit{DirectImpact}(P_{TIC})$$

PotentialEnablement > 0

L'impact à l'installation de la solution est positif

PotentialEnablement < 0

L'impact à l'installation de la solution est négatif, il n'y pas d'impact positif

Cas d'une optimisation

Processus : Livrer 19 tonnes de produits du Havre à Paris en camion

Optimisation
de 30 km
grâce au GPS



Impact de
224 km

-



Impact GPS
sur le trajet

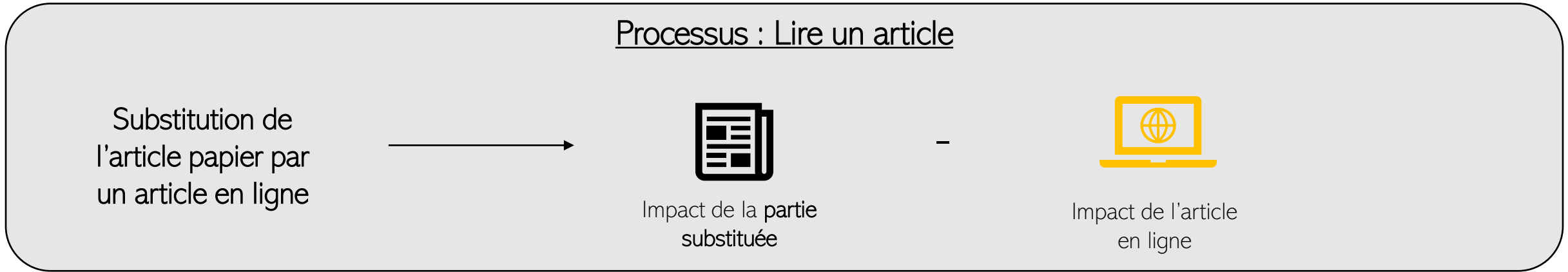
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Impact de
194 km

$$\begin{aligned} \text{PotentialEnablement} = & \\ & (\text{DirectImpact}(P_{REF})) - \\ & (\text{DirectImpact}(P_{TIC}) + \text{DirectImpact}(P_{REF_optimisé})) \end{aligned}$$

Cas d'une substitution partielle



$$\text{Potential Enablement} = (\text{DirectImpact}(P_{REF}, A) + \text{DirectImpact}(P_{REF}, B)) - (\text{DirectImpact}(P_{TIC}, A) + \text{DirectImpact}(P_{REF}, B))$$

A

correspond à la partie substituée

B

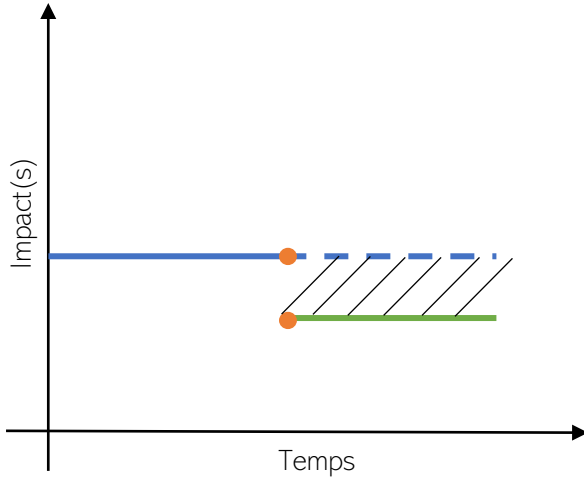
correspond à la partie non-substituée

Evolution de l'impact du processus en fonction du temps

●
Temps t de la mise
en service du P_{TIC}

—
Impact du P_{TIC}

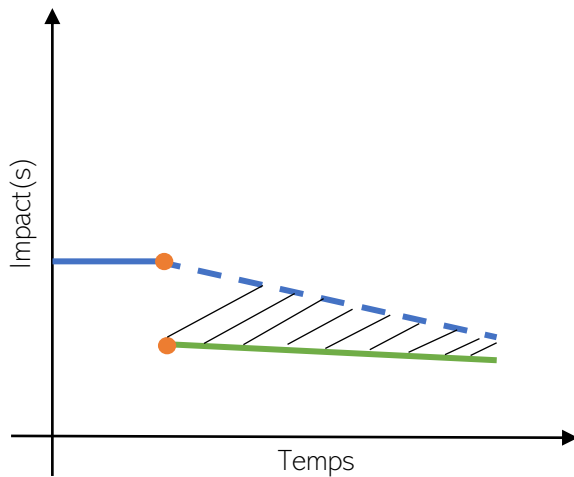
—
Impact du P_{REF}



Vue statique : l'impact du P_{REF} et du P_{TIC}
n'évolue pas en fonction du temps

- -
Impact
hypothétique du
 P_{REF} sans la mise
en service du P_{TIC}

////
PotentialEnablement



Vue temporelle : l'impact du P_{REF} et du P_{TIC}
peut évoluer en fonction du temps

3 – Evolution des usages

Effets rebonds

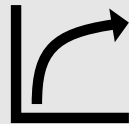
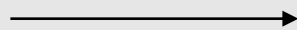
Enjeux

Jusqu'à présent, on a regardé l'impact d' **UN** processus

Qu'en est-il de la mesure de **l'évolution des usages du processus** permis par le P_{TIC} ?

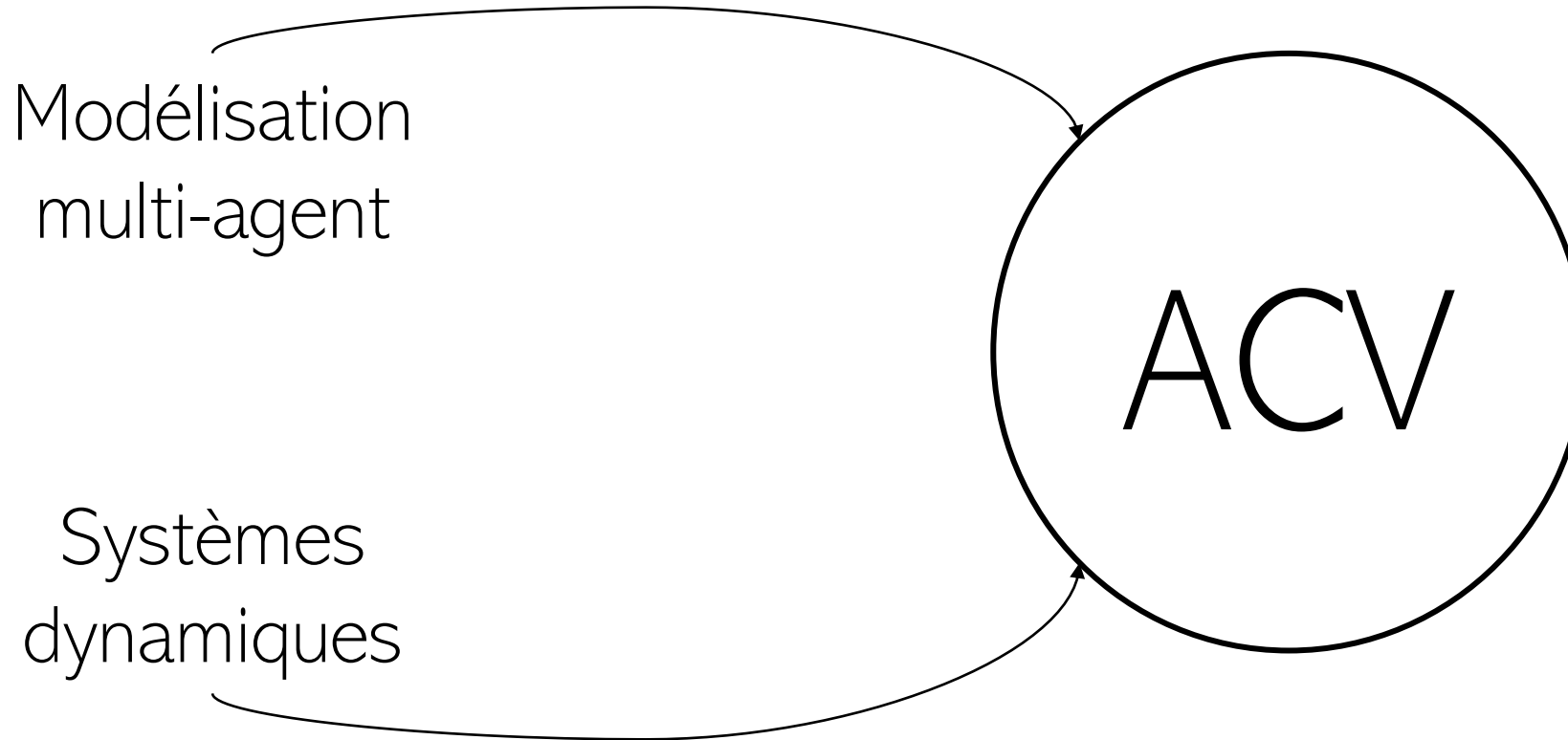
Processus : Lire un livre

Substitution du
livre papier par
l'ebook



Augmentation du nombre de livres lus sur l'ebook
(P_{TIC}) par rapport au livre papier (P_{REF})

Intégrer la modélisation dynamique à l'ACV



Utiliser des outils d'autres secteurs de recherche

Quantitatif

Economie
Statistique

Courbe d'expérience
Sondage

Qualitatif

Sociologie
Ethnographie
Anthropologie

Entretiens
Entretiens groupés
Observation participante

4 – Utilisation de la mesure

Dans le cadre d'une éco-conception

Autre

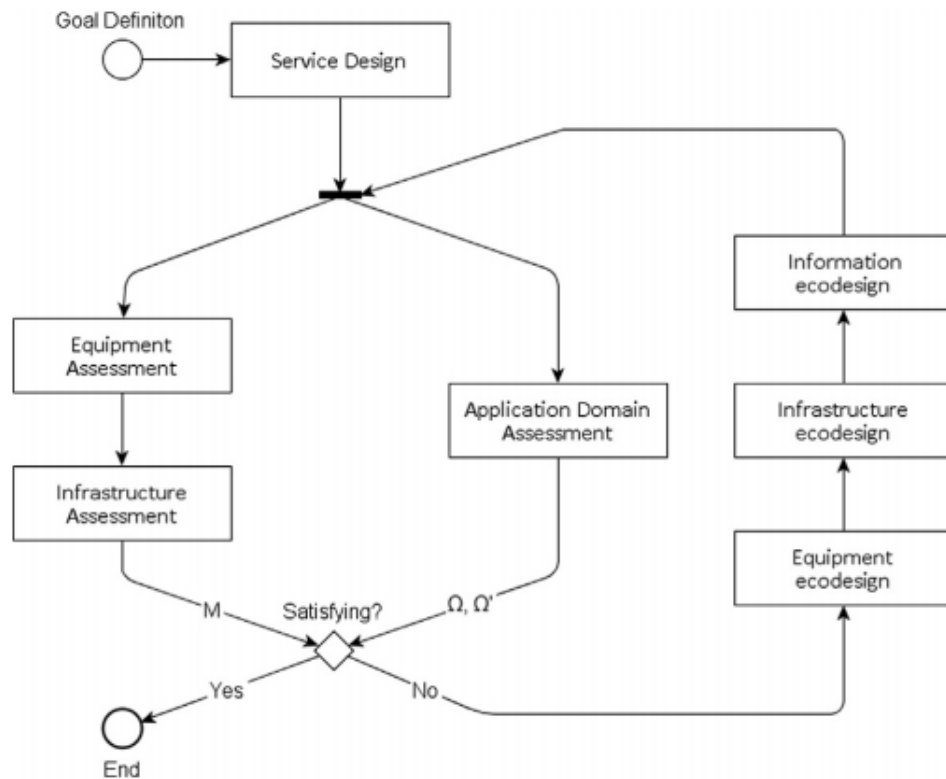


Fig. 3. Ecodesign method for optimization services.

- Utiliser la mesure dans le cadre d'un GO-NOGO
- Utiliser la mesure dans le cadre d'un suivi temporel de l'impact

Conclusion partielle

Calculer l'impact environnemental net de l'utilisation des TIC pour l'optimisation ou la substitution d'un processus

