Social Media Intelligence for Innovation and Product Development: The Case of Sustainability

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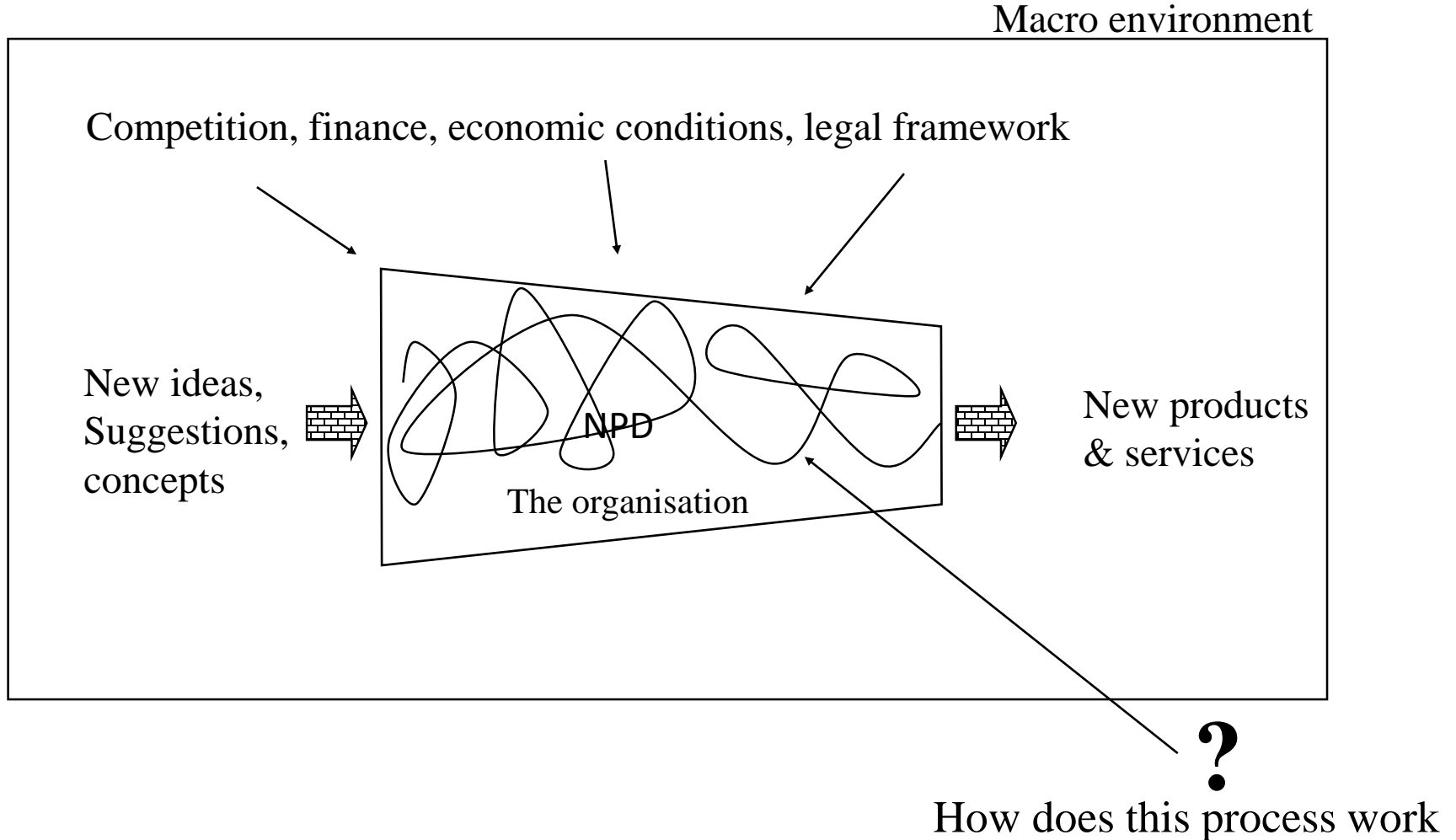
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- Literature Review
- Research Aims and Objectives
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Background and Introduction

- New product development process
- General paths of NPD:
  - Technology push
    - A new scientific foundation or a new innovation
  - Market pull
    - Market analysis is required
    - What do customers want?
- Ideation stage and its significance
- Ideation process: identifying a problem or creating a need
- Social media as an external ideation source

Looking in from the outside-
The Macro View of NPD

Macro environment

Competition, finance, economic conditions, legal framework

New ideas,
Suggestions,
concepts

NPD

The organisation

New products
& services

?
How does this process work

The Basic 'Stage' Based New Products Process

**STRATEGY PRECEDES PROJECT**

Phase 1: Opportunity identification & selection
Generate new products opportunities, evaluate and rank them

Phase 2: Concept generation
Select high potential/urgent opportunities, begin customer involvement

Phase 3: Concept/project evaluation
Evaluate concepts on technical, marketing & financial criteria

Phase 4: Development
Design, test & validate prototypes. Scale-up production. Prepare marketing strategy, tactics and launch plan. Approve business plan.

Phase 5: Launch
Commercialise from plans/prototypes and begin distribution and sale
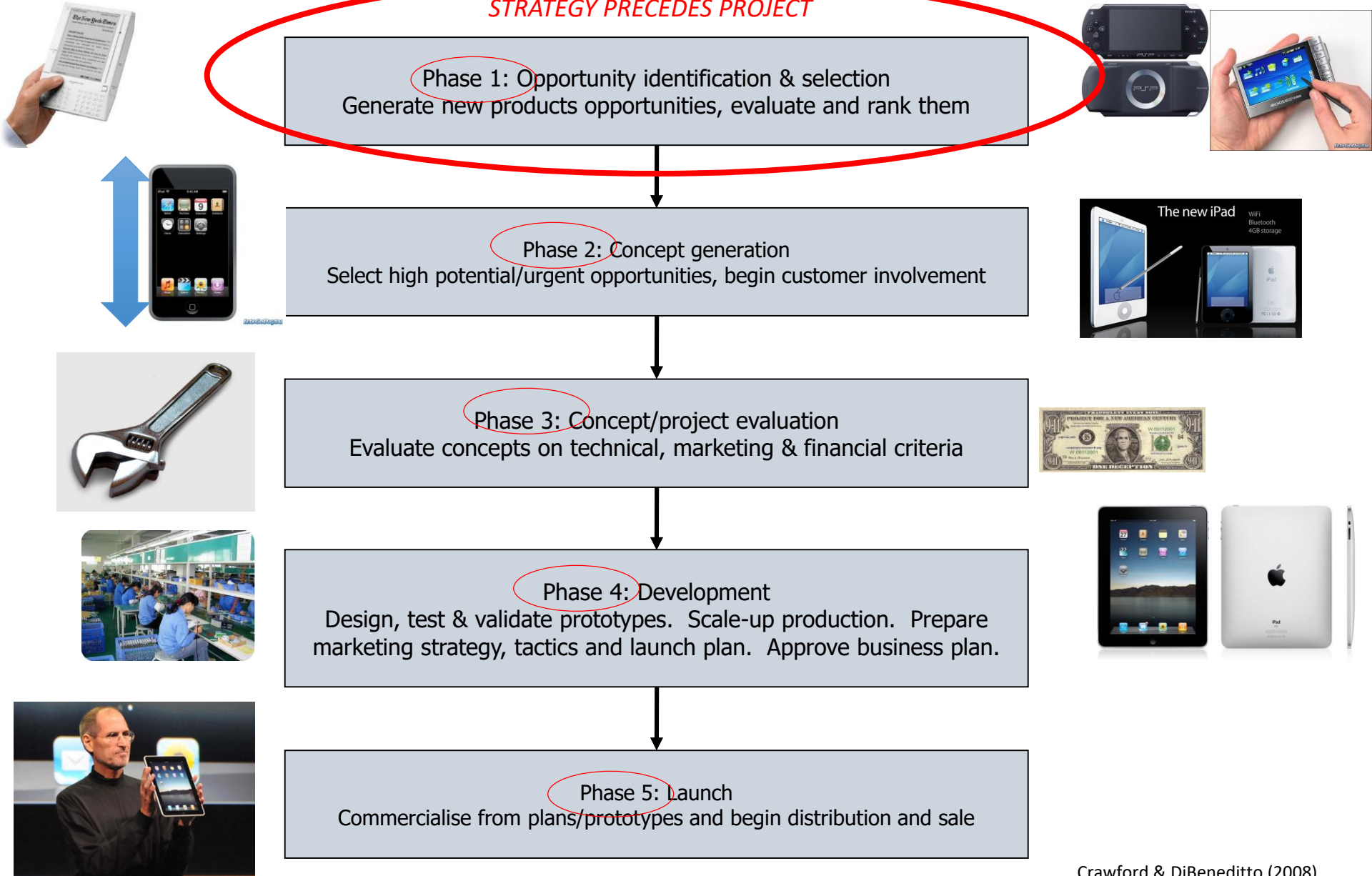
So is this the only NPD process?

Many models!

Wolf (1994)	Booz, Allen, & Hamilton (1982)	Cooper (1998)	Griffin (1997)	Wheelwright & Clark (1992)	Dimancescu & Dwenger (1996)	Crawford & DiBeneditto (2008)
Idea conception	Identify new product strategy	Idea generation	Idea/concept generation	Build up knowledge and capability	Idea	Opportunity identification & selection
Awareness	Exploration	Preliminary assessment	Idea screening	Idea generation	Design	Concept generation
Matching	Screening	Concept	Business analysis	Product involvement definition and selection	Plan	Concept/project evaluation
Appraisal	Development	Development	Development	Design and build prototypes	Engineer	Development
Persuasion	Testing	Testing	Test and validate	Pilot production	Produce	Launch
Adoption decision	Commercialisation	Launch	Commercialisation	Manufacturing ramp up	Distribute	
Implementation					Dispose	
Confirmation						
Routinisation						
Infusion						

Phase 1: Opportunity identification & selection
Generate new products opportunities, evaluate and rank them

Phase 2: Concept generation
Converge urgent opportunities, begin customer analysis

Phase 3: Concept/project evaluation
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What is an idea?

- I have got no idea what is an idea! ☺
- "A thought or suggestion as to a possible course of action." - Oxford Dictionary.
- Who decides on an opinion if it is an idea or not?
- Idea for the innovation process – it should be related to the needs or expectations of the customers or the relevant community in a wider context.

• "The difficulty lies not in the new ideas but in escaping from the old ones" John Maynard Keynes.

• We accept idea as a suggestion, a solution or an opinion which is proposed or pioneered by the social media user.

Idea Generation

- Ideation, ideation and ideation…
- Different sources of ideas
  - Individual/inventor level effort - Microsoft case
  - Apple case – Xerox Sues Apple Computer Over Macintosh
  - HP case - Audio oscillator from two Stanford University students
  - Feedbacks - customers as a source of information
  - R&D departments
  - Innovation networks/clusters and open innovation
  - Crowdsourcing - Lego case
  - Suppliers – Toyota case – TPS
  - Competitors – Their products/services and their IPs – LG case
  - Incremental innovations that are based on previous products/services
  - http://www.kickspy.com/top
  - **And now social media…**

Literature Review

- Many studies are found to be examining social media data
  - NLP and semantic studies focusing on methodological issues
  - Customer analysis (mostly segmentation and examination of customer profiles)
  - Competitive analysis and benchmarking
  - Many studies related to marketing such as branding, marketing communication plans etc.
  - Many studies are related to examining "public concerns"
  - Abnormality detection – focusing on identification of threats, suicide prevention, traffic incidents etc.
  - Many classification related studies such as emotion-based sentiment analysis
- Very few studies focusing on idea classification and identifying ideas for NPD process:
  - Pak and Paroubek (2010) – Opinion mining (positive, negative and neutral)
  - Bifet and Frank (2010) - Knowledge discovery (positive or negative feelings)
  - Kruse et al. (2013) – Idea mining (clustering using k-means)
  - Milosovic et al. (2018) – Classification of social innovation (naïve bayes and BoW)

Gaps in the literature and challenges of the data

- Gaps in the literature:

  • There is no any study focuses on classification of ideas from social media sources as "idea" and "not idea".

  • No adapted methodology found for an idea classifier

  • No practical study that illustrates idea of consumers.

  • No practical study found to be offering solutions for sustainability focusing on the opinions of the social community

- Data related problems:

  • Social media data is very noisy unlike patent or publication databases

  • Short text problem

  • Imbalanced data

  • Difficulties to justify what is an idea and what is not!

Justification for The Research Context: Sustainability

- First of all – too much focus on economical development/performance but not on sustaining what we have!

- Sustainability oriented ideas are thought to be shared more voluntarily

- Sustainability oriented strong social community

- Sustainability specific issues:
  - Endless pollution,
  - Climate change risks,
  - Scarcity of resources,
  - Reaching to limits in biocapacity
  - Path dependency to decision making

Sustainability oriented focus and concerns

- Sustainable material management,
- Sustainable transportation and housing
- Climate change and environmental infrastructure
- Sustainable use of resources
- Biodiversity and ecosystem protection
- Circular economy
- Low carb energy security
- Green and inclusive innovation
- "Net positive"

Staff involvement | Environmental management | Guest information | Water

Energy | Washing & Cleaning | Food & Beverage | Waste | Administration

Indoor Environment | Green Areas | Green Activities | Corporate Social Responsibility

Research Aim and Objectives

- This paper aims to mine Twitter data to explore the trends and retrieve ideas for sustainability-oriented considerations.
- The main approach of this study is to classify the tweets to be an "idea" or "not an idea".
- Objectives of this study are:
  - To establish a classifier model to mine ideas from social media,
  - To examine the ideas and opinions of the sustainability community,
 - To cluster and illustrate potential sustainable innovations.

Method

- The collection of 22891 relevant tweets using the Twitter API - Search query: (Idea OR #idea) AND (sustainabil* OR #sustainabl*)
- Text pre-processing operations such as the removal of webpage links, e-mail addresses and other unnecessary symbols (such as punctuation). Exclamation marks and question marks were not removed.
- Tokenization, stop word removal and stemming operations using the Porter Algorithm.
- Representing tweets using a classical text representation technique, the term frequency-inverse document frequency (TF-IDF) statistic, and BERT (a state-of-the-art word embedding method).
- Manual labelling of 1199 tweets as positive or negative class.
- Oversampling using the synthetic minority oversampling technique (SMOTE) on the labelled dataset to balance the number of positive and negative class samples.
- Training supervised and semi-supervised algorithms on the resampled dataset and obtaining classification models.
- Applying the classification models to the remaining unlabelled tweets and creating a new set that includes the tweets that are labelled as positive.
- Creating heatmap visualisations using all the tweets that are labelled as positive.
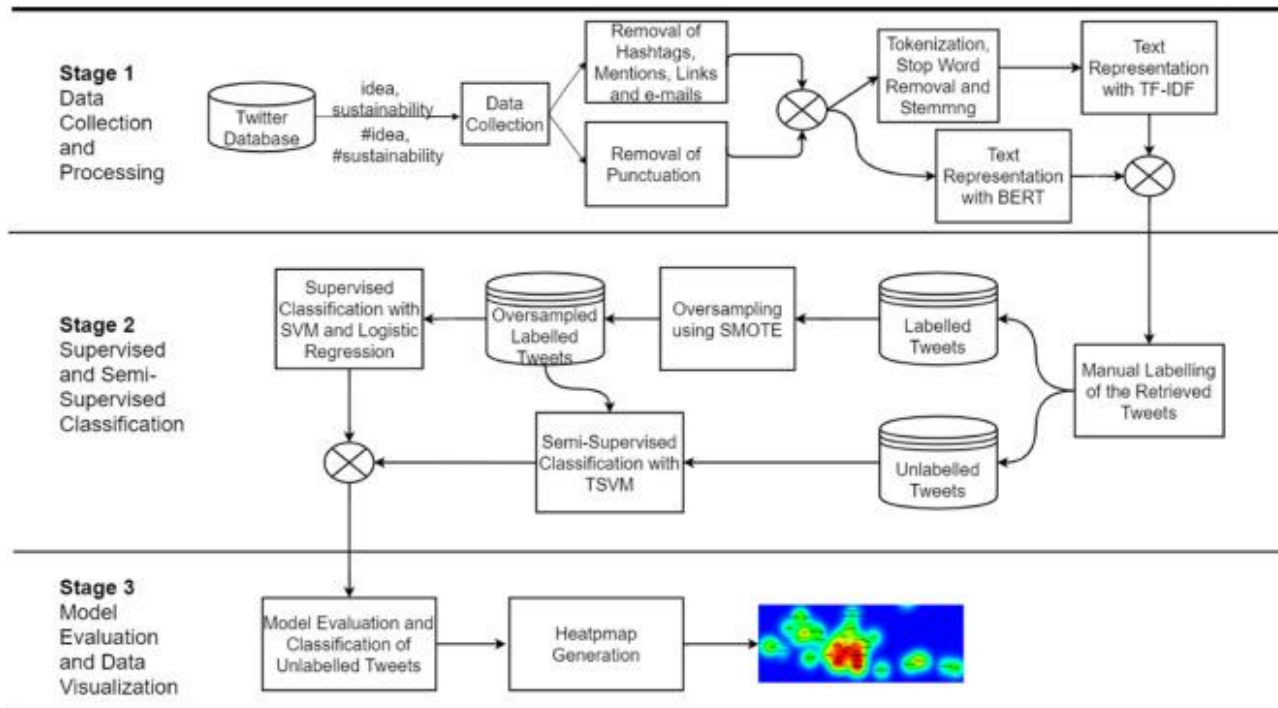
Results: Performance of the classifiers with SMOTE with respect to the number of training samples.
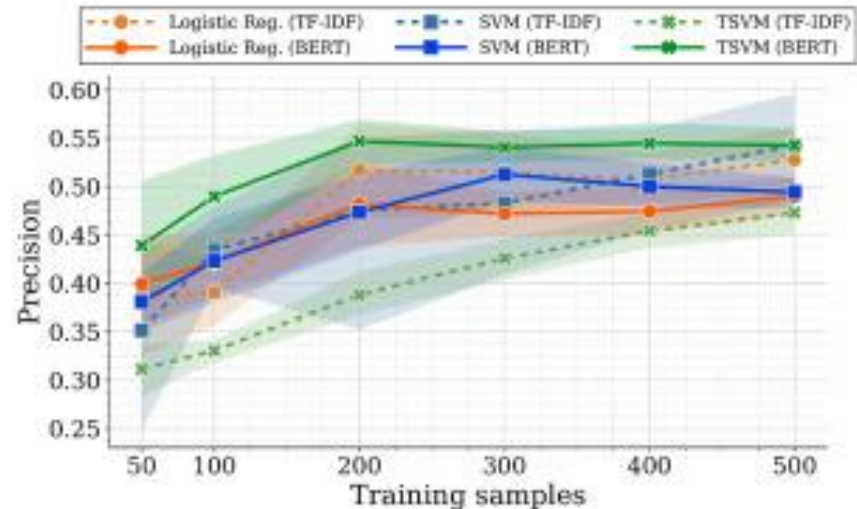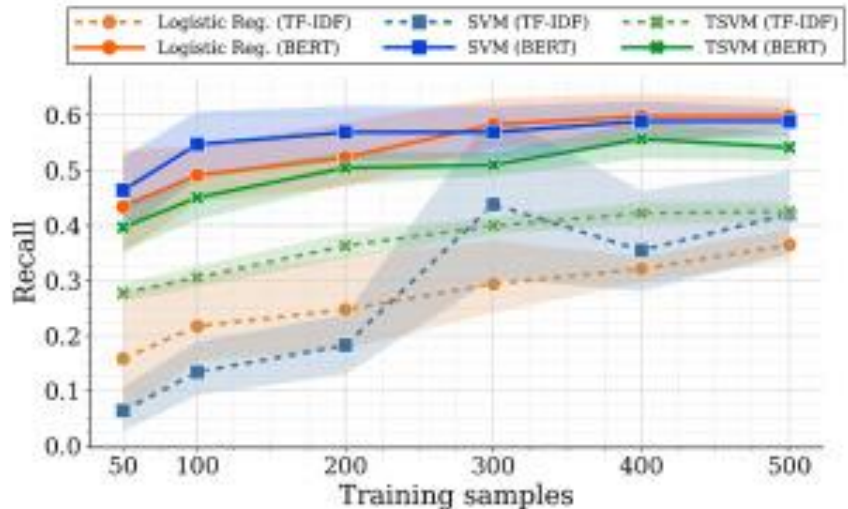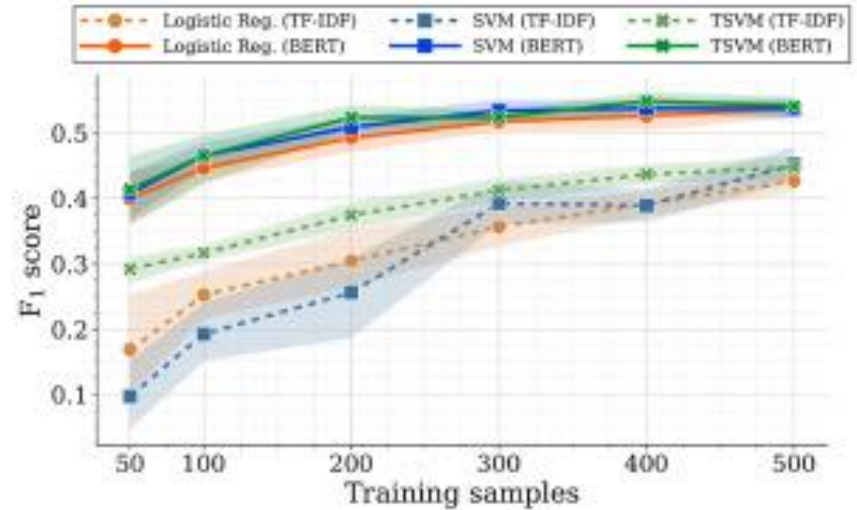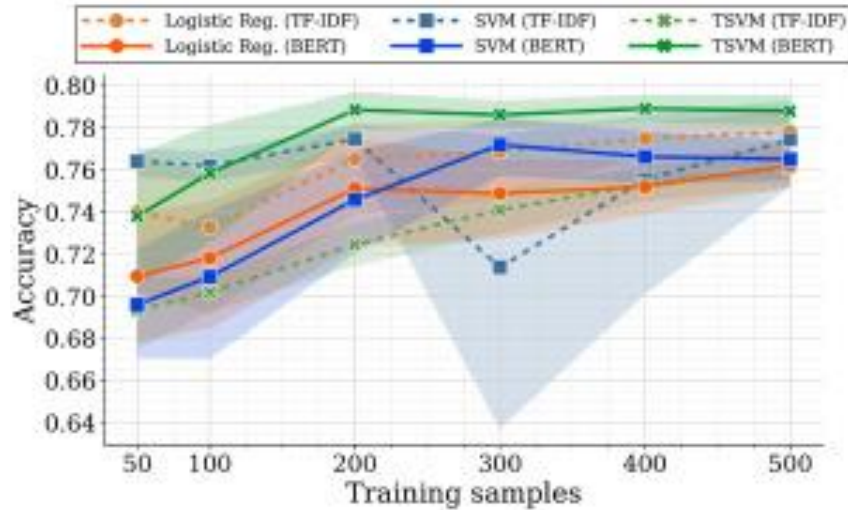
Results: Performance of the classifiers using 900 training samples and BERT for text representation

		Accuracy	Precision	Recall	F1 Score
Logistic Regression	Average	0.761	0.486	0.655	0.557
	Standard Dev.	0.025	0.042	0.020	0.026
Support Vector Machine	Average	0.773	0.505	0.641	0.564
	Standard Dev.	0.025	0.042	0.048	0.038
Transductive SVM	Average	0.784	0.526	0.596	0.558
	Standard Dev.	0.027	0.053	0.053	0.049

Results: Sustainability Ideas

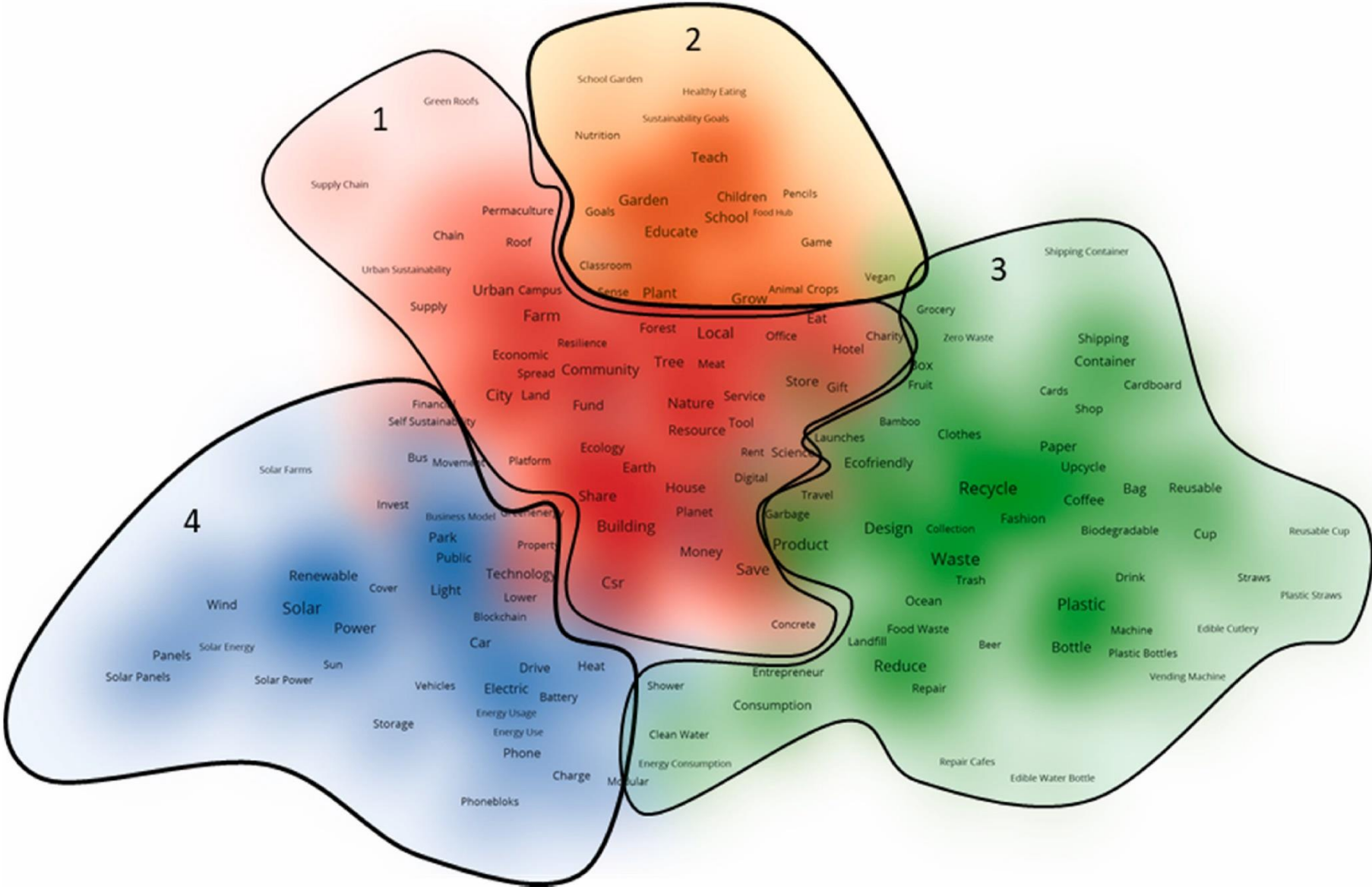| "Ideas"	"Not Ideas"
Recycled tires as shoe soles? Great idea and Timberland (a leader in sustainability) will be doing it.	under 25? got a great idea for carbon reduction and sustainability? want to win up to $10,000? Visit http://www.youth4sustainability.com/
Metrics for food-system "sustainability"? An interesting idea. Ripe for co-optation?	Is "sustainability," the idea of designing systems that can continue indefinitely, even remotely possible? Do we need a new target?
Enabling Innovations is an idea to connect people with local resources - for sustainability (thrivability, even).	@akm1 Good point; sustainability matters. May I suggest you submit the idea to http://www.asuchallenges.com/?
Great idea: Time to start a campaign for a Nobel Prize for Sustainability? #green #climatebill	ideating: sustainability/green that's all we hear these days--elephant in room: asset inertia--I have an idea...interested? Please reply...
great idea. Online message board for sustainable farmers: http://ow.ly/wXcN #farm #organic #sustainability	Learned so much about the #Ford sustainability today from @ScottMonty I had no idea how green Ford is! #fusiondriveNYC
A good idea: Simplify #Sustainability Program Management with Business ERP Software http://bit.ly/2JMrXJ	why has higher education failed to grasp the BIG Idea of sustainability?

Comparison of Labelled and Unlabelled Results

Unlabelled

Labelled

Clustering Sustainability Ideas

Illustration of sustainability ideas

Categories of ideas	Examples
Cluster 1 - Sustainable production	• An online message board for sustainable farmers • Meat idea: tracking produce back to farmers • Urban sustainability using vertical farms • Rooftop fish: the future of urban farming • The use of greenhouses in cities • Window farms • 'Farm from a box' – a solar-powered farm using a modified shipping container • Leather from pineapples • A solar-powered floating farm • Vertical ocean farming and fishing
Cluster 2 - Sustainability education	• Education regarding sustainability and healthy eating habits • Early education of children regarding sustainability • Solar education week • Electrical vehicle education • A summer camp that encourages sustainability education • Education of children concerning energy efficiency and sustainability
Cluster 3 - Sustainable packaging	• Karma cup system from Starbucks • Cups into compost for urban gardens • Edible water bottle • Edible food packaging • A convertible pizza box with built-in plates • Supermarket vegetable packaging that allows one to grow their own vegetables • Packaging based on mushrooms
Cluster 4 - Sustainable energy	• Dance floors that generate electricity • Exercise bikes that create energy for a sustainable gym • Helping developing countries to build wind turbines from scrap car parts • Using abandoned spaces to promote sustainable energy solutions • Glowing bio-LED trees to replace streetlamps • Environmentally friendly Lego-type bricks for the construction of houses

Conclusions

- The results presented in this study on social media mining for sustainability ideas can aid in resolving the misconception that data obtained from social media are of low quality and are limited to providing directions for organisations and relevant communities.

- This study has both practical and methodological contributions:

  - ***The practical contributions:*** *our study highlights many examples for sustainability-related ideas, and these ideas can be used for product, service or business solutions to achieve global sustainable goals.*

  - *The examples presented in clusters 1 and 3 (Fig. 5) can be used for sustainable production and packaging solutions. The examples presented in cluster 2 (Fig. 5) can be used for sustainability adaptations. The examples shown in cluster 4 (Fig. 5) can be used to develop innovative methods for the production and use of sustainable energy.*

  - ***The methodological contributions:*** *we successfully created a classification model to identify the tweets that contained 'an idea' and 'not an idea'. This classification model was used as a pre-processing step so that the query results returned by the Twitter API were cleared from the tweets that contained the search terms used in the query but did not contain an idea.*

  - *This is the first social media mining model developed to retrieve ideas, and this is one of very few studies in which a classification model was used as part of a pre-processing step.*