Problem Statement

Where Does Crowd-based Requirements Engineering End and Market Research Begin?

Eduard C. Groen

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Where Does CrowdRE End and Market Research Begin?

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- public -

Where Does CrowdRE End and Market Research Begin?

I actually took a break from the CrowdRE workshop this year

…well that worked out great, didn't it?

What happened? Well, my brother-in-law happened.

The back story is as interesting as the paper itself!

Where Does CrowdRE End and Market Research Begin?
…read all three pages of the paper!

Where Does Crowd-based Requirements Engineering End and Market Research Begin?

Eduard C. Groen

Fraunhofer Institute for Experimental Software Engineering IESE, Germany, eduard.groen@iese.fraunhofer.de
and Department of Information and Computing Sciences, Utrecht University, The Netherlands

Abstract—In recent years, market researchers have increasingly adopted automation, among other things to understand what users want from their product or service and how satisfied they are overall or with specific features or changes. Crowd-based Requirements Engineering (CrowdRE) is concerned with similar questions and employs requirements engineering (RE) methods to answer them. This suggests that the boundary between the fields of market research and CrowdRE has become blurred. This in turn raises the question: When is something still CrowdRE, and when has it become market research? This is an important question because it may require the community to rethink how industry might perceive CrowdRE in a wider context, and how future research should be framed. This problem statement paper explores this question along several real-world scenarios to trigger discussions in the community regarding possible solutions.

Index Terms—Crowd, crowd-based Requirements Engineering, market research, problem statement

I. INTRODUCTION

Crowd-based Requirements Engineering (CrowdRE) is a subdomain of requirements engineering, making it inherently rooted in software and systems engineering. Interestingly, however, the definitions of CrowdRE [1]–[3] are phrased more broadly and suggest that CrowdRE can be applied to any (software) product or service, provided that RE methods are used in the analysis. From its onset, CrowdRE was positioned between existing approaches, including Market-Driven RE [4], which proposes the use of instruments from market research such as questionnaires to obtain user requirements, typically from known stakeholders. In 2017, Groen et al. [2] argued that CrowdRE distinguishes itself from Market-Driven RE in two respects. First, CrowdRE can be applied continuously over the constant influx of user feedback, while in Market-Driven RE, surveys are typically conducted in discrete phases and end whenever the strategic information need has been satisfied. Second, the crowd has a weaker bond to the organization, with user feedback getting obtained indirectly and without the crowd members' knowledge, while Market-Driven RE is mostly performed directly with prototypical, potential, or actual stakeholders.

On the other hand, the field of market research has rapidly evolved in recent years, increasingly adopting analytics tools that provide detailed information to a market researcher. Market research is concerned with typifying the market in which an organization operates, identifying relevant players, revealing trends, and understanding the organization within this market [5]. Market researchers seek to understand and listen to customers using analytical techniques such as social listening. Analysis services such as App Annie[1] present them with insight reports about apps, and consultancy platforms such as Qualtrics[2] provide decision support for stakeholder management. These tools essentially use online data to present analytics for products that are already on the market, quite similar to analysis dashboards in the domain of CrowdRE, like OpenReq Analytics [6]. There is, however, at least one clear distinction: While CrowdRE organizes analysis results according to requirements dimensions, market research performs targeted queries to determine the success of a particular intervention. However, especially where market research is aimed at a software or embedded system, market researchers might be looking at similar aspects as CrowdRE, such as bug reports or feature requests.

Over the years, the increase in automation may have blurred the boundaries between CrowdRE and the customer- or user-oriented subset of market research. Perhaps for this reason, one of the key questions formulated for the CrowdRE 2022 workshop is: "How can CrowdRE learn from other disciplines such as marketing, public relations, or advertising to increase users' interest and motivation to actively participate?"[3] This raises important questions, beginning with the challenge of whether CrowdRE can still be considered an independent field in its own right, and if so, how CrowdRE should be positioned towards market research. Depending on how these questions are answered, this might have major ramifications for the future of CrowdRE, especially regarding how it is perceived and adopted in industry, which compelled me to explore this problem by exploring possible interfaces between CrowdRE and market research in several scenarios (Section II) and deriving possible implications (Section III). Section IV concludes the paper.

II. SCENARIOS FOR CROWDRE VS. MARKET RESEARCH

Section I established that the touchpoints between CrowdRE and market research lie especially in analytics; the data used, the statistics performed over the data, and in some cases the resulting information need. To discover possible points of friction, let us consider four scenarios.

Scenario 1: Taxi app. With app store feedback analysis, this first example still stays close to home for CrowdRE. Unlike most apps, a taxi app not only receives feedback on the interaction with and the functions and quality of the app, but also the user's experience with the quality of the physical taxi service. This includes aspects such as: Did the taxi show up on time or at all, was the driver polite, was the amount charged fair, and were complaints adequately addressed? These topics might seem to be more of interest to market research than to requirements. But one could argue that a user complaining about being charged a no-show fee even though they waited at the right place and even saw the car drive past them, can inspire a requirement for a system function that determines whether the user was in the right place and should not be charged. In that case, is CrowdRE borrowing off market research data?

In research, a series of workshops was specifically dedicated to the analysis of app reviews for market analysis [7]. It originated from the 36th CREST Open Workshop in 2014, which was dedicated to App Store Analysis,[4] featuring 16 talks over the course of two days, among others by scholars often cited in CrowdRE literature, such as Walid Maalej, Federica Sarro, Maleknaz Nayebi, and Soo-Ling Lim. In 2016, the workshop was continued as the NII Shonan Meeting on Mobile App Store Analytics.[5] It finally was held as the International Workshop on App Market Analytics (WAMA)[6] in 2016 (9 accepted papers), 2017 (4), and 2019 (7).

Scenario 2: Robot mop. We could apply CrowdRE to a software-intensive system such as a smart home product that vacuums and mops the floor. Once the robot is set up, the associated app does not necessarily play a central role. This is why app store reviews that focus on the app itself are of less interest than product reviews found on online marketplaces, websites of electronics stores, and video platforms. Users might describe how easy the set-up procedure was, how well the robot performs, how much maintenance is required and at what cost, and whether the manufacturer or reseller provides good service. Manufacturers might use this information to make design choices or to improve aspects of their business. But are the outcomes of these analyses primarily of interest to the engineers, or to the marketing department? For example, the user experience of such a robot is strongly affected by decisions from marketing to personalize the robot by allowing modifications or giving it a name. Do requirements identified through CrowdRE analysis play a key role here, or are they a side-product of market research?

Scenario 3: Car. Despite a strong trend towards software integration in connected vehicles, apps and other software still play a relatively rudimentary role. Vehicle data gets abundantly transmitted and analyzed, but this performance data does not reveal the user's perception of the car. User opinions can be obtained through social media and car-specific forums. Groen et al. [2] describe a scenario in which online user reports of problems are compared to usage data in order to identify recurring problems with a particular model faster, enabling preventive measures (callbacks) and guidance for car workshops to detect and resolve the issue quicker. Although this feedback is not necessarily related to the (embedded and information) software systems of the car, it is still of interest to CrowdRE to help vehicle manufacturers gauge how well certain innovations are received, or whether the vehicle appeals to its target audience; questions that market researchers at a car manufacturer may have, but which essentially validate whether stakeholder requirements regarding certain features have been met. Perhaps CrowdRE could solve the information needs of market researchers by providing analyses (i.e., classifications) that are typically already being performed.

Scenario 4: Power tool. Physical products that do not require software to operate, like a mechanical saw, might seem far removed from CrowdRE. Software can still play a role for these products though; a QR code sticker or a near-field communication (NFC) chip could guide users to relevant online resources like manuals, tutorials, customer support, or channels for obtaining spare parts or accessories. Moreover, second-hand tools are often traded over online classifieds websites, revealing the durability of the device by the condition at which it is offered after a certain number of years, and the opinions expressed in the classified ads. Manufacturers with a long-standing reputation may wish to understand the performance of their products. They are often faced with the strategic decision to sacrifice quality to reduce the price gap to cheaper competitor products. Finding that their earlier products are still in high demand because they remain reliable even after one or two decades might inspire the decision to remake that model without compromising its original quality. At face value, this has little to do with software engineering, or indeed CrowdRE. But a central question in CrowdRE is how the crowd – i.e., the users of a product or service (cf. [2], [3]) – share their opinions over online platforms. Through QR codes or NFR chips, even the interaction with the company through its own platforms could be more closely monitored. Hence, perhaps the disciplines of CrowdRE and market research could mutually inspire each other to understand the crowd and their needs even for products not traditionally associated with RE.

III. IMPLICATIONS FOR CROWDRE PRACTICE & RESEARCH

In all scenarios, it is not very clear-cut whether the analysis primarily serves the goals and needs of CrowdRE analysts or those of market researchers. Indeed, user feedback research in RE has sometimes gone beyond traditional software product qualities and analyzed market-related aspects such as the fairness of the pricing model (e.g., Ciurumelea et al. [8]). Is this invading another domain or, considered more optimistically, an early sign of two adjacent domains potentially inspiring each other to consider additional perspectives? From the scenarios, several implications can be derived to achieve synergies:

Identified implications for CrowdRE practice:

- **CrowdRE analysis results are useful for market research.** This calls for market research to adopt CrowdRE

insights and methods into their practice, with a focus on identifying and describing their users or customers (i.e., their stakeholders), understanding the ways in which they provide feedback, and the needs they express. In turn, it compels CrowdRE to regard itself as a means of providing decision support not only to software developers, but also to marketing and decision-makers (e.g., by measuring key performance indicators).
- **CrowdRE analysis results should not only be used to improve a product's software components, but also its context.** CrowdRE should focus more on aspects of RE that are less concerned with the software itself, but rather deals with satisfying stakeholders by addressing their needs for adequate customer support, fair pricing, durability of physical components, etc.
- **CrowdRE and market research should mutually share their know-how.** CrowdRE should give impulses to this mainly business-driven field, which has little IT experience, by providing market researchers with a better background in computer science. Market research and adjacent fields should bring techniques into CrowdRE to appeal to, engage, and motivate the crowd – which is in line with the CrowdRE'22 workshop's key question on learning from disciplines such as marketing, public relations, and advertising (see Section I).

Identified implications for CrowdRE research:

- **CrowdRE research should be inspired more by research on other products and services.** Research in domains related to marketing and market research explore reviews relating to food [9], [10] and travel [11], [12], or feedback gathering in general [13], the insights of which can be extrapolated to better understand user feedback for RE. A good starting point could be the publications from the WAMA workshop series (see Section II).
- **CrowdRE research should enrich research on automation in market research.** Despite the many market research tools, the body of literature on automated evaluation of users and their feedback in market research is relatively sparse, possibly because of the domain's limited experience with machine learning. Relevant works include a seminal paper on automated marketing research [14] and a recent study on the consistency of online product reviews with market research techniques [15].
- **CrowdRE could spark research on applying its techniques to non-software products.** All four scenarios in Section II have the potential of being an interesting subject to pursue in the scope of research projects and doctoral dissertations. This should stimulate cross-disciplinary work with other domains.

IV. CONCLUSION

In this problem statement, I have explored similarities between CrowdRE and market research. Both fields have adopted automation, which has caused them to analyze similar data for comparable purposes, as could be seen in the four scenarios discussed. The central problem is whether CrowdRE is and will remain sufficiently distinct from market research. The solution put forth in this paper is that we should accept that boundaries are fading, and take an optimistic perspective, where both domains start aiming for a common goal; specifically, one where CrowdRE analysis results become more valuable to decision-makers and marketeers, while the outcomes of market research have greater value for designers and developers of (software) products and services. This would turn this problem statement into a potential benefit that makes CrowdRE more versatile overall.

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Footnotes:
[1] Now rebranded as data.ai; https://www.data.ai/
[2] Owned by SAP; https://www.qualtrics.com/uk/platform/
[3] https://crowdre.github.io/ws-2022/submissions.html
[4] http://crest.cs.ucl.ac.uk/cow/36/
[5] https://shonan.nii.ac.jp/seminars/070/
[6] https://appmarketanalytics.github.io/, in conjunction with the ACM International Symposium on Foundations of Software Engineering (FSE).

Background
The paper's origin

Experiences with industry

Some people see the potential of CrowdRE
- Multiple projects resulted in: "Wow, Marketing should see this!"

Not everybody likes CrowdRE
- One industry project fell through because the Market Research department at a company felt *threatened* by the solution we offered
- At another company, the feedback analysis was performed by the Marketing department, and they were content with their Excel files

Research is inspiring
- We get interesting insights from performing explorative research on apps that we occasionally perform about additional app aspects
- Project experience in various domains triggers new associations

A chat with my brother-in-law

Hanging out in his garden on 14 May
- My brother-in-law is a mechanical worker
- We were talking about my CrowdRE research

An alternative approach
- He felt that app analysis is boring
- Instead, why not use it for performing market research on *tools*
- I defended CrowdRE of course
- This could be an interesting topic for other researchers to pick up

Background
The paper's genesis

The night of 15 to 16 May
- I couldn't sleep. My mind went over the chat with my brother in law.
- I suddenly realized something that was slumbering in my subconsciousness: the boundary between CrowdRE and market research is unclear!
  - In a positive sense, CrowdRE results are considered relevant for market research; in a negative sense, the added value is not always clear
- I had an "aha experience" and various examples from multiple domains started running through my head

The morning of 16 May
- I had to write my thought process down, and in just two hours I had described the situation and exemplary scenarios
- Now what? Do I send it to our Business Development people? Should I share this with other researchers and practitioners?
- Actually, when is the submission deadline for CrowdRE? This Thursday, May 19? Ok, sure!

Before the submission deadline (which got extended)
- I decided to submit a Problem Statement and had one page left to fill
- The additional time I used to derive implications from the scenarios for CrowdRE
- The extra time before submission allowed me to take care of the formalities, talk to our Business Developers, and off it went!

Contribution
I did three things in this paper

1) I analyzed the problem
- Identify interfaces between CrowdRE and market research; especially automated data analytics
- These boundaries have blurred because user-oriented activities in market research increasingly rely on automation
- Is CrowdRE still an independent field in its own right? How should it be positioned towards market research?
- The ramifications of those questions can be major!

2) I made the problem tangible
- Scenarios describe cases that make the similarities and differences between both domains clear
- What aspects serve the goals and needs of either CrowdRE analysts or market researchers?
- Borderline cases in CrowdRE research that are about market research, like fairness of the pricing model

3) I found a solution: let's work together!
- Derived possible implications and recommendations to achieve synergies between both domains

Helpful was also this goal of the CrowdRE'22 workshop:
"How can CrowdRE learn from other disciplines such as marketing, public relations, or advertising to increase users' interest and motivation to actively participate?"

Problem Statement

Where does CrowdRE end and market research begin?

- "Concerned with typifying the market in which an organization operates, identifying relevant players, revealing trends, and understanding the organization within this market" (Hague, 2022)
- Rapidly adopting analytics tools to understand and listen to customers (e.g., social listening)

- Applies strategies from Market Research in RE

- As subdomains of RE inherently rooted in software and systems engineering
- Surveys that are typically conducted in discrete phases until a strategic information need is satisfied vs. continuously
- Direct contact with prototypical/potential/actual stakeholders vs. a weak bond with feedback gathered and analyzed indirectly

- All definitions of CrowdRE (by Martin Glinz, by myself) include *any* (software) product or service

- CrowdRE and analysis services use online data to present analytics for products that are already on the market
- Organize results according to requirements dimensions vs. determining the success of a particular intervention
- But: if the product is a software or embedded system, both look into things like bug reports, feature requests

Market Research

Market-Driven RE

CrowdRE
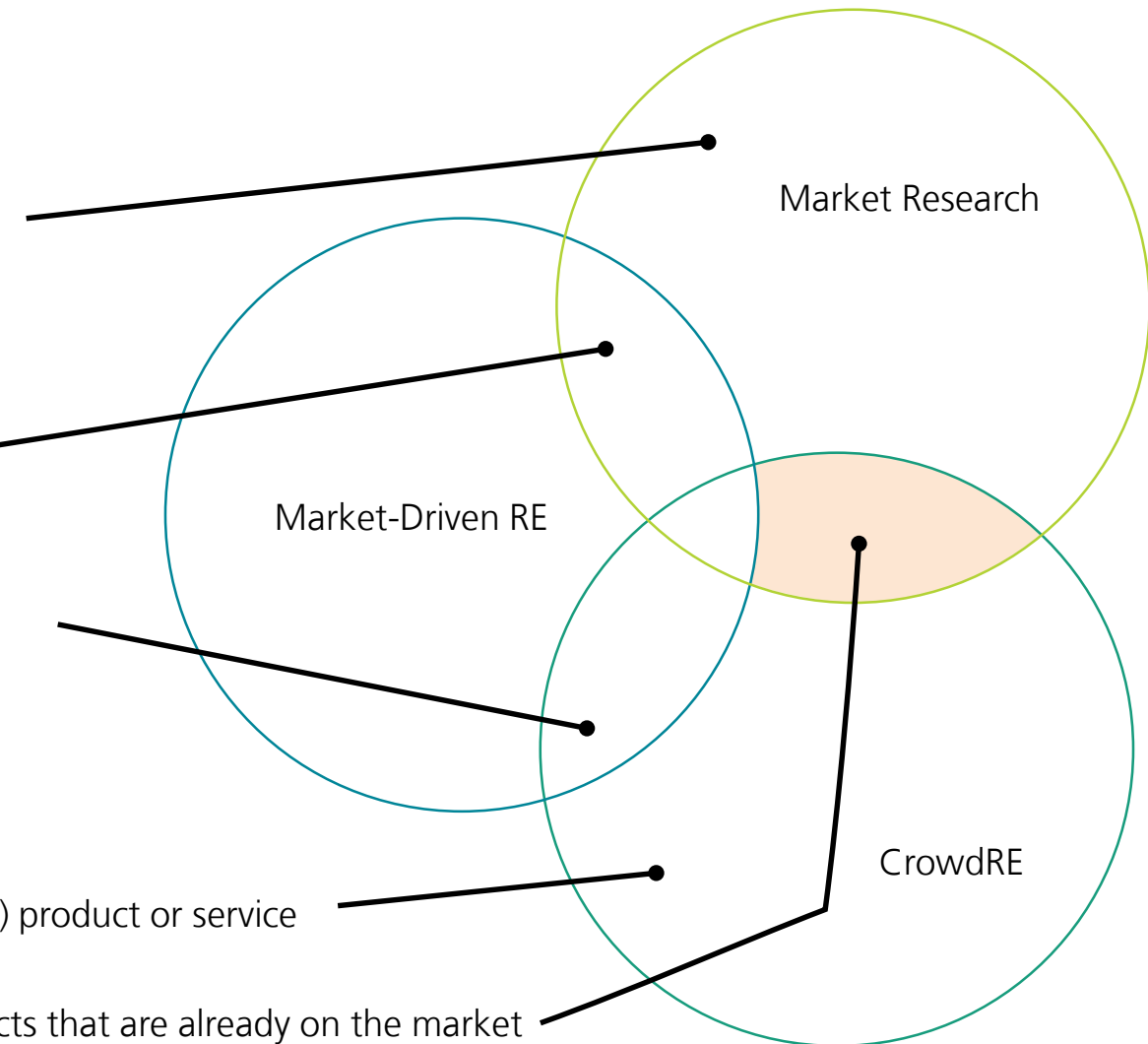
Problem Statement
Earlier effort related to market research

- A series of workshops was specifically dedicated to the analysis of app reviews for market analysis
    - 2014: 36th CREST Open Workshop; focus on App Store Analysis
    - 2016: NII Shonan Meeting on Mobile App Store Analytics
    - 2016: First International Workshop on App Market Analytics (WAMA)
    - 2017: Second International Workshop on App Market Analytics (WAMA)
    - 2019: Third International Workshop on App Market Analytics (WAMA)
        - See https://appmarketanalytics.github.io/

- People involved with this workshop include scholars often cited in CrowdRE literature:
    - Walid Maalej*
    - Federica Sarro
    - Maleknaz Nayebi
    - Soo-Ling Lim
    - and others

Hint: something about a keynote earlier today…

Scenarios

1) Taxi app

Context

- Feedback to taxi apps are about:
  - The app (interactions, functions, quality)
    - Primary focus of CrowdRE
  - The service (taxi booking, timeliness, ride, driver, problems)
    - Primary focus of market research

CrowdRE vs. market research

- Can a complaint about being charged a no-show fee that was the driver's fault be a basis for a function that checks who is at fault?

Scenarios
2) Robot mop

Context

- A software-intensive system that vacuums and mops the floor
- Users interact more with the robot than with the app
- Reviews on online marketplaces, websites of electronics stores, and video platforms are of greater interest than app store reviews
  - Set-up procedure, robot performance, maintenance, costs, service

CrowdRE vs. market research

- Is the analysis for design choices or to improve aspects of the business primarily of interest to the engineers, or to the marketing department?
  - E.g., decisions by marketing, like personalization options, strongly influences the user experience

Scenarios
3) Car

___

Context
- Even with connected vehicles, software/apps play a rudimentary role
- Transmitted vehicle data does not reveal user opinion

CrowdRE vs. market research
- User feedback can help gauge how well certain innovations are received and whether the vehicle appeals to its target audience
- A market research question, as well as requirements validation

Note
The infobox in the seminal CrowdRE paper *"The crowd in requirements engineering: The landscape and challenges"* (IEEE Software, 2017) describes a CrowdRE scenario with vehicle data and user feedback

Scenarios
4) Tool

Context
- Non-software physical products that do not require software to operate like a mechanical saw
- Possible software integration by links to online resources (manuals, tutorials, support, webshop) with QR codes, NFC chips
- Online classifieds websites for trading second-hand tools revealing the durability of the tool over several years
  - Understand the performance of a model; shape strategic decisions (e.g., remaking an older model without sacrificing quality)

CrowdRE vs. market research
- A central question in CrowdRE is how the crowd -- i.e., the users of a product or service -- share their opinions over online platforms
  - Interaction with (private) platforms of the manufacturer can be monitored

Implications
For CrowdRE practice

CrowdRE analysis results are useful for market research
- Market research can adopt CrowdRE insights and methods into their practice, with contributions such as>
  - identifying and describing users / customers (i.e., stakeholders)
  - understanding how they provide feedback and express needs
- CrowdRE should regard itself as a means of providing decision support to:
  - software developers, as it has always done
  - marketing and decision-makers (e.g., by measuring key performance indicators)

CrowdRE analysis results should not only be used to improve a product's software components, but also its context
- CrowdRE should focus more on aspects of RE that are less concerned with the software itself
- Satisfying stakeholder needs for adequate customer support, fair pricing, durability of physical components, etc.

CrowdRE and market research should mutually share their know-how
- With market research being a mainly business-driven field, CrowdRE should give impulses based on its IT experience
- CrowdRE can learn from market research and adjacent fields with what techniques they appeal to, engage, and motivate the crowd*

* Remember the CrowdRE'22 goal?

Implications
For CrowdRE research

CrowdRE research should be inspired more by research on other products and services
- Learn how to better understand user feedback for RE based on research from marketing and market research
- User reviews regarding restaurants,[1] food ordering,[2] tourism,[3] hospitality,[4] and feedback gathering in general[5]

CrowdRE research should enrich research on automation in market research
- There are many market research tools, but hardly any literature on automated evaluation of users and their feedback in market research
  - Perhaps due to the domain's limited experience with machine learning?
- There is an older, well-regarded paper on automated marketing research[6] and a recent insightful work that assesses how consistent the analysis of online product reviews is with outcomes through market research techniques[7]

CrowdRE could spark research on applying its techniques to non-software products
- The scenarios are interesting to pursue in the scope of interdisciplinary research projects and doctoral dissertations

[1] "Behind the Ratings: Text Mining of Restaurant Customers" (Jia, 2018)
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Conclusion

CrowdRE shouldn't end where market research begins, nor vice versa

The problem
- It is difficult to really distinguish CrowdRE from market research by the way they use automation to analyze data for comparable purposes
- Is CrowdRE sufficiently distinct from market research?

My proposed solution
- We should accept that boundaries are fading
- Let's work together and aim for a common goal where:
  - CrowdRE makes sure its analysis results are useful for decision-makers and marketeers
  - Market research makes sure its output is useful to designers and developers
- This would help CrowdRE to become more versatile overall