Bringing Technology and Humanitarian Values Together: A Framework to Design and Assess Humanitarian Information Systems

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Abstract— Designing information systems (IS) in support of humanitarian work has been a challenge widely pursued for decades. However, one aspect that has been undervalued within systems design is the role of the underpinning humanitarian values and culture as part of system effectiveness. Further, it remains understudied how we might incorporate those values into the information system design process. We address both these aspects by 1) analyzing humanitarian values of effectiveness as they impact information systems design, and 2) incorporating humanitarian values as part of the design criteria. In this paper, we present the idea that the "maturity" of an IS design to be effective for the humanitarian context is assessed by how well it incorporates humanitarian values. Therefore, we move away from a product-centered design towards an approach, which features the socio-technical relationship. We present a maturity matrix, which aims to translate and communicate humanitarian effectiveness into the design and development terminology used by technology designers. This matrix is housed within a participatory framework that allows for the development of trust and shared understanding between these two domains. The framework serves as a road-map for designers and humanitarian agencies to adapt the IS design and development process to better accommodate the IS needs of the humanitarian mission, its values, and culture.

Keywords—humanitarian technology, human-centered design, sociomaterality, ICT4D, IS design, humanitarian values, hidden work, effective design, complex systems design.

I. INTRODUCTION

Humanitarian organizations are in the need of Information Systems (IS) that allow them to do their work in a more efficient and effective way. These terms, however, have contrasting and sometimes conflicting meanings in the field of humanitarian operations than within the traditional engineering and business domains in which the art of designing of IS has been established. These unresolved interpretations of effective work stand as one possible cause for repeated failing of information systems implementations, and lack of expected progress toward sustainable IS designs within the humanitarian domain.

The challenge of connecting domains with different value-systems for the purpose of designing effective IS first requires an awareness of philosophical assumptions we have in design and development of technology and what we perceive as effective work.

Designing IS that better meets the needs of humanitarian agencies (HA) requires an evidence-based understanding of the successful work within its domain. Therefore, we use the success factors (SF) and success driven behaviors (SDB) identified in the grounded, ethnographic work of Mays, Walton, Lemos and Haselkorn on the information needs of successful practitioners as our model [1]. These behaviors and the information needs they support are facilitative over directive, highly relational, dynamic, and participatory. This model presents a different sort of challenge to IS design: that of considering how humanitarian values change the traditional assumptions and methods of IS design and development.

Design and development of technology has excelled at the creation of IS for organizations with well-defined and predictable decision-making structures. This paper represents a call, however, to go further into socio-technical domains and the development of new methods that can be more accommodating of the less fixed decision-making of distributed organizations. This paper reveals technical themes that emerged when considering the more socially-driven values of humanitarian work, providing a starting point to build upon. It proposes a framework for enabling the design of IS that fit the needs of humanitarian organizations and communities involved in the work. The proposed solution is an effort to translate factors that make humanitarian work by practitioners in the field successful for IS designers and connect it to aspects of IS design that can potentially support these factors, when being incorporated into the design process.

It sets a precedent in this unexplored area, with our effort to bridge a communication gap identified between designers and humanitarian organizations. The findings contribute an initial road map for designers and humanitarian agencies to better adapt the IS design and development process for accommodating the IS needs of the humanitarian values and culture.

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II. Related Work

A. IS Design Foundations into Socio-technical Advances

Ubiquitous to current day software design and development is an entrapment in the paradigms of the time. IS design was primarily born out of military initiatives [2], grew into adulthood under the computerization of government and for-profit corporate communication systems, and decades of iteration rooted in these types of work systems [3]. Therefore, IS design and development methods are aligned with certain assumptions of how organizations conduct work congruent these work-systems (e.g., closed systems, top-down decision making, control as a form of optimization, and product/service delivery oriented goals).

Examples of these traditional methodologies include: structured programming techniques used in the last 40 years [4, 5, 6] which have been replaced by object-oriented approaches [4, 7]. In the former example, the system is conceptualized as a flow of functions and processes with inputs and outputs, whereas the second one depicts a system as objects, methods, and inheritances [4]. As well, the requirements document – the ever-persistent starting point of all IS design – reflects this history. IS design has been summarized as "some variant of the following phases of: requirements determination, design, construction, implementation and operation." [2, p.43].

Increasingly, context-aware socio-technical system communities, such as Computer-Supported Collaborative Work (CSCW), have exposed the risks of adopting such methods for highly complex contexts. Beginning in 1993, Orlikowski was already talking about the importance of recognizing cognitive, organizational, and structural elements as part of the design process of new technologies as well as their implementation in organizations [8]. Her focus lied in acknowledging the importance of the role and relationship between technology and human interaction, and understanding how it influenced the way people reflect and assess the value of technology [9]. Feenberg in his Critical Theory of Technology, observes society and technology "communicate constantly through the realization of values in design and the impact of design on values" [10, p.68]. Moreover, he criticizes the existing bias present through the interpretation of a social requirement into a technical specification, defined as technical codes, but carrying the values of the dominant technical actors [10].

Today, human-centered design (HCD) approaches are addressing the reality that technical solutions are part of a larger social system that requires holistic analysis [11]. Socio-material methods such as seamless cognitive systems engineering and contextual design are advancing – and challenging – technology design and development to innovate a long history of tradition in this area.

B. The Need for New Approaches

Although the technical research is limited in its sharing of stories of failed technology, there are ubiquitous testimonies of humanitarian technology initiatives that fail to achieve their desired purpose; to adapt to the needs of the humanitarian community; or to be adopted or achieve adequate scale [12, 13, 14]. The UNHCR Innovation unit has concluded such phenomena with: "In many cases, well-intended developers find themselves confronted with the realities of operating in an unfamiliar and challenging context." [13]. Thus, as Baxter and Sommerville observe, while systems might "work" from a technical perspective, they still do not succeed in delivering the needed support to the core work of the organization. [15]. In particular, there are three underlying barriers in design and development that Baxter and Sommerville have named in their problem classification for lack of accepting socio-technical methodologies in software engineering, that we also found highly relevant in our research. Those are: inconsistent terminology, conflicting value systems, and lack of agreed success criteria [15].

1) Terminology

There is a terminology gap which occurs when humanitarian organizations and technology designers come to work together towards the development of IS. The process can easily fail due to the lack of shared meaning among the parties even when using similar language. Technical communication's historic focus in "for-profit" and "top-down" business-related environments, has fostered a lack of robust research in broader sectors such as non-profit work and therefore, its different characteristics and terminology [14, 16]. Because humanitarian operations is a hidden form of work, without specific exposure, it is common for outsiders to overlook assumptions in the terminology made about the work [17].

Inconsistent meanings in the use of terminology present the problem of translation and thus, a need for development of a shared-understanding. One importance of socio-technical approaches with the intent for understanding work practices via HCD methods aim at offering representations and details of how technology influences the work in relationship to the humans making use of it [9, 18]. The representations of work created from HCD approaches[1] can then serve as a starting point for designers and involved stakeholders to begin a conversation for developing common meaning.

2) Value Systems

Moving forward towards what comprises one of the main problems for adopting technologies that affect humanitarian organizations, is a difference between humanitarian values and the historical aspiration of technology development. Changes in technology have been rooted in the growth of economy, with the engine of change ignited by the motivation to keep on making profits [3]. Nonetheless, even though not all individuals might be driven by market incentives, the larger part of technological change comes behind the "intentional actions taken by people who respond to market incentives" [3, p.72]. Thus, technology, itself, is "value-laden, invested with and aiming at values in both genesis and execution" with the value equations of an economic work system [19, p.41]. Whereas, humanitarian work is driven by the motivation to assist individuals who are in need [14].

The legal framework under which these two types domains are constituted reflects their culture and sets boundaries and freedoms on the way they behave and operate [14]. This is

[1] Such as ethnographic work, action research and participatory design

reflected and derived into how the work is constituted. On one side, for-profit organizations are required to maximize profits. Quantifying success has a long and broad tradition in the economics [20] and manifold measures are derived via e.g. productivity efficiencies and optimization of costs, where the design works towards profit targets. Qualitative measures are also incorporated, yet the priority will remain under achieving a positive quantitative bottom-line. This is what we call in our study an "optimization" for control and sustainable markets. On the other side, non-profit organizations are legally obliged to uphold and be respectful of their missions. This translates into being successful under moral codes. For example, the Code of Conduct of the Red Cross and Red Crescent Societies include the humanitarian imperative[2] to provide humanitarian assistance above all else, and the humanitarian principles of humanity, neutrality, impartiality and independence [21, 22, 23].

3) Agreed Success Criteria

There is a lack of agreed upon specific operational success criteria for humanitarian success. With differing missions and legal obligation to their missions, the definition of success in the daily operations differs from agency to agency, and from unit to unit. The goal of meeting needs is highly contextual. Widera and Hellingrath [24] note that the manifold existing performance measurement approaches in the area of logistics are hardly applied by humanitarians. They illustrate the reason for this is that most available approaches neglect to discover and design measures appropriate for the practitioner realities.

Therefore, this research builds on the grounded study of Mays, Walton, Lemos, and Haselkorn which identifies the work model and information needs of successful humanitarian practitioners [1]. Thus, this definition of success is based on the work practices or behaviors which are developed in the field when interacting and collaborating with communities in need.

III. METHODOLOGY

A team of seven IS students and four supervisors took on a nine-month project that consisted of an extensive initial discovery phase. Discovery included domain learning via literature, interactive workshops, and interviews with humanitarian practice and HCD experts. This was followed by a four-month iterative design process with a humanitarian practitioner *for developing a solution for humanitarian agencies to help guide technology designers in their humanitarian technology needs, and hold them accountable to those needs* [24]

A. Discovery

Students first individually reflected on current personal views in order to recognize their own assumption around humanitarian effectiveness and IS design. This was followed by analysis and reflection of relevant literature for the humanitarian context. Next, the team familiarized themselves with the success driven behaviors of humanitarian practices identified in Mays, et al. [1]. The student team then conducted one-hour, inquiry interviews with six experts within humanitarian practice and five IS design experts to gain deeper insight into the challenges and realities of the humanitarian domain. This also included a combined review of 34 actual interviews conducted with successful practitioners in Mays' original study.

B. Iterative Coding, Analysis, and Design

From the discovery phase, a holistic, participatory and iterative analysis of the data was conducted. Iterative scoping and analysis of the problem space and problem definition was conducted over 16 weeks which included iterative validation from an experienced humanitarian practitioner. The team would consult previous interviews and conduct additional interviews when areas emerged that needed greater clarification. After a validated identification of the problem space, and analysis of the key needs, barriers, and gaps the team proceeded to explore appropriate solutions.

The next phase of research followed two conceptual streams a) development of a communication process for shared learning and creation between stakeholders, and b) development of a translation tool between the two domains.

1) Conceptualization of a Framework:

The first stream of analysis conceptualized a solution to bring communication, co-learning, trust and co-creation between humanitarian and IT professionals. This followed the same HCD principles of holistic analysis and stakeholder participation in design decision-making using iterative representations [11, 15]. Beginning with brainstorming, the solution ideation was narrowed and iterated within participatory design sessions that incorporated a validation by a humanitarian practitioner as part of the iterative decision-making. The resulting framework concept is discussed in the findings section below.

2) Conceptualization of a Translation Tool:

In the second stream, the team pursued creation of an artifact to help translate humanitarian values into IS design. Based on existing expertise in IS and the team's new thorough understanding of the information needs of humanitarian practice and its domain, a comprehensive analysis of the impact of design approaches on each of the thirty SDBs was conducted. These SDBs were systematically analyzed for both the IS development and design needs as well as IS design and development conflicts through qualitative open coding on an online platform. There were at least two coders for each SDB.

From this large-scale matrix a second level of open-coding was conducted. Team members divided the SDBs, providing at least two open-coders per SDB and systematically analyzed the SDB matrix for the repeating technical themes that emerged. Affinity diagramming of the individual codes in a joint session created joint themes. These technical themes make up the Y axis of the final matrix and described in the findings below.

[2] "that action should be taken to prevent or alleviate human suffering arising out of disaster or conflict, and that nothing should override this principle." [22, p.20]

IV. FINDINGS

A. Humanitarian-IS Designer Communication Gap

Our analysis identified a critical gap in shared meaning and understanding of terminology, values, and successful work between humanitarian and information systems domains. The gap of understanding comes from both sides: the designer lacking humanitarian values and work operations expertise, and HAs lacking IS/technological development expertise.

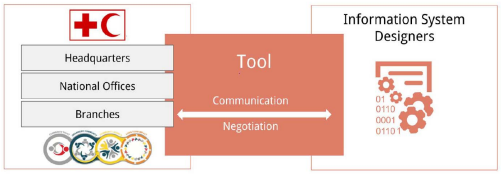

Fig. 1. A tool to bridge the communication gap

We further identified that the most important role of our solution would be to bridge the communication gap and work towards a shared understanding between humanitarian organizations and designers (regardless of their background). Our findings are that the two domains lack the necessary awareness and expertise of the different languages and values of the other, and thus how these moderate the way they each do their work. There exists a critical need to translate meaning across entities in order to move toward successful design in the humanitarian context (fig. 1). Therefore, we envisioned i) a space or framework for negotiating meaning among the different parties involved and ii) a translation tool to bridge the terminology and domain gaps. The devised solution of *a Guidance and Assessment Tool* at its base is a negotiation framework that allows for meaning translation across entities involved in a design process in order to align the potential IS to the humanitarian SDBs

B. Guidance and Assessment Tool

The Guidance and Assessment Tool (GAT) is envisioned as solution to support the translation of humanitarian effectiveness for IS designers, who intend to develop an intervention into a complex system by designing IS for the humanitarian space. We sought to communicate appropriately to designers what is most important for humanitarian technology design by incorporating humanitarian values into the language of design and development. This also provides a starting point for humanitarians to develop an understanding of how the technology design domain operates and its particular values.

The GAT consists of two components: (1) A Maturity Matrix for Humanitarian Technology Design and (2) A Guidance Framework for Humanitarian Technology Design and which houses the use of the Maturity Matrix.

1) Maturity Matrix for Humanitarian IS Design

The matrix serves as facilitative as well as stand-alone artifact acting as a tool for translation and/or assessment of IS regarding its alignment with humanitarian effectiveness. Along the Y axis we share the critical technical themes that emerged in our analysis (explained in the following section). Across the X axis is listed a spectrum of compatibility for HA needs for IS design and development approaches. We classified this as maturity levels, where the first column begins with the current beginning state of each technical theme as: first column = not aligned with SDBs, progressing onward to increasing alignment, with the 4th representing a more optimal alignment (fig. 2). We discovered there was a progression of maturity that aligned with methods. The lower spectrum reflected an alignment with more traditional, strict, technical-driven design method. Higher on the spectrum, design principles aligned better with synergistic approaches which combine the technological and sociological elements of a complex context. The 4th and final level, is futuristic in practice –taking elements of cutting edge, early methods that are moving in that direction– to imagine a greater socio-technical relationship for which pragmatic methodology still needs to be found.

The five major technical themes that emerged as most relevant for the alignment for humanitarian effectiveness (along the Y axis) are:

Stakeholder-Driven Design: The theme focuses in the relevance of having stakeholders (and not only direct users) as principal decision-makers of the design process. It aims at facilitating mutual understanding from the different parties, minimizing the unintended consequences of an IS deployment, derived from the omission of relevant parties.

This, for example, relates to meeting the operational aims to accommodate the human rights law of self-determination and the principle #7 of the ICRC Code of Conduct to "involve programme beneficiaries in the management of relief aid" [21, p.4]. The designer is required to act beyond a traditional designer role which transfers a client's requirements into a technical solution determined by the designers himself. In this case, stakeholders act as the solution's co-designers, and the IS designer is called to act as mediator among the several stakeholder groups.

Moreover, a consequence from not involving a sufficient number of stakeholders ends up in having systems designed in a way which do not reinforce or motivate the participation of those who possess the most valuable information at the lowest levels. Therefore, a significant challenge that must be accounted for with this approach is the required time it accounts for considering the involvement of stakeholders and group decision-making. It is more time-consuming every time a new individual joins the process.

Accountability and Transparency: This theme highlights the level of access a stakeholder has, as well as its understanding of how the system operates. For this theme, it was found that the concept of transparency, a central ingredient of many of the success driven behaviors, was linked to several other terms like: roles, information sources, information flows, and workflows. A method for achieving this is through the recording and storing of documentation. Having records of the whole process, documentation of system transition and co-creation of it with all stakeholders supports SDBs such as Facilitating Discovery (SDB11), Formalizing Trusted Spaces (SDB15), and enabling Mutual Authority (SDB7).

The information needs of success driven behaviors are bi-directional, relying on the expertise of those working in the

field. If coded in the opposite way (e.g. one-way, or top-down direction imposition), a breach in community trust might be provoked, ending up in a lack of community information sharing and collaborative work with practitioners in field.

Context-Reflecting Roles: Systems typically offer functionalities for the administration of user rights and roles in order to assign access to functionalities and information within the system. With context-reflecting roles management, roles in a system are determined by the stakeholders intimately connected to this context. In the case of humanitarian organizations, the design should be thought of as enhancing the degree of participation of communities and aid workers in all phases of disaster preparedness and response. Where effective IS rely on these actors to be consciously acknowledged as the key stakeholders, community agency in the decisions is critical for driving effectiveness. Thus, there is a need to be dynamic in the sense of configurability and flexible assignment according to mutually agreed roles and responsibilities in the deployment context (e.g. decided by practitioners and community, not fixed). The conflict arises if the roles and access is not being determined by those at the field level who need to have the information available, but being imposed by an external party whose assumptions may be misaligned with the effective practices of humanitarian work

Sociomateriality: As part of the design process, this theme highlights the characteristics of a complex context and considers the ability of technology to more deeply adapt with the ever-changing needs of the environment, such as individual technical literacy, culture, and language. The theme accounts for how the technological artifact will, in turn, influence and shape different organizational realities, both positive and negative. System flexibility stood out constantly as an important element as it mediates the way field workers operate with certain tools. In this sense, systems which have limited flexibility to adapt some of their functions per context fail to lighten up the burden of the field work.

Including the role of the designer, itself, being elevated to that of a negotiator and translator of the different needs from the several stakeholders (each with their own value-system), the malleability of the technology to flow at the bequest of the social drivers is imperative. Awareness of contextual factors enable one to balance the conflicting interests and align the negotiations to what is best for those in need. The designer in this environment is situated as a mutual co-creator; and needs a tool that can absorb, accommodate and adapt to the practices and particularities of a specific context, diverse stakeholders and their dynamic nature.

IS technology currently lacks the ability to iterate at this deeper level to accommodate this context. Methods such as task-oriented programming and modeling dynamic workflows are making inroads into merging the work of design and development through different coding languages (e.g. TOP[3]), as well as leaving the design open enough to be able to change in highly dynamic settings [25].

3 Task-oriented programming. A coding language recognizing audience terminology and merging the role of designer and developer – originally developed out of system design work with coast guard duty officers [25]

Accessibility: Successfully meeting information needs of the work in the field relies heavily on trust and social interaction between humanitarian practitioners and communities and giving voice and agency to communities. The diversity in technical literacy, culture, education and language within communities requires major efforts to bridge the social and technical. Tailoring a system specifically to the context and making it accessible and understandable for all stakeholders is a major challenge of systems design in the humanitarian context. These practices refer to SDBs such as Speaking with Cultural Competency (SDB3), Following Community Structure (SDB1), and Creating Clarity of Roles (SDB9). It is necessary to consider the technical environment of the deployment context, e.g. stakeholder proficiency with computers or smartphones. Supported input and output formats have to be adjusted accordingly, e.g. by offering paper-based alternatives to digital formats if technical literacy is limited, or if the context calls for an alternative system to cope with frequent power grid failures.

As humanitarians tend to work with communities who have different levels of literacy and ways for communicating, systems which are designed to input single data formats (e.g. Latin alphabet characters) can limit the way practitioners record data or communicate with communities as they might be in the need of doing the translation work from the language of the community (e.g. special characters or pictographic language) into the fixed format of the communication system they are given. In addition to it, this poses a barrier for the humanitarian organization, field workers, and aid recipients as they might feel an external form of communication alien to their own as being imposed to them.

This matrix serves as a form of thesaurus to translate the impact of technical design solutions on successful practice. It aims to align meaning from successful practices into a technical understanding and to reduce the gaps between these two domains. It identifies what is important in design from the humanitarian perspective, only this time using a technical language which can be understood in a simpler manner by those who are not familiar to humanitarian operations. As a tool in the greater framework process, it serves as a critical bridge in negotiation, so that a common understanding is derived.

2) Guidance Framework for Humanitarian IS Design:

While the Maturity Matrix provides a capacity to better assess if an IS or a design is aligned to the successful practices of humanitarian work, the Guidance Framework aims to address the need of effective communication between the technical community of IS designers and actors in the humanitarian domain to bring more helpful design solutions. In addition to it, it enables HAs a form of a screening process for identifying technology designers who have the will to engage in a design process which challenges embedded professional and personal assumptions that might not be valid and applicable to other domains.

The Maturity Matrix serves as a companion to the Guidance Framework, serving as a translation and mediation artifact for navigating the humanitarian practice-IT design conversation. We believe this artifact enables communication

of these two distant domains and attempts to draw them closer by highlighting the importance of what matters and is effective in terms of practice.

The Guidance Framework has been organized in three phases i) Recognition Phase, ii) Orientation Phase, and iii) Negotiation Phase. Each of these address capacities needed for negotiation between parties to happen. They move away from imposing directions or isolated decision-making processes and move towards facilitating co-learning among stakeholders. This way, the proposed technical solution will be an outcome of a co-design process among IS designers and humanitarian actors, which is adjusted to the applied domain needs and which promotes participation and involvement of practitioners and communities in a broader scale for making decisions.

Recognition Phase:

This is the first step of the designer's journey before entering into the domain. Prior to gaining a deeper knowledge of the terminology or effective practices, it is essential that the designer realizes the gap between his/her own working assumptions and those which might be part of a humanitarian context. It is this cognitive dissonance caused by conflicting realities and underlying values, which should drive the designer into stepping through the additional phases of this learning process.

To facilitate this, the Matrix might initially serve as a starting point to make the designer aware of the unique considerations of designing for the humanitarian domain. The conflicting paradigms can enable recognition of gaps in understanding and priorities. The Matrix's content is aimed to inspire designers to take a closer look at the criteria and concepts emphasized in the humanitarian domain; or to self-select out recognizing if their design methods are not aligned with the needs of humanitarian work.

The next phase will rely on the designer's initiative and motivation for learning about the humanitarian domain. If the designer shows willingness to mold his/her current design paradigms and adjust them to what the domain is requiring, he or she may choose to go deeper in understanding the humanitarian work environment.

Orientation Phase:

The Orientation Phase aims at orienting a designer to the humanitarian organization's existing value-system and basic understanding of effectiveness. The designer is provided literature on the domain, reflection exercises, a sample case study, and a test.

Through self-discovery, in this phase, the designer receives the opportunity to reflect on his/her own assumption about humanitarian effectiveness, and re-orient from phase one. After having acknowledged the existence of a more complex reality with different work practices and values (e.g. in comparison to those of a commerce environment), they increase their ability to properly recognize where principles of humanitarian effectiveness might be violated in designs of technical solutions. In this case, designers play a more active role to show their willingness and initiative towards the expected change through an acknowledgement of the socio-technical relationship. And thus, show their ability to consider contextual factors as part of their design process.

The phase is structured in three sub-steps (Self-Learning, Orientation Workshops, and Designer Test), each with literature and methods engaging designers in the learning process of the humanitarian domain. Ending with a practical case study to assess if the designer has reached the threshold to continue with the co-designing process of a technical solution for the context.

If the designer shows self-learning, they could move to working with a humanitarian practitioner on a case (possibly a problem they need a solution for). Such a step is envisioned as to begin a collaboration relationship with HAs to build trust and co-learning. It is opportunity to show if they can present their skills not as a strict design and development process, but as an adaptable toolset of technical knowledge to be used in a different way to design an artifact which impacts positively in the work of the HA.

Negotiation Phase:

This last phase highlights the importance for listening and understanding what the stakeholders need and the acceptance of the designer in a facilitation role vs. sole-decision-maker role. The designer is further on the development of a common language and engaging trust, for which he/she enters this phase as a mutual partner of the HA.

Through the incorporation of participatory methods that promote discussion and negotiation, designers and stakeholders work together towards a co-created solution which can operate within a complex context as it acknowledges the socio-technical relationship and their agents within this system. The nature of a participatory approach will make sure that the decision-making process stays within the stakeholders and is not reliant on the designer in isolation.

During this phase, the Matrix facilitates the design of an effective intervention into the complex context, by translating humanitarian effectiveness in a language shared with designers. This will allow the designed artifact achieves a high level of context fitness. For example, that it is adaptable to language, organizational culture, or situation.

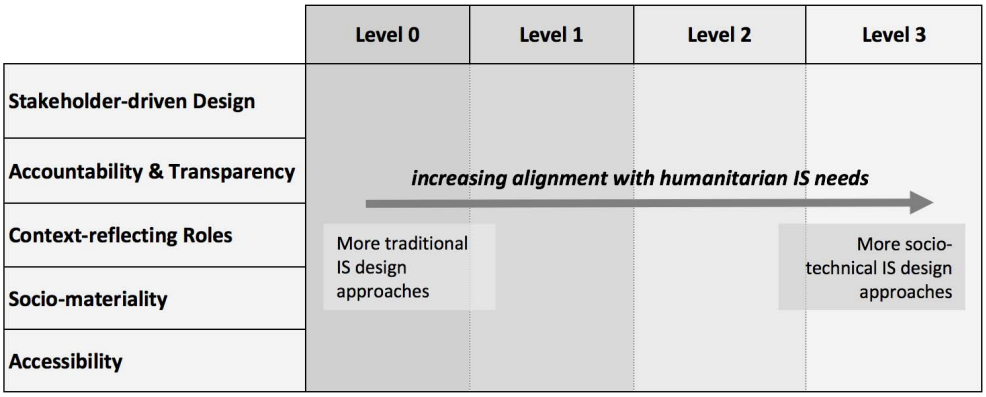

Fig. 2 - Representation of the Maturity Matrix

As a consequence, the designer is able to communicate and facilitate the IS design to HAs. The latter will make use of the Matrix to assess the design and screen for the appropriate elements of the technological solution which do not hinder the practices they consider to be effective. Moreover, HAs will be enabled to negotiate with designers on the socio-technical elements which are needed to achieve their mission of delivering help to those in need.

V. DISCUSSION

A. Limitations

The presented findings are grounded in broad and representative qualitative data, but the construction of the GAT has only been formatively iterated within the project team. An application and dedicated evaluation with project-external practitioners is missing so far. The appropriateness of the GF facilitating the process of IS design between the designers and humanitarians has to be executed, observed and analyzed in one or more real case scenarios. Depending on the experiences with the GF evaluation, the application of the Matrix will reveal its limitations and benefits for a collaborative co-design process between the involved stakeholders. Results need to be incorporated in further iterations of the Matrix.

B. The need for socio-technical maturity of system design methods

Based on the research, it was curious that as we mapped the technical approaches, we found that our four levels were aligned with some similar elements of the existing modelling paradigms:

(1) Level 0: Characteristics of Object-driven design founded on requirements emerged as the lowest level of maturity as basically the designer is the one making decisions and commanding the way a technical solution might look like

(2) Level 1: User-centered design elements which incorporate human interaction with devices could be seen at this level. Here the user has a role in influencing the way a technological product or service is being designed [26].

(3) Level 2: Human-centered design characteristics are introduced, incorporating a participatory approach of involved parties in the design solution. Here, we could consider that any solution would be an intervention in a system of systems. In the case of a technology solution, not only is the user being included as part of the process, but as design decision-maker, as well as including other individuals which might by indirectly linked to or affected by the final solution. Moreover, this approach focuses in reaching some degree of alignment between the stakeholders through an iterative design process [15].

(4) Level 3: is not entirely defined as it might represent an ideal state of complete stakeholder involvement with design, acknowledging the symbiosis of the socio-technical relationship in all its extensions. This level emerged in consideration of advancing methods – that there is still an opportunity (and need) for the existing socio-technical approaches (e.g. HCD) to take a step beyond in the acknowledgement of the complex context.

The first iteration of analyzing IS development through the lens of the thirty SDBs revealed that there were key recurring areas across the board that conflicted with the needs of the practice. Several design practices or IS elements were identified from what is considered as the traditional approach and which challenge the role of the designer as to whether this working mindset would be effective if applied to IS solutions in the humanitarian domain. For example, the way successful field workers make decisions with the communities they work includes an openness and involvement that requires complete transparency to what is recorded, how it is recorded, at the time it is recorded.

This is not currently part of what our design and development processes see as necessary and for that reason may not even be realistically possible with today's methods. The embedded lack of transparency in IS design creates as an obstacle to the access of practitioners to the relevant information owned and contributed by communities and most critical to successful outcomes.

These design or system elements and others like transparency of decision-making, data management or participation space came as recurring topics during the coding process. It is because designers normally operate under another

value-system which proves to work in other contexts, and raises the need for increased discovery and application of socio-technical methods

VI. CONCLUSION

Design and development of technology has excelled in a particular types of work domains. This paper is a call to go further into the socio-technical domains. The relevant technical themes that emerged provide a starting point to build upon. As we advance and validate the GAT, designers and humanitarian agencies now have an initial road map to better adapt the IS design and development process for accommodating the IS needs of the humanitarian values and culture. We believe the matrix and framework offer strong contributions to the field.

A. The humanitarian-IT rosetta stone

Our major intended contribution of this research is that it represents the first effort for a translation of meaning within these two different domains of IS design and humanitarian operations. The "rosetta stone" between these two domains lies in our effort to define technical processes as main design characteristics which considers, in their essence, those practices which proved to be effective in humanitarian work. A major takeaway from this work is that the framework can be used as a basis for future research. Most importantly, it has set a precedent on this unexplored field, contributing with an effort to start bridging the communication gap identified between designers and humanitarian organizations.

B. A framework for conducting human-centered design with humanitarians.

Three distinct components of HCD are system-focused vs. product focused, holistic approaches with multiple stakeholders, and including stakeholders as designers [27]. For it to be done successfully, it ultimately requires a shift in mentality for a designer. The steps and phases within the framework represent the learning journey of the technology designer through the development process of an effective humanitarian IS artifact while becoming familiar with the work and practices of the domain. In this experience, the designer recognizes the different working environment. The designer is presented with the choice to contribute in the domain not by providing a solution developed on his own, but to adapt his/her toolset of technical knowledge into a co-designing process which acknowledges the values and work practices of those with whom he/she is designing. Moreover, through the framework, use of HCD facilitates understanding of what is valuable for HAs and developing a trust relationship, where success of design, at its essence, is based on shared-understanding and negotiation.

Following an approach of learning through the experience of others and challenging the traditional paradigms of design, this paper aimed at developing a framework for the design and assessment of information systems in the humanitarian context. This not only required diving into a completely new domain, but also working on a problem that has hardly been addressed by other researchers before.

C. Taking the research forward

There is no ultimate solution to the problem. The proposed one, as a guidance approach, tries to abstract from concrete examples and give a general guidance as to how the design of IS for the humanitarian context needs to be approached differently than conventional software development projects in a business context.

The framework proposed is a first approach to enabling the design of IS that fit the needs of humanitarian organizations and communities involved in the work. The proposed solution is an effort to translate factors that make humanitarian work by practitioners in the field successful to IS designers and connect it to aspects of IS design that can potentially support these factors, when being incorporated into the design process. Greater iteration and validation is needed to deliver a usable tool.

Further, taking the research forward in the future, we would expect to include advancing knowledge and tools to involve co-creation and support of community input. Practitioner/Community-centered design is the ultimate goal of humanitarians in support of their mission. To best support the mission, providing technology that enables a high level of community involvement is needed.

D. Beyond humanitarian impact

Going beyond the humanitarian domain, these concepts might offer advances for other contexts, as the human-centered approach that was taken can potentially enable a more effective design of IS in other scenarios as well. This expansion of the Maturity Matrix to other fields comes from the discussion of whether the communication gap is exclusive to the humanitarian domain, or a more general problem. As expected, even though the humanitarian domain possesses very particular characteristics that sets it apart from other domains (e.g. commerce), the problem of translating meaning is present in several other fields. Mainly because of the already mentioned underlying value systems and difference in priorities for considering what is relevant and successful within the structure of an organization. All of this provides us enough argument and opportunity for thinking of such an expansion.

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