

Representing Goals, Needs and Outcomes in Social Work

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Abstract

Social services play a vital role in modern societies worldwide, with increasing interest and investment in their improvement. Efforts are being made to modernize the field and enhance the effectiveness of service provision by focusing on outcomes. However, the inconsistent and incompatible definition and use of service goals, needs, and outcomes pose challenges. The lack of clear semantics makes it difficult to understand and utilize the collected data, impeding decision support systems and information integration. In this paper, we review various interpretations and usages of social work goals, needs, and outcomes, and analyze the challenges in representing them. We propose an ontology that centers on representing stakeholder goals, needs, and outcomes, showcasing its utility in validating logic models and theories of change used by social services agencies.

Keywords

ontologies, knowledge engineering, knowledge representation and reasoning

1. Introduction

Effective machine-processed information is crucial for the success of social work interventions. However, existing frameworks struggle to address the challenges in this domain. Terminologies used by different communities of practice are often informal and incompatible, hindering information collection, processing, and sharing. Formal frameworks, such as ontologies, offer a solution by enabling the representation, organization, and storage of information with automated reasoning capabilities. In the context of social work, stakeholder (e.g., client, community) goals, needs, and outcomes lack sufficient formalization. To address this, we propose a framework aimed at establishing a principled operationalization of social service provision.

Our framework provides a common terminology for data storage and access, along with a methodology for capturing stakeholder information. It facilitates needs discovery, matching services to needs, and continuous outcome monitoring. It integrates with existing frameworks and supports extensions for activities like appointment scheduling, service planning, needs evaluation, and progress documentation. By employing an ontology to capture core knowledge about goals, needs, and outcomes, our proposal serves as a data model and infrastructure

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for social work information systems. Additionally, it helps reduce ambiguity and resolve terminological discrepancies among sub-fields and communities of practice.

This paper is organized as follows. Section 2 presents background on existing work and representational frameworks relevant to describing goals, needs and outcomes in social services. Section 3 introduces a set of use cases that grounded our work, describe the requirements engineering process used and define the scope for the conceptual model presented here. Sections 3, 3.7 and 3.8 define the main classes being proposed. The paper concludes in section 4 with a discussion of avenues for future work.

2. Background

Client and community goals form an essential part of the rationale for the provisioning of social services, yet they lack standardization, varying approaches being used to elicit and record them. Goals can range from imprecise formulations that reference actions to be taken, e.g., “engaging people”, to statements about desired values for measurable characteristics, e.g., “the client’s daily alcohol intake will be 0”. The inconsistent expression of goals within and across organizations hinders assessment and comparison.

The lack of consensus in defining and representing goals is not unique to social services but is observed across disciplines such as economics [1, 2, 3, 4], psychology [5], philosophy [6], sociology and social work [7, 8] and computer science [9, 10]. Research in psychology and organizational behavior has focused on goals as motivators, emphasizing conscious goal setting [11]. Goals are often defined as the aim or end of an action, consisting of content and intensity components. However, due to vague definitions in the literature, these components are rarely differentiated in practice.

At the other end of the spectrum, computation-oriented fields tend to use precise statements, e.g., constraints on *states* [12, 13]. For example, in *goal-oriented* Requirements Engineering (RE) approaches, explicit identification and management of stakeholder goals is an integral part of the process. They capture, at different levels of abstraction, the aims a system should achieve, their formulation referencing the properties intended to be ensured.

Goals can be expressed using different degrees of formality, from natural language descriptions, to diagrams and assertions written in a formal language [14]. The informal and semi-formal approaches to defining goals are often imprecise, as the meaning of the entities appearing in goals is simply encapsulated in the names used for them in the natural language description provided. Relationships between entities are also often only loosely defined. Formal approaches, for example those based on languages such as Telos [15], support capturing a richer semantics, including temporal information such as the fact that a particular situation will happen eventually, never, or for a limited time. Increasing the precision with which goal semantics is captured has the added benefit of allowing meta inferences about goal composition, similarity, and conflict, as well as about causal relationships that may exist between goals. For example, sometimes client voiced goals, such as the desire to remain unhoused, conflict with goals, such as participation in a residential addiction treatment program, set for the client by a social worker. Managing conflicts among various stakeholder viewpoints and goals is a major concern in RE, which we do not consider here. We leave tackling the representation of conflicting perspectives

to future work.

The notion of goals has been present in another computation-oriented area, artificial intelligence (AI), for almost as long as the field has been in existence. Goal models appear in AI in various approaches, among the most widely known being those that use planning languages (e.g. PDDL) and action programming languages (e.g., GOLOG). Goals, things that agents want to be true, are stated as logical formulas (e.g., [16]). Goals are also central to machine learning (ML), especially reinforcement learning (RL) and deep learning (DL) [17]. Goals in ML can be anything from traversing a maze to providing answers when presented with a query/prompt. There is no standard methodology for expressing agent goals in ML and often, the goals are simply hard coded, despite the ability of ensuring alignment between the goals of human and artificial agents being a major concern.

Regardless of how they are expressed, however, across domains, goals are considered to influence the behaviour of the agents who pursue them, or of the agents who design systems aimed at fulfilling them. In order to capture the sensitivity to the human condition that permeates social sciences and provide the precision required for operationalizing goals in a way that allows for objective measurement and instrumentalization, we meld in our proposal approaches from social sciences such as psychology, where a goal is considered, for example, a “cognitive representation that guides behavior to a competence-related end state that the individual is committed to either approach or avoid”, [11], and computational sciences, such as software engineering, where goals refer to “intended properties to be ensured” [12].

Introduced by Doran et al. [18] decades ago, the SMART (*Specific, Measurable, Attainable, Realistic, Time-bound*) criteria for formulating goals are receiving increased attention in social work. For example, in order to comply to the SMART criteria, a goal such as “the client will stop drinking” should be revised to contain a measurable feature and a timeline, e.g., “by December 31st, 2023 the client’s daily alcohol intake will be 0”, and be deemed attainable and realistic by the goal setter, the social worker in this case. Our proposal aims to support the formulation of SMART goals and, since consensus related to methods for assessing the attainability and realism of goals is lacking, we focus on the remaining three criteria.

As our work seeks to support grounding the social work practice in measurable and actionable evidence, and linking the provision of social services to expressed intentions (and desired outcomes), the social sciences discourse focused on whether *human needs* are contingent on (*human*) *goals* is also relevant to our framework.

A substantial portion of the scholarly conversation about needs involves identifying and defining “basic human needs” and their relation to other types of needs. Maslow’s hierarchy [19] is a commonly cited typology that ranks needs based on the assumption that lower-level needs must be satisfied before higher-level needs can be addressed. This hierarchy includes physiological, security, social, esteem, and self-actualization needs. Recent work has extended this approach to the social service space, providing formal definitions for client-ranked needs and practical-ranked needs imposed by service constraints [20].

Other frameworks propose alternative categorizations of needs. Desmet et al. proposed a classification containing 13 fundamental needs and 54 sub-needs, also challenging the idea of a strict need hierarchy [9]. Max-Neef introduced the idea of needs (subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom) forming a network rather than a hierarchy, and was also one of the first to discuss the role of need

satisfiers in the fulfillment of needs [21]. Needs are often expressed indirectly through proxies, such as identifying a potential satisfier, e.g., “I need English tutoring”. However, formulating needs in terms of specific satisfiers can obscure the true nature of the need [2] and lead to suboptimal provision of services.

The approach proposed in this paper was informed by the use cases collected via the COMPASS project¹ and by those provided by the local social services agencies we collaborate with [22]. The ontological choices we have made in this work are aimed at enabling a representation of the knowledge in the social work domain that supports the structuring of client management and social services provision based explicitly on goals, needs, need satisfiers and outcomes. While the formalization of needs in the context of social services has been considered in previous work [23, 10], open access evidence of conceptual analysis and formalization of client *states*, *problems*, and *goals* and *outcomes* is scant. The ontological choices we have made are aimed at enabling a representation of the knowledge in the social work domain that supports the structuring of client management and social services provision based explicitly on goals, needs, need satisfiers and outcomes.

(Since the formulation of goals precede the articulation of needs, we do not consider that once a need satisfier X is selected, the *need for X* becomes an instrumental goal.)

Goals, needs and outcomes are related via the characteristics that anchor them. For example, a client’s imprecisely defined goal *to be sober soon*, could be operationalized, using the *daily alcohol intake* as the anchoring characteristic, as follows: *at the end of July 2023, the (client’s) daily alcohol intake will be 0*. This formulation provides a timeline, *July 2023*, as well as specificity as the daily alcohol intake is a commonly used and can be objectively measured.

The intended semantics of the concepts in the proposed representational framework are described in natural language. The framework is axiomatized in the Web Ontology Language (OWL), with the resulting artifact being part of the COMPASS Ontology². The ontology has been designed to facilitate the correct management and exchange of client and services information among the systems operating in the social work domain. Among the applications we have considered are social services modeling, matching services to client needs, individual and group service planning (e.g. scheduling appointments and issuing referrals).

3. Ontology Development

The framework was developed according to the following steps. First, *requirements gathering* allowed us to develop a clear understanding of the domain and required scope of the ontology. We used motivating scenarios, provided as user–stories and specified as competency questions (CQs) by our partner organizations, who are active in the field of social work. (We strived to achieve *completeness* with respect to the representational requirements while keeping the size of the ontology at a manageable level, given that very large ontologies can cause scalability problems and increase the complexity of reasoning.) Second, whenever possible, existing ontologies, e.g., the Time Ontology, that are suitable for *re-use* were identified and included in the development. Third, concepts to be included in the ontology were identified using a

¹<https://www.digitalsupercluster.ca/projects/compass/>

²Compass Ontology: Available at <https://github.com/csse-uoft/compass-ontology>

methodology that combined (1) a bottom-up procedure based on the motivating scenarios provided by the partner organizations, as well as (2) a top-down approach focused on relevant literature in the pertinent domains, such as social work, sociology, and psychology. Finally, the evaluation of the ontology was addressed by first assessing for coverage against the competency questions specified in the requirements gathering stage. The appropriateness was verified by domain experts. Then, the usability of the ontology was assessed considering concerns such as the human ability to formulate queries of interest using a system that incorporates the ontology, the accuracy of responses provided by the system's inferential/query component, the degree of explanatory capability offered by the system, etc. (The ontology is included in two systems: (1) as the core of a comprehensive platform for social services provisioning developed as part of the COMPASS project and as part of a specialized module for managing refugee programs coordinated by Canadian settlement agencies.)

3.1. Use Cases and Competency Questions

Our partner organizations developed uses cases and an initial set of CQs based on their domain expertise and we augmented this set with questions we developed independently with the help of other social work stakeholders. CQs are a set of questions that a representational framework must be capable of answering. For example, “*What are the goals of client X?*”, “*What are the needs of client X?*”, “*What are the outcomes for Client X after 6 months of receiving English as a Second Language training?*” or “*What are the outcomes for Community Y after the completion of the Refugee Awareness for Inclusive Communities initiative?*”. (An in-depth discussion of the uses cases provided by the domain experts is beyond the scope of this paper and in the following we will refer directly to the questions developed based on them.)

Service providers, as well as funders, often express what specific social programs and interventions intend to do via *theories of change*. Many different theory of change frameworks exist, with established communities of practice often designing and adopting for use their own representational infrastructure. Although no methodological consensus has been established to date, the main components of a theory of change are the activities proposed and the expected results of those activities at individual and community levels. Goals are taken into consideration during the process of designing programs and interventions, but frequently are either not included explicitly in the theory of change, or are conflated with the expected outcomes. Regardless of the actual representational infrastructure used, social work theories of change agree that the root of all goals is a desired change, moving from one state to another, more desirable one, and that the journey to achieving it, which starts with a goal, is punctuated by outcomes.

In the remainder of this section we introduce the core concepts and properties, accompanied by the competency questions (CQs) that motivated them. The purpose of this core is to axiomatize a set of intuitive semantic primitives that is adequate for describing the fundamental notions relevant for social work stakeholders (e.g., clients, communities, service providers, funders). The characterization of the basic social work stakeholder-related concepts makes few assumptions beyond what is needed to describe them and has, therefore, a relatively weak logical expressiveness. The basic ontological commitments of our proposal are based on scenarios that will be detailed before introducing each concept (and property).

3.2. States

CQ: What is the current state of my client?

Relevant classes: *StakeholderState*, *CurrentState*, *DesiredState*, *HumanState*, *ClientState*, *SocialBarrier*, *CommunityState*, *OrganizationState*

We define a *StakeholderState* as the condition of a stakeholder with respect to its circumstances, often, but not necessarily durable or lasting. This generic notion of state is further specialized into states pertinent to the various types of social work stakeholders, i.e., *Human State*, *Community State*, *Organization State*.

$$\forall x, CurrentState(x) \rightarrow StakeholderState(x) \quad (1)$$

$$\forall x, DesiredState(x) \rightarrow StakeholderState(x) \quad (2)$$

$$\forall x, y, hasStakeholderState(x, y) \rightarrow Stakeholder(x) \wedge StakeholderState(y) \quad (3)$$

Human states³ range from physiological states such as “is feeling hungry”/“has a sense of hunger”), to more complex cognitive constructs, such as “is unable to communicate in English”, “feels fulfilled in one’s chosen career” and “is successfully integrated into the host country’s society”. We specialize *human states* by introducing *client* and *community states*, both of which are relevant to the practice of social work. We assume that regardless of their *currentstate*, stakeholders prefer to be in certain states, their **desired states**. (Desiring to be in a certain state constitutes a goal in our framework.)

$$\forall x, ClientState(x) \rightarrow HumanState(x) \quad (4)$$

$$\forall x, y, hasClientState(x, y) \rightarrow Client(x) \wedge ClientState(y) \quad (5)$$

States are defined by formulas that constrain the value of relevant characteristics. For example, one can define the state of a person depending on the values of their *immigration status* characteristic. For example, person’s state is (1) “is a permanent resident of Canada” if (the value of) their *immigration status* is “permanent resident”, (2) “is a refugee claimant”, if (the value of) their *immigration status* is “refugee claimant”, etc.

Various local governments and agencies serving newcomers have introduced alternative terminologies to specify the immigration status of a person (and the various states the person can be in, based on it) in ways that better suit their needs and it is desirable, necessary even, for the information systems operating in this space to be able to handle multiple parallel vocabularies. Our proposal supports associating the instances of states (and other ontology classes) with multiple such externally defined terminologies.

It must be noted that in practice, client and community states are often ascertained manually by social workers and asserted directly in the client files and other documents. Nonetheless, ontology-based mechanisms for defining client and community states based on their characteristics allows organizations to automatically infer states based on the primary information recorded about these characteristics in their information systems.

³We adopt the notion of a human “state” at a moment in time, and recognize that other representations adopt the notion of processes, such as feeling an emotion [24]

The basic *ClientState* class has the following object properties:

- *isBarrierFor*: links to instances of type *ClientState* that specify the other states that could be adversely affected by this state.

$$\forall x, y, isBarrierFor(x, y) \rightarrow ClientState(x) \wedge ClientState(y) \quad (6)$$

- *hasTimeScale*: specifies the timescale of the state, e.g., a person experiencing “chronic homeless” is define as having the “chronic” time scale, differentiated from other scales, such as “acute”, “episodic”, “short-term”, “medium-term”, “long-term”.

$$\forall x, y, hasTimeScale(x, y) \rightarrow ClientState(x) \quad (7)$$

- *hasCode*: specifies zero or more codes, corresponding to state classifications created by various organizations

$$\forall x, y, hasCode(x, y) \rightarrow ClientState(x) \wedge Code(y) \quad (8)$$

Object properties *hasStatus* and *hasClientState* link instances of clients to instances that specify, respectively, their status and state.

3.3. Problems

CQ: What are my client’s problems?

CQ: What are my community’s problems?

Relevant classes: *StakeholderProblem*, *ClientProblem* *CommunityProblem*

We assume that the difference between the actual and the desired states (or the existence of a risk related to exiting a desired state) is perceived by stakeholders as a problem to be solved, i.e., the *problem* (class *StakeholderProblem*, *ClientProblem*, *CommunityProblem*, *OrganizationProblem*) is a cognitive representation of the discrepancy between an actual state and a desired state.

The use of the term *problem* has a long history in social work. Problems are used to identify the key areas related to clients’ circumstances and are often recorded in client files as proxies for client needs. We assume that a problem activates the motivation to solve it and that this, in turn, leads to formulating *goals* for achieving the desired change in state(s), and further to identifying the *needs* related to attaining the goals, picking *satisfiers* for those needs and selecting *services* that provide the satisfiers. The object property *hasProblem* links instances of clients (individuals, groups, such as constituent groups,⁴ and communities) to instances of class *Problem* that specify the issue that they are facing.

$$\forall x, y, hasProblem(x, y) \rightarrow ((Client(x) \vee Community(x)) \wedge Problem(y)) \quad (9)$$

⁴A constituent group is a group that sponsors refugees to Canada on behalf of a Sponsorship Agreement Holder.

3.4. Goals

CQ: What are my client's current goals?

CQ: What are my community's current goals?

Relevant classes: *StakeholderGoal*, *ClientGoal*, *GroupGoal*, *CommunityGoal*

Alleviating, resolving or eliminating a problem (e.g., experienced by stakeholders) is integral to the operationalization of needs. The first step after a problem is identified is to determine the goals associated with solving it. The object property *hasGoal* links stakeholders (e.g., individual clients, groups and communities) to their goals.

Goals can be divided based on various criteria, and can be formulated at several levels of abstraction (according to what is suitable for the relevant community of practice) from an informal characterization based on a controlled vocabulary to a logical formula that specifies the values the relevant stakeholder characteristics must have on a particular date. For example, a client's goal might be for their English language level⁵ to equal 10 by December 31, 2023.

A goal can consist of several sub-goals whose fulfillment contributes to meeting the parent goal, i.e., instances of type *StakeholderGoal* can be linked to other *StakeholderGoal* instances via object property *hasSubGoal*. This mechanism for capturing goal dependencies is similar, but not identical to the goal decomposition strategies employed in Requirements Engineering, as only the connection between parent and child goals is captured. More expressive dependencies, such as the fact that a specific parent goal is fulfilled if and only if its two component goals are fulfilled, is captured via rules.

Goals reveal needs. The object property *inducesNeed* links goals to the needs they engender.

$$\forall x, y, \text{hasGoal}(x, y) \rightarrow \text{Stakeholder}(x) \wedge \text{StakeholderGoal}(y) \quad (10)$$

$$\forall x, y, \text{hasSubGoal}(x, y) \rightarrow \text{StakeholderGoal}(x) \wedge \text{StakeholderGoal}(y) \quad (11)$$

$$\forall x, y, \text{inducesStakeholderNeed}(x, y) \rightarrow \text{StakeholderGoal}(x) \wedge \text{StakeholderNeed}(y) \quad (12)$$

Goals are characterized by properties such as their *name* and their *description*. *Qualitative* attributes such as *priority* and *optionality* facilitate goal ranking and conflict resolution. (Other qualitative attributes such as *feasibility* and *usefulness* will be considered in future extensions of the framework.)

In order to support refinement, validation, conflict management, explanation and evaluation, goals must be specified as precisely as possible. At the same time, formal specifications that allow for the application of more powerful reasoning mechanisms due so at the price of a higher specification effort/cost. Domain practitioners, who normally have limited technical training, may find semi-formal approaches much more accessible and therefore, the availability of information systems that can assist domain experts with producing precise specifications are essential to the successful field deployment of any formal representational framework.

3.5. Needs

CQ: What are the unmet needs of client X?

⁵e.g., as defined by the Canadian Language Benchmarks (CLB)

CQ: What needs are clients presenting to staff?

CQ: What are the needs of community Y?

Relevant classes: *StakeholderNeed*, *ClientNeed*, *GroupNeed*, *CommunityNeed*, *ExpressedNeed*

Needs provide the conceptual focus for social work practice and several theoretical conceptualizations of human needs have been developed to date. In view of social work's imperative to act in a concrete manner to alleviate the situations experienced by clients, in our framework a need is explicitly connected to a goal, and through that to the problem that induced it. Meeting a need has as a consequence the fulfillment or partial fulfillment of the goal that induced it.

In our ontology, a client need (class *ClientNeed*) defines the changes needed in a client's state and relies on two elements: (1) a type of measurable feature that would be changed (or maintained), such as life skills or mental health state, and (2) an action (e.g., *improve*, *acquire*, *develop*) that enacts the change (or maintains the status quo).

Operationalizing client needs as differences between measurable/observable features allows us to 1) infer a client's current needs, and 2) check the satisfaction of a need via observable client outcomes. Tools for needs-assessment of clients used in social work collect two types of needs (used for prioritizing services as well as for reporting on client outcomes and client satisfaction) [25]. *Normative needs* are those identified by the social worker or clinician administering the assessment instrument. *Expressed needs*, those described by the client, parent or legal guardian. A client need can be both normative and expressed.

3.6. Areas of Concern

CQ: What needs related to housing and homelessness are being referred for?

Relevant classes: *AreaofConcern*

In the practice of social work, needs are often are grouped by reference to areas of concern, e.g. health-related needs, employment-related, needs, parenting-related needs, housing-related needs, etc. The grouping of needs based on areas of concern aligns well with our conceptualization of need. The *areas of concern* are defined by each community of practice. A need may belong to several areas of concern. Needs are linked to areas of concern via the object property *belongsTo*.

3.7. Need Satisfiers

CQ: What supports are available (locally) for my client?

CQ: Which services match mental health-related needs?

Relevant classes: *NeedSatisfier*

Needs are met by *need satisfiers*, which include various categories of *beings*, *havings*, *doings* or *interactings*, from concrete resources such as goods and money, to the more abstract laws, mechanisms, tools, processes, opportunities and settings where the needs are met. In our framework, need satisfiers, represented by class *NeedSatisfier*, are provided via (social) services. This helps define a clear relationship between social services and the target needs, via the *need satisfier* being provided. Many communities of practice divide need satisfiers in the following categories, including *resources* (e.g., goods, money, facilities, housing), *knowledge and information* (e.g., training, coaching, education, legal advice), and *supports* (e.g., companionship,

supported transportation). However, there is no universal classification that all communities of practice have agreed to follow.

Object property *forNeed* links instances of need satisfiers to instances of *Need*, specifying the needs the satisfier (partially) fulfills. Object property *hasNeedSatisfier* links instances of needs to instances of *NeedSatisfiers*, specifying the satisfiers that can (partially) fulfill the need. Object property *changes* links satisfiers to instances of *StakeholderCharacteristic*, specifying the characteristic changed by the satisfier. For example, *one-on-one English training* is a satisfier that will positively affect the ability of a person to communicate in English. A *rent supplement* will positively affect the ability of a person to pay their rent, will also decrease the person's risk of eviction, etc. It should be noted that it is assumed that for a satisfier to be linked to a need, the satisfier must be able to change a characteristic that is relevant for the need.

3.8. Outcomes

CQ: What are the outcomes of client X after attending English classes for newcomers for six months?

CQ: What are the outcomes of community Y at the end of the initiative to improve immigrant readiness?

Relevant classes: *Outcome*

In our framework, outcomes are directly related to the needs that were identified and for which the stakeholder (e.g., individual client, group, community) has received services. They are expressed in terms of the characteristics that were affected by the social intervention provided. For example, if the ability to communicate in English (e.g., measured as a CLB level) of a newcomer youth who received one-on-one tutoring has ameliorated, the corresponding outcome is "improved CLB level". This information is recorded via two properties associated with outcomes, the *type of change* observed, i.e., "improved", via object property *hasChangeType*, and the *characteristic* that was affected, i.e., "CLB level", via object property *forCharacteristic*. We plan to extend the current framework to accommodate more complex outcome descriptions that would include also information about the size of the change, e.g., an improvement by 20%.

We have evaluated our proposed framework for correctness and completeness by demonstrating that it meets all the requirements captured in the CQs provided by our partners. Details of the evaluation, including translations of the CQs into SPARQL queries, are provided in [22].

4. Conclusion

In current social work practice, client and community needs are often reported and categorized based on the social services provided to address those needs. However, this approach obscures the actual needs and hinders accurate assessment of service gaps and intervention impact. Our work contributes to a deeper understanding of goals and needs in social work practice by operationalizing them through measurable characteristics. The proposed core ontology enables the recording of goals and needs while highlighting their connection to underlying states and the link to social services through satisfiers. The ontology's competency and completeness were evaluated by demonstrating its ability to answer competency questions posed by subject matter experts using SPARQL.

In future work, we plan to expand the ontology to allow for capturing relative changes and facilitate the analysis of service provision at the community level, the identification of service gaps, and the optimization of the service mix. Additionally, we aim to analyze and operationalize client satisfaction and its relationship with achieved goals and outcomes.

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