## Deliverable D – Normalization Report

### Introduction

The report summarizes the levels of normalization achieved for three ERDs designed to address the UNWFP "Where We Work" case study focusing on SDG-02 Zero Hunger. Each of the options aimed at satisfying different functionalities of the UNWFP's mission. It examines the stages of normalization reached, justifies the level each achieved, and addresses the potential impacts of further normalizations.

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**ERD 1: Countries and Projects Focus**

1. **Normal Form Achieved**:
    - **3NF** (Third Normal Form)
2. **Justification for 3NF**:
    - ERD 1 incorporates the key entities **Countries**, **Projects**, **Donors**, and **ProjectStatus** with attributes fully dependent on primary keys. For example, in the **Projects** table, non-key attributes such as **ProjectName**, **Description**, and **StartDate** are fully functionally dependent on the primary key, **ProjectID**. No transitive dependencies exist between non-key attributes, fulfilling 3NF requirements.
3. **Appropriateness of 3NF**:
    - In a nutshell, 3NF is the design that will work best for this. It ensures that data related to the projects and their respective countries are well organized with no redundancy. Each country will link with multiple projects and donors without duplication. This structure reduces the amount of storage needed and avoids update, insert, and delete anomalies; hence, it is appropriate for country level-project level data management.
4. **Impact of Further Normalization**:
    - Further normalization beyond 3NF-for example, Boyce-Codd Normal Form-would be neutral. This design is already reduced in redundancy and maximized in data integrity; further normalization is unlikely to enhance performance or clarity in the structure of the data.

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**ERD 2: Countries, Volunteers, and Events Focus**

1. **Normal Form Achieved**:
    - **3NF** (Third Normal Form)
2. **Justification for 3NF**:
    - ERD 2 incorporates entities like **Countries**, **Events**, and **Volunteers**. In this model, each event and volunteer entry is directly dependent on the **CountryID**, with no partial or transitive dependencies among non-key attributes. For instance, in the **Events** table, attributes like **EventName** and **Description** are fully functionally dependent on **EventID** (primary key), confirming the table's conformity to 3NF.

3. **Appropriateness of 3NF**:
    - Achieving 3NF in this design would ensure that the data is accurate in terms of tracking events and volunteers in different countries. This model supports the needs of UNWFP in effectively managing and organizing data concerning events. Because the relationships between events, volunteers, and countries are non-redundant, 3NF fits perfectly in maintaining the integrity of the data in the database.
4. **Impact of Further Normalization**:
    - Further normalization would have a neutral impact. As the 3NF design already eliminates redundancy and maintains functional dependency, moving beyond 3NF would neither significantly reduce redundancy nor improve data management for events and volunteers.

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**ERD 3: Emergency and Work Types Focus**

1. **Normal Form Achieved**:
    - **3NF** (Third Normal Form)
2. **Justification for 3NF**:
    - ERD 3 focuses on emergency-related data, including **EmergencyCountries** and **Work**. In this schema, non-key attributes within tables depend solely on primary keys, with no partial or transitive dependencies. For example, in the **Work** table, attributes such as **FocusArea** and **Impact** depend directly on **WorkID**, satisfying 3NF.
3. **Appropriateness of 3NF**:
    - This 3NF structure is appropriate because it organizes emergency and work-related data without redundancy, ensuring that countries experiencing emergencies can be linked directly to relevant work types. This design minimizes anomalies and ensures data consistency across emergency data.
4. **Impact of Further Normalization**:
    - Further normalization is unlikely to have any positive effect. As the 3NF structure reduces redundancy and improves integrity for data concerning emergencies, it can be assumed that higher forms of normalization will not be able to provide additional advantages.

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**Conclusion**

All three ERDs achieve 3NF, ensuring efficient data management and reduced redundancy across entities such as Countries, Projects, Events, and Emergency Situations. Higher levels of normalization would likely have a neutral impact on each design, as 3NF already supports data integrity and efficient data retrieval for the UNWFP's operations under SDG-02 Zero Hunger. The database designs are thus optimized to meet the core functionalities required by the case study.