INNOVATION CASE STUDY

November 2019

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Height/Length Measurement Devices Project

EVALUATION OFFICE

Evaluation of Innovation in UNICEF Work
Case Study: Height/Length Measurement Devices Project

United Nations Children's Fund
Three United Nations Plaza
New York, New York 10017
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This case study report for the Height/Length Measurement Devices (HLMD) Project is one of thirteen innovation case studies which were conducted as part of a global evaluation titled "Evaluation of innovation in UNICEF work'. The case study component of the evaluation was conducted by Deloitte LLC. The HLMD case study report was prepared by Edward Thomas, Katherine Arblaster, Ariel Kangasniemi, Laura Maxwell and Adarsh Desai. Beth Plowman, Senior Evaluation Specialist, Evaluation Office led and managed the overall evaluation process in close collaboration with the Supply Division.

See innovation case studies at: https://www.unicef.org/evaldatabase/index_103533.html.

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LIST OF ACRONYMS

AC	Advisory Committee
APC	Advance Purchase Commitment
ARIDA	Acute Respiratory Infection Diagnostic Aid
CO	Country Office
DHS	Demographic and Health Surveys
DRP	Division of Data, Research and Policy
EO	Evaluation Office
HLMD	Height/Length Measurement Device
IRB	Innovation Review Board
IU	Supply Division Innovation Unit
LSMS	Living Standard Measurement Study
LTA	Long-Term Agreement
MICS	Multiple Indicator Cluster Survey
MNC	Medicines and Nutrition Centre
PD	Programme Division
PIP	Product Innovation Project
R&D	Research and Development
RFP	Request for Proposals
SD	Supply Division
SDGs	Sustainable Development Goals
TPP	Target Product Profile
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

Since 2014, UNICEF has embraced innovation as one of its key strategies to achieve results for children. That commitment is reaffirmed in its current Strategic Plan, 2018-2021, and is evident in the organization's programming and institutional architecture. Indeed, since 2014, significant progress has occurred in a relatively short period of time, backed by clear strategic intent and targeted investment. With the increased foothold of innovation in UNICEF, it is important and timely to take stock of these efforts through high quality evidence to inform decision-making, learning and accountability. In keeping with the need for this evidence, UNICEF conducted an global evaluation of innovation in 2018.

The objective of the global evaluation was to assess UNICEF's 'fitness for purpose' to employ innovation as a key strategy to achieve the outcomes and goals defined in its strategic plans covering the period 2014-2021. A set of innovation case studies was a key element of this global evaluation, along with an organizational assessment and a synthesis project. The case studies were guided by three objectives:

- To provide detailed descriptions of a set of innovations across stages of the development continuum inclusive of contextual influences
- To assess the application of innovation principles or other standards for a set of innovations with particular attention to issues of ownership and scale
- To produce clear conclusions and considerations for policy, strategy and management decisions to further enhance innovation as key change strategy.

Case studies were conducted by Deloitte LLP over the period February 2018-January 2019. Mixed methods were utilized for data collection including key informant interviews, document review and observations in the field.

The innovation case examined in this report concerns the Height/Length Measurement Device (HLMD) Product Innovation Project (PIP) will drive improvements to current measuring devices and development of novel products. New and/or improved products are intended to improve data quality, for use in household surveys and health facilities in programme countries. The UNICEF Supply Division (SD) employed a model of co-creation with industry through competitive procurement processes. The Project Team utilized a Target Product Profile (TPP) describing the purpose of a new (or improved) product, including the minimum and ideal performance criteria. A Request for Proposals (RFP) was then launched, with the objective of establishing long-term agreements (LTAs) with manufacturer(s) for procurement of improved HLMDs. As of October 2018, two devices that met the criteria of the first tender process have not yet reached commercial availability; prior to procurement through SD, products must obtain regulatory approval and complete accuracy studies.

PIPs at SD are governed by the Innovation Review Board (IRB), which is responsible for decision-making. The Advisory Committee (AC) of experts provides technical expertise when requested by the Project Team, but engagement could be optimized for greater consistency and to better leverage expertise. The HLMD project is led by a diverse Project Team, with membership from the SD Innovation Unit (IU) and Medicines and Nutrition Centre (MNC), Programme Division (PD) and the Division of Data, Research and Policy (DRP), and is responsible for day-to-day decision-making. While the composition of the Project Team provides a wide range of subject matter expertise strengthening the project as a whole, challenges with communication and alignment on expectations have been identified.

Limited financial resources have been required for project activities prior to field trials, as Project Team members sit within their respective divisions and/or units, and contributions are in addition to their regular duties. Further, investment in the research and development (R&D) of new and/or improved products is made by developers and manufacturers, rather than UNICEF. UNICEF provided value to manufacturers by

developing a description of the required and ideal requirements of HLMDs in the TPP, its expertise on user needs, and coordinating and covering the cost of field trials. However, there is uncertainty regarding who should hold responsibility for field trials of product innovations, and the need for acceptability studies to better understand if devices meet end-user needs in programme countries, and whether they are caregiver- and child-friendly.

HLMDs selected through the first tender process have not yet completed field trials and/or obtained regulatory approval required for procurement through SD, and have therefore not yet been used at the programme level. The ideal outcome of the PIP is commercial availability of HLMDs that meet global demand and improve data quality at household survey and health facility levels; however, it is unclear how UNICEF will facilitate scale-up and generate demand for devices.

Teams considering user-centred and demand-driven approaches to innovation should take away a number of lessons learned from the innovation pathway taken by the HLMD project so far. With respect to innovation broadly at UNICEF, teams should continue to validate the need for innovations, to ensure investment in projects that are demand-driven. Further, diverse Project Teams and expert advisory groups can provide significant value to innovation processes; however, communication should be strengthened with greater opportunities for meaningful engagement. Finally, UNICEF should develop a knowledge generation and sharing plan to disseminate project status, outcomes and device performance, and consider strategies for demand generation (e.g., results of acceptability studies) and scale-up early in the project, to ensure that innovations are used at the programme level following project completion.

1. INTRODUCTION

The world is changing faster than ever before, and so too are the challenges facing its most vulnerable. Conflict and displacement, disasters and climate change, urbanization and disease outbreaks are growing increasingly complex and inter-related, demanding new strategies and approaches. Innovation for development – exploring new ways of delivering programmes, with new partners and new technologies – is increasingly recognized as crucial to meeting the Sustainable Development Goals and the promise of the 2030 Agenda for Sustainable Development.

Since 2014, UNICEF embraced innovation as one of its key strategies to achieve results for children. That commitment is reaffirmed in its current Strategic Plan, 2018-2021, and is evident in the organization's programming and institutional architecture. Indeed, since 2014, significant progress has occurred in a relatively short period of time, backed by clear strategic intent and targeted investment. A number of formal structures have evolved, and new milestones achieved.

With the increased foothold of innovation in UNICEF, it is important and timely to take stock of these efforts through high quality evidence to inform decision-making, learning and accountability. In keeping with the need for this evidence, UNICEF conducted an global evaluation of innovation in 2018. The evaluation comes at a time when the organization is considering how best to maximize its resources for innovation and is intended to inform those decisions in an impartial manner, backed by credible evidence.

The objective of the evaluation was to assess UNICEF's 'fitness for purpose' to employ innovation as a key strategy to achieve the outcomes and goals defined in its strategic plans covering the period 2014-2021. It also sought to provide insights on how innovation contributes to UNICEF's goals and objectives, as well as how innovation might contribute to increasingly effective organizational responses in the coming years. The global evaluation was designed with three core components including: an organizational assessment, a set of innovation case studies and a synthesis project.

The case studies are intended to serve organizational learning by unpacking and examining the multiple pathways and dynamics which underpin innovation within the organization. In addition, the case studies contribute to accountability by assessing the manner in which innovation work in practice reflects the strategies and principles which UNICEF has developed to guide these efforts.

Three objectives guided the work:

- To provide detailed descriptions of a set of innovations across stages of the development continuum inclusive of contextual influences
- To assess the application of innovation principles or other standards for a set of innovations with particular attention to issues of ownership and scale
- To produce clear conclusions and considerations for policy, strategy and management decisions to further enhance innovation as key change strategy.

Cases are defined as *the processes an innovation was identified, developed, tested, implemented and taken to scale along with contextual factors such as underlying organizational and partnership arrangements*. The primary audience for the case studies is internal to UNICEF including senior management and programme managers at HQ, regional and country level. Its uses include informing the implementation of the Strategic Plan 2018-2021 particularly the change strategy focused on innovation. UNICEF commissioned Deloitte LLP to conduct thirteen case studies to examine innovation across the spectrum of innovation types, country contexts and internal (UNICEF) and external (partner, supplier) actors.

All case studies were structured around a modified version of the Deloitte Doblin Framework for Innovation. Within this

framework, four thematic dimensions (i.e. approach, organization, resources and capabilities and metrics and incentives) are seen as necessary to enable successful innovation. Case studies employed a mixed methods approach to build a complete picture of the innovation process and identify findings related to these four thematic dimensions. The evaluation team collected qualitative and quantitative data through desktop review, case study informant interviews and field visits. More information on the methods used appears in Annex A. A listing of stakeholders and interviewees appears in Annex B. Documents reviewed appear in Annex C.

The innovation case examined in this report concerns the Height/Length Measurement Devices (HLMD) Project that aims to drive improvements to current measuring devices and development of novel products. New and/or improved products are intended to improve data quality, for use in household surveys and health facilities in programme countries.

This report includes information on the context for the development of HLMDs (Section 3), the innovation journey (Section 4), findings (Section 5) and considerations for UNICEF and conclusions (Section 6).

2. INNOVATION AT A GLANCE

Description of the innovation

Reliable measurement of height and length is essential for monitoring the impacts of short- and long-term nutrition and health interventions. Height and length form the basis of indicators of stunting and wasting among children under age 5, and are important components of measuring progress towards global goals, including the Sustainable Development Goals (SDGs).[1] However, reliable data collection for this indicator continues to be a challenge in the field due to the limitations of current equipment, including product design, and user- and child-friendliness of the device. In response to these challenges, in 2016, the SD began a PIP to improve on available and/or develop novel anthropometric HLMDs.

Intended innovation outcomes

Based on its experience with product innovation, SD is moving towards a model of co-creation with industry through competitive procurement processes. Through this approach to product innovation, SD guides product development by providing developers with Target Product Profiles (TPPs) describing the identified need, and required and ideal product performance. TPPs aim to communicate to industry the need for development of devices that are fit for UNICEF's purposes, for eventual procurement through SD.

The HLMD project communicated the need for development of new and/or improved devices to measure height and length of infants and children that are more accurate, and user- and child-friendly. SD communicated this need by providing product developers and manufacturers with the future estimated demand for procurement for programme and Multiple Indicator Cluster Survey (MICS) use in a Request for Proposals (RFP). The objective of the PIP was to establish a long-term agreement (LTA) with a manufacturer for procurement of a new HLMD. The combination of an LTA and estimated demand was intended to lower the risk of investment in research and development

[1] Development Initiatives, *Global Nutrition Report 2017: Nourishing the SDGs*, Development Initiatives, Bristol, UK, 2017.

(R&D) for manufacturers, thereby driving R&D of novel products (low- and/or high-tech).

TPP purpose	To accelerate development and commercial availability of low- and high-tech devices, that will improve data quality, and the user and child experience.
Primary use	For use in household surveys and health clinics.
Desired solution(s)	• Improvement to current product design (e.g., measurement boards), with the addition of a digital output. • Novel products using more complex technology (e.g., laser, infrared, ultrasound), which would optimally not require a height/length measuring board or physical contact with the child.
Environment	Measurements can be taken in fixed health facilities and/or community settings (e.g., mobile clinics, household surveys); therefore, the environment in which devices are used is highly variable. Devices receive significant usage and may be exposed to temperature extremes, rough treatment during transit, humidity and/or rain.

Innovation users

Products are to be designed with the following primary user groups for HLMD product innovations in mind:

- **Household survey interviewers:** Responsible for taking measurements in the field, and typically have secondary school education or less, and one week of training on anthropometric measurement.
- **Health-care providers** (e.g., physicians, nurses, health assistants, researchers): May take measurements in a health facility or community settings, with a wide range of education and literacy levels. This user group has varying levels of training, depending on the health facility level.

3. CONTEXT FOR DEVELOPMENT OF HLMD

Key takeaways

- Measurement of height (standing up) for children age 2 years and older and length (lying down) for children under age 2 years is important to **monitor levels of stunting, wasting and overweight** in children globally
- SD is a **major procurer of HLMDs**, having procured approximately US$12.6 million worth of devices between 2012 and 2016
- Reviews of household survey data quality indicate **poor data quality** in some country contexts, due in part to the **design of height/length measuring boards** used in the field
- HLMDs have not undergone significant design changes since the stadiometer was introduced in the late-1800s[2] to improve accuracy and user-friendliness, despite documentation of poor data quality, indicating the need to **accelerate development of new and/or improved products**.

[2] Muehlenbein, Michael P., ed., *Human Evolutionary Biology*, Cambridge University Press, 2010.

3.1 Development/humanitarian context

Anthropometric variables are used to measure the physical properties (primarily size and shape) of the human body, used to evaluate prognosis and guide medical intervention of chronic and acute diseases. UNICEF uses anthropometric indicators to monitor the various ways in which malnutrition can manifest in children and infants, including stunting, wasting and overweight.

- **Stunting** refers to linear growth retardation due to chronic or recurrent malnutrition, which often coincides with failure of a child to grow cognitively. This results in children measuring as too short for their age and the conditions associated with stunting are often irreversible[3]
- **Wasting**, also referred to as acute malnutrition, is a condition in which children are too thin for their height, due to rapid weight loss or failure to gain weight. Children with moderate and severe wasting are at increased risk of death due to weakened immunity and long-term developmental delays, but treatment is possible[4]
- **Overweight** refers to being too heavy for one's height, due to over consumption of calories compared with levels of activity. Overweight puts children at increased risk of noncommunicable diseases (e.g., diabetes) later in life.[5]

At the population level, anthropometric indicators are often used in comparative analysis and to monitor progress of nutritional programmes. It is therefore important that data are accurately reported and comparable between countries. To obtain population-level data on the above forms of malnutrition, anthropometric indices commonly include three major indicators of child growth.[6]

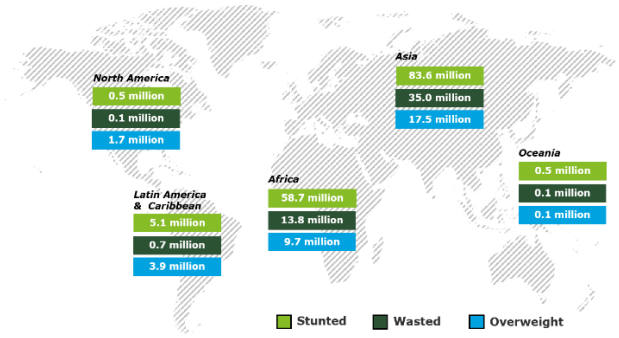
Figure 1. Common anthropometric indicators of child growth

Height-for-age	Low **height-for-age** is used to identify **stunted linear growth**. This is reflective of suboptimal health and/or nutritional conditions, which at the population level tend to be associated with poor socioeconomic conditions.
Weight-for-height	Low **weight-for-height** is used to identify **wasting** or **thinness** in children associated with acute undernutrition. This may be the result of a recent rapid weight loss. Conversely, high weight-for-height is used at the population level as an indicator of overweight.
Weight-for-age	Low **weight-for-age** is a composite indicator, which comprises elements of stunting and wasting, but can be complicated to interpret in populations where overweight is seen along with stunting.

Although the number of children under age 5 suffering from stunting and wasting has steadily declined since the year 2000, progress is slow and the international community is far from being on track to achieve the World Health Assembly (decision-making body of the World Health Organization (WHO)) targets set for 2025, and the SDGs set for 2030. In 2017, an estimated 151 million children globally under age 5 were stunted, 38 million were overweight, and 51 million were wasted (Figure 2).[7]

[3] Prendergast, Andrew J., and Jean H. Humphrey, 'The Stunting Syndrome in Developing Countries', *Pediatrics and International Child Health*, vol. 34, no. 4, 2014.
[4] United Nations Children's Fund, World Health Organization and World Bank Group, *Levels and Trends in Child Malnutrition: Joint child malnutrition estimates*, 2018.
[5] Ibid.
[6] World Health Organization, 'Country Profile Indicators: Interpretation guide', Nutrition Landscape Information System, 2010.
[7] UNICEF, WHO and World Bank Group, *Levels and Trends in Child Malnutrition*.

Figure 2. Percentage of children by nutritional indicator and region in 2017



3.2 Innovation context

HLMDs are used by UNICEF and other organizations (e.g., WHO) to measure the height (standing up) of children and length (lying down) of children under 2 years of age. UNICEF collects and reports height and length data in partnership with national governments, and maintains the Joint Child Malnutrition Estimates database with the World Bank Group and WHO. However, reviews of household survey data quality on child malnutrition have shown that techniques and devices currently used to measure height and length of children are producing inaccurate results in some country contexts.[8, 9] Reviews of data quality and criteria measures completed by USAID and the Harvard School of Public Health have demonstrated missing or implausible (when compared with growth standards) height/weight data proportions of as high as 23.7 per cent in household surveys.[10] Analysis of these findings has suggested that the main threats to data quality include imprecise anthropometric measurement tools (e.g., HLMDs), challenges reading and recording measurements, and fieldworker (i.e., measurer) variation in positioning of children, and reading and recording measurement results.

Despite challenges with design and use of first-generation models of HLMDs, the tools available to measure children have not undergone significant changes in recent years to improve accuracy and/or user-friendliness. The opportunity to innovate new and/or improved HLMDs stands not only to improve the accuracy of devices, but also to reduce the chances for errors and/or inaccurate measurement by health workers and survey staff. There is also an opportunity to improve the user and child experience, and to accelerate the process of product improvement through a market-based approach to innovation.

3.3 UNICEF programme context

SD, based in Copenhagen, drives external product innovation to prompt and/or accelerate development of fit-for-purpose (i.e., appropriate to achieve the intended results) and value-for-money (i.e., optimal combination of cost, quality and sustainability) products with the potential to positively impact UNICEF programmes. The division is able to leverage UNICEF's procurement power to drive PIPs, which are initiated when there is an unmet product need in UNICEF programmes and/or emergency response. In 2017, UNICEF procured approximately US$3.86 billion worth of supplies and services for children, including US$219.9 million in nutrition supplies.[11] PIPs can apply to products that do not exist or are not in procurable form. SD accelerates development of product innovations that encourage healthy markets and diversify the supplier base, complementing UNICEF's unique position to understand global needs and demands for new or improved product offerings, convene stakeholders, and drive scale.
SD procures and supplies a range of anthropometric equipment on behalf of UNICEF Country Offices (COs) and partners,

[8] United States Agency for International Development, 'An Assessment of the Quality of DHS Anthropometric Data, 2005-14', DHS Methodological Reports 16, 2015.
[9] United States Agency for International Development, 'Anthropometric Data in Population-Based Surveys Meeting Report', 2016.
[10] Corsi, Daniel, Jessica M. Perkis and S. V. Subramanian, 'Child Anthropometry Data Quality from Demographic and Health Surveys, Multiple Indicator Cluster Surveys, and National Nutrition Surveys in West Central Africa Region: Are we comparing apples and oranges?', *Global Health Action*, vol. 10, 2017.
[11] United Nations Children's Fund, *Supply Annual Report 2017*, UNICEF Supply Division, Copenhagen, 2018.

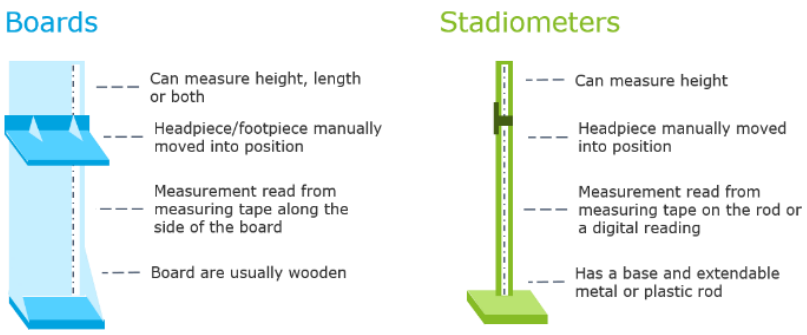
including two portable devices used to measure height and length:

- **Infant/child length and height measuring board**. The device is made of wood, has an accuracy/precision of ± 0.2 centimetres (cm), and a range of 0–120 cm. An extension can be added to enable measurement of adults, 0–210 cm
- **Infant/child length and height stadiometer**. The device is made of plastic, has an accuracy/precision of ± 0.2 cm, and comes in two sizes depending on whether the measurer will use the device to measure length (i.e., infantometer; resembles a board) or height.
  Note: Accuracy and precision levels of ± 0.2 cm are provided by suppliers, but recent reviews of field measurements suggest that these levels are lower when applied to field settings.[12]

Measuring boards and stadiometers are the types of HLMDs currently procured through SD to measure height and/or length of children under age 5 (Figure 3). Measuring boards currently used in household surveys are made of a wooden material. The wooden boards have a sliding headpiece to measure children and adults, and can be used standing (to measure height) or lying down (to measure length). The second type of HLMD procured is a stadiometer, which is made of plastic or metal and measures height in children and adults. The stadiometer is accompanied by a separate plastic measuring board to be used to measure length. Since the wooden measuring board is the least expensive and most robust/durable version and can be used to measure length and height, it is favoured for use in household surveys.

SD procured a total of 131,353 HLMDs with a value of approximately US$12.6 million between 2012 and 2016.[13] Procurement external to SD (e.g., local procurement; procurement through other United Nations agencies and non-United Nations organizations) is difficult to estimate due to recycling of HLMDs year over year; however, feedback collected by the Project Team during the project planning phase indicated that one organization procured between US$84,000 and US$168,000 worth of product per year.[14] Total procurement potential is therefore higher than the estimated value provided by UNICEF to industry. UNICEF and its partners use currently available HLMDs procured to support various activities, including UNICEF programming and data collection in the field. Ongoing surveys and studies that use current versions of HLMDs described above include the UNICEF-supported Multiple Indicator Cluster Survey (MICS) Programme, the United States Agency for International Development (USAID) Demographic and Health Surveys program (DHS), and the World Bank Group Living Standard Measurement Study (LSMS) programme.

Figure3. Key features of boards and stadiometers available on the market



[12] World Health Organization and WHO Multicentre Growth Reference Study Group, 'Reliability of Anthropometric Measurements in the WHO Multicentre Growth Reference Study', *Acta Paediatrica*, 2018.

[13] United Nations Children's Fund, 'UNICEF Target Product Profile Height/Length Measurement Device(s)', 2017.

[14] United Nations Children's Fund, 'Market Research on Height/Length Boards and Stadiometers', UNICEF Data and Analytics Section, 2015.

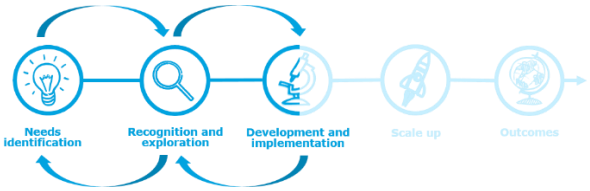
4. THE INNOVATION JOURNEY FOR HLMD

Key takeaways

- The UNICEF Division of Data, Research and Policy (DRP) **identified the need for new HLMDs** in response to poor data quality due to product design and use (validated by similar findings by USAID and the Harvard School of Public Health), which it brought to the attention of the SD Innovation Unit (IU)
- Following approval of the PIP, the multi-sectoral Project Team completed **preliminary market analysis**, complemented by engagement with industry to better understand the need for HLMDs
- A TPP was developed, **communicating the need for and characteristics of improved low- and/or high-tech HLMDs** for use in the field, with the opportunity for manufacturers to obtain LTAs with SD
- UNICEF issued the first tender, and as of July 2018 is in the process of **completing the technical evaluation of proposals**, which **may include field trials** of select prototypes.

The innovation pathway for HLMD follows the stage-gated innovation process detailed by SD for PIPs. The innovation process is not yet complete, as products will soon begin the field-testing process.

Figure 4. Innovation process followed by the HLMD PIP



Needs identification

Recognizing the need for improved HLMDs

The identification of the need for improved HLMDs came from the UNICEF DRP, which identified a product gap at the CO level. In 2012, UNICEF piloted a new anthropometry-training programme for MICS in Bangladesh, during which the team identified several challenges with the current iteration of the height/length measuring board, both related to data quality and user experience. For example, the bottom of the wooden board tends to become dirty as children stand on the base when height is measured; since this part of the board is where the head is placed for length measurements, it can become unhygienic for children under age 2 unless well cleaned between uses.

In addition to challenges with the physical attributes of the wooden board, those responsible for aggregating, analysing and reporting on data from DHS and MICS at the DRP identified low levels of accuracy of height and length measurements of infants and children. In a review of household survey data quality, USAID confirmed the issue of poor data quality through a study of 52 DHS surveys conducted between 2005 and 2014.[15] In its report, USAID recommended that DHS explore opportunities for the use of new equipment to measure height and length of children, particularly those under 2 years of age. USAID offered digital and lightweight measuring boards as possible solutions.

Identification of the need for new and/or improved HLMDs

Despite improvements to MICS training programmes piloted in 2012, teaching measurers techniques to obtain accurate results using the infant/children length/height measuring board, poor data quality persisted.[16] In response to the issue of poor data quality, in November 2014, the Data and Analytics

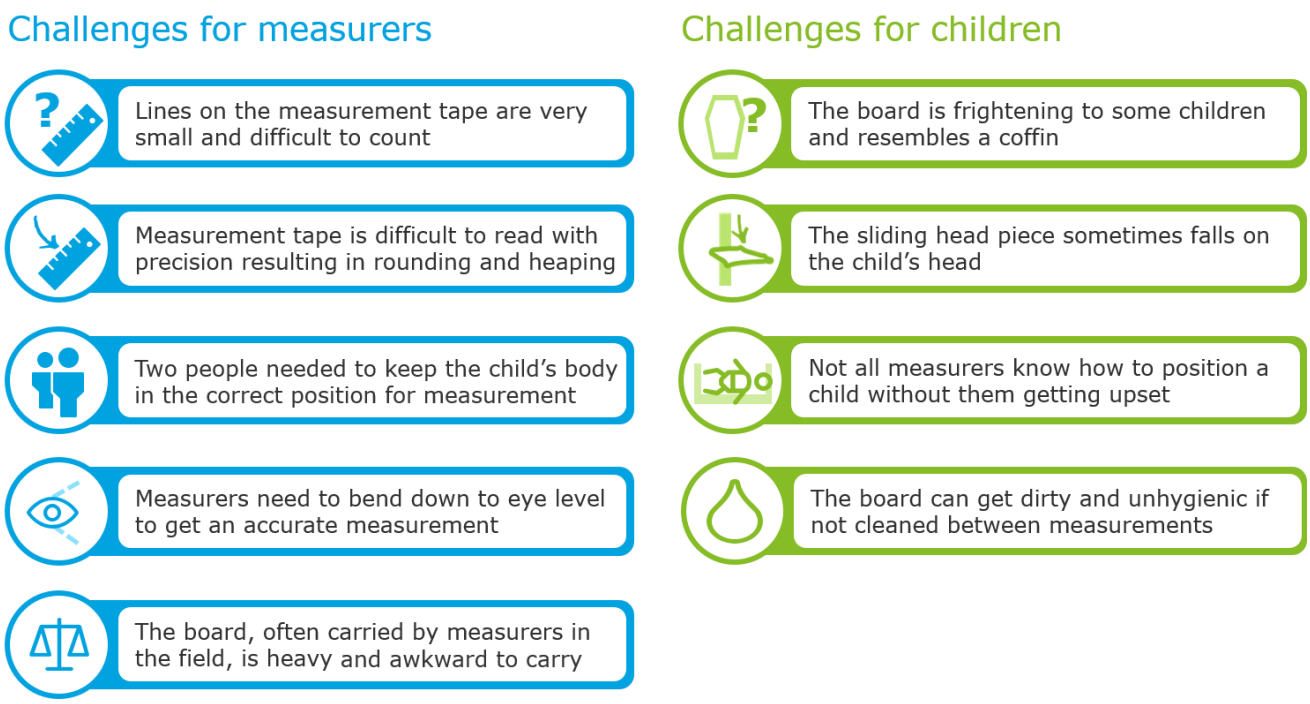
[15] USAID, 'An Assessment of the Quality of DHS Anthropometric Data, 2005-14'.

[16] United Nations Children's Fund, 'MICS 5 Pilot: Anthropometry training report', 2012.

Section of the DRP (having heard of ARIDA, a PIP to develop a pneumonia diagnostic) approached IU and requested that they begin to work on improving existing HLMDs. To validate the need for a new and/or improved product, DRP and SD worked to identify challenges with the existing product that resulted in inaccurate data. Although it was initially believed that poor data quality was the result of inadequate training and supervision of measurers, several other issues began to emerge related to the use and design of the tool.

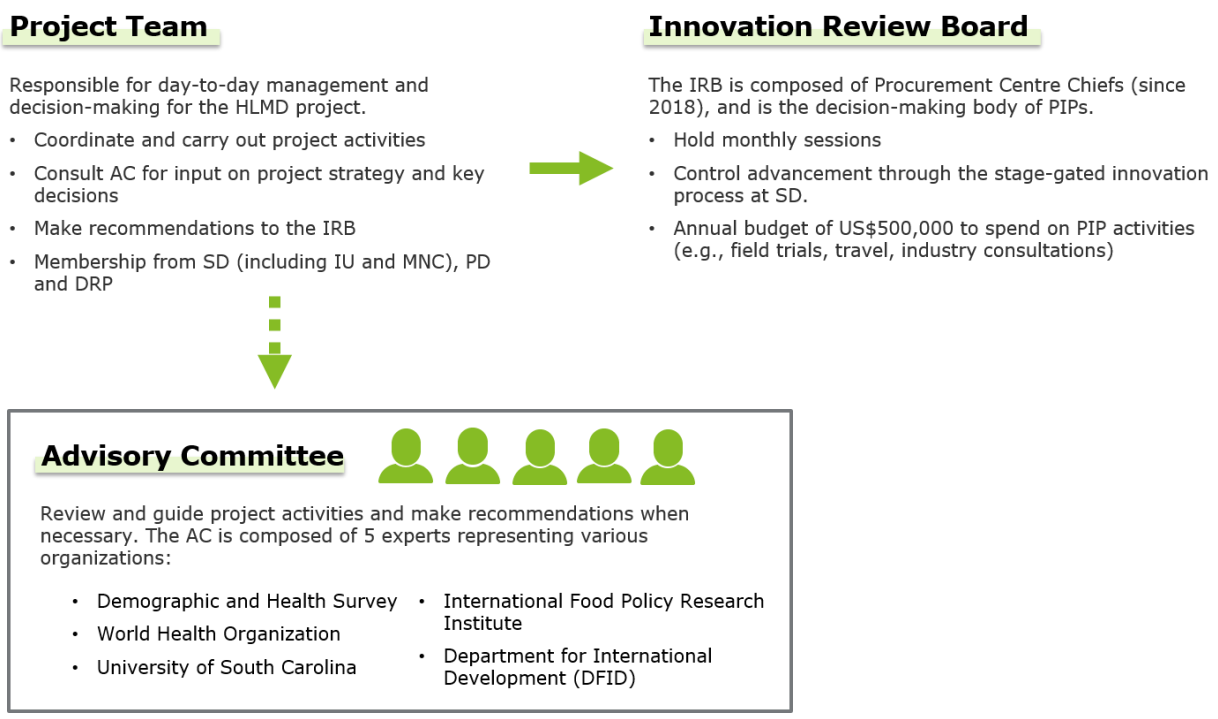
User challenges related to the current design of the board can be divided into two categories, namely, challenges that negatively affect data quality and challenges that negatively affect the user experience. These can be further divided into issues related to child-friendliness (or lack thereof) of the design of the device, and training of measurers. Design flaws of the board not only create unnecessary stress for children and their parents, but also create additional barriers to obtaining accurate results.

Figure 5. Challenges identified with the current model of the height length measuring board



In January 2015, the DRP and IU met with the SD Medicine and Nutrition Centre (MNC), the procurement centre at SD from which they required endorsement of HLMD to become a PIP. In the year following, DRP coordinated research and generated evidence of the need for improvements to HLMDs. This included identifying major and minor problems with the current design, drafting the Project Charter (which includes considerations for risks, project purpose, etc.), developing an overview of commercially available devices, interviewing stakeholders (e.g., WHO, MICS, USAID, academia) for input on the ideal specifications of HLMDs, and drafting the TPP. IU and MNC provided input on these materials, which were presented to the IRB for approval of the project as a PIP. In December 2015, the project was approved by SD as a PIP by the Chief of Innovation and MNC, demonstrating sufficient need; the Project Team and Advisory Committee (AC) were established shortly after as part of the governance and decision-making bodies for the project (Figure 6). Following endorsement of the project as a PIP, the project continued to conduct activities normally covered in the exploration phase of SD's stage-gated innovation pathway.

Figure 6. Key players in management and decision-making for HLMD PIP



Recognition by SD of the need for improvements to the existing product used in the field to improve data quality, rather than simply improving training and supervision of measurers, was an important step for this innovation. Although improved training and supervision may have had a positive impact on data quality, simple improvements to product design (e.g., using a digital output rather than having measurers count the lines on a measuring tape while holding a child in the correct position) offered UNICEF an opportunity to create a new 'gold standard' in HLMDs for use in the field.

Recognition and exploration

Preliminary market research

Following approval of the HLMD as a PIP, IU and DRP continued preliminary market research. This included SD-led interviews with nutrition specialists from the top five CO procurers of anthropometric devices, and a review of available products on the market, which fall into three main categories: boards, stadiometers and applications. The market scan identified a range of products, excluding those for clinic-based use that would not be well suited for use in the field. The DRP developed product descriptions for measuring devices identified, including accuracy, materials, weight and other defining features such as a digital component for reading measurements.

In addition to identifying available products on the market and confirming that none met the specific needs identified for use in UNICEF programmes, the team identified several product innovations to measure height/length already under way. Product innovations identified included:

- **Philips:** Development of a video technology to measure height, weight, head circumference and mid-upper arm circumference
- **PATH:** Investigation of how to apply technology used to measure curled-up earthworms to children
- **University of Toronto:** Development of a portable device using a computer-assisted infrared tool to measure height and length without direct contact with the child

- **Arizona State University:** Development of a product using laser technology to measure height and length without direct contact with the child.

Household survey field observation

In October 2016, IU Project Manager travelled to Nigeria to observe anthropometric field data collection through the National Bureau of Statistics for MICS in the field. The objective of the mission was to develop a better understanding of the challenges that measurers experience when using the wooden height and length measuring board. The PM and the local MICS team led focus groups discussions, interviews, and field observation in five states across Nigeria, selecting teams for observation with the lowest completion rates based on review of initial data sets from the survey. Findings included challenges related to:

- **Transport:** The measuring board was too heavy and the carrying strap uncomfortable
- **Stability:** Optimal setup of the board requires a 90-degree wall against which it can be placed and an even surface, often unavailable in field settings
- **Work position:** Measurers often have to kneel and/or bend over to take measurements, which is uncomfortable and may lead them to remain standing
- **Positioning:** It is challenging to keep a child in the correct position while measuring
- **Environment:** Households are often dimly lit, making it hard to read the numbers on the measuring tape, which are of a small font size and sometimes wear off
- **Child-friendliness:** The headpiece should lock into position, but often falls onto the child's head; children are often upset and/or crying due to the stress of being measured.

The mission to Nigeria was an important and productive step to furthering understanding at SD of the challenges with the current wooden measuring board. Confirming challenges that had previously been reported and identifying additional challenges provided a more solid foundation on which specifications for an ideal product could be communicated to manufacturers.

Identification of product demand

During its preliminary market research, DRP consulted with 20 stakeholders from 12 organizations. Stakeholders consulted agreed that there was a need for a new HLMD with an easy-to-read output (digital or mechanical) in order to improve data quality by reducing human error associated with reading of a measuring tape under less-than-ideal conditions. At the time, stakeholders could not verify the market potential for improved HLMD(s), as the majority of major household survey programmes (e.g., MICS) support implementation at the government level and therefore lack insight to the number of devices procured annually. However, previous amounts procured by UNICEF were provided, totalling 131,353 devices procured for a value of US$12,654,607 from 2012 to 2016 (this excludes procurement by other United Nations agencies and external organizations). This amounts to approximately US$96 per device for the baby/child HLMD offered in the UNICEF Supply Catalogue. Other versions available through the catalogue are slightly more expensive, at US$135 and US$175, as they are designed to be large enough to measure adults and are composed of materials that are more durable.

The focus of this PIP is on measurement of infants, children and adults with the lower price of the baby/child HLMD used as a reference. It is clear that HLMDs intended for use in household surveys and the field in general exist in a niche market, with relatively little procurement potential. Prior to the start of the PIP, this may have contributed to little change in products such as the Shorr Board (wooden height/length measuring board) since its inception. This could present a challenge to generating interest from suppliers, but provides an opportunity to steer the market towards improved products for use in UNICEF programmes, that would not otherwise be developed.

Development of the Target Product Profile

SD uses Target Product Profiles (TPP) to communicate requirements on the purpose of a new (or improved) product that does not currently exist on the market, and the minimum and ideal performance criteria. The tool is an

important component of SD's model of co-creation with industry through competitive procurement processes. SD designs TPPs to be less prescriptive than procurement specifications provided to product developers through the RFP process. This provides industry the opportunity to challenge the minimum and ideal performance characteristics provided by UNICEF. The process is also intended to stimulate greater creativity in the innovation process, while still guiding industry towards a product that will be fit-for-purpose for use in UNICEF programmes.

The TPP serves as a key alignment document internally at UNICEF and with implementing partners that are interested in using the device (e.g., through review by the AC). The TPP underwent a series of iterations while it was in development, which allowed identification of and alignment on the desired specifications for an improved and/or new product. Further, following release of the first version of the TPP, manufacturers were invited to submit comments and/or questions on guidance provided in the document over a period of three months (January to March). Industry consultation and feedback on the document was particularly valuable, as manufacturers were provided the opportunity to challenge UNICEF assumptions, provide feedback, and ultimately shape the minimum and ideal requirements of the device.

The Project Team presented its proposal to move through Gate 1 of the stage-gated innovation process in December 2016, which the IRB approved, following which SD released the TPP.[17] The approach to innovation through the TPP is unique, as its objectives are to accelerate development of two types of product (Table 1), fundamentally different from each other.

Table 1. Product categories described in the TPP for HLMD

PRODUCT CATEGORY	OBJECTIVE
Improvements to current design	Incremental innovation, through improvements to current design of HLMDs with the addition of a digital output (i.e., analogue to digital).
Novel innovative devices	Development of a new, innovative product using technologies (e.g., laser, infrared, ultrasound and optics).

The solution intended to make improvements to the current design of HLMDs is meant for more immediate use in the field, assuming that time to commercial availability will be shorter. On the other hand, novel devices are expected to be more complex, and are intended for field use further in the future. The model of innovating to improve and then to create should, in theory, work well to drive development of HLMDs leveraging new digital technologies for use on a longer time horizon, while addressing immediate challenges with the wooden measuring board in the interim.

A series of characteristics were provided to manufacturers, describing the minimum and ideal performance for each. Development and selection of required product attributes for inclusion in the TPP was based on market research, observation of household survey data collection in Nigeria, and the personal experiences of Project Team members. The resulting profile accounts for operational/functional (e.g., key functions, methods of use), performance (e.g., accuracy, precision), product (e.g., storage life, durability, child-friendly) and user (e.g., portability, output display, training) requirements. It was particularly important for Project Team members from DRP that the device could provide a reliable and precise measurement every time it was used (i.e., repeatability).

[17] United Nations Children's Fund, 'UNICEF Target Product Profile Height/Length Measurement Device(s)', UNICEF Supply Division Innovation Unit, 2017.

Project Team members from SD were also able to offer more tactical considerations for HLMDs, including packaging and regulatory approval requirements, based on previous experience with product development and procurement. The TPP included a target unit price to allow industry to understand the unit price up to which UNICEF would be able to procure a new and/or improved product. The targeted unit price of an improved device meeting the minimum performance characteristics provided in the TPP is US$150–200. The targeted unit price for a novel device meeting the ideal performance characteristics provided in the TPP is up to US$300. The unit price of the board currently used for household surveys (Portable baby/child L-hgt mea.syst/SET-2; Figure 7) is US$91 (US$181.13 for a set of two boards).

Interestingly, following issuance of the first RFP, the supplier of the existing board added the image of a giraffe (to the current version and the improved version submitted through the RFP including a digital output), to make the device more child-friendly. This was an unexpected but welcome improvement, and members of the HLMD Project Team indicated they had received reports that children have reacted positively to the addition of the image. The target unit price ranges provided to developers and manufacturers were important to guide R&D of devices that are affordable for use in health facility and survey contexts.

Consultation with industry

Once the Project Team was satisfied with the product description included in the TPP, it held one-on-one phone calls with suppliers (i.e., individual supplier consultations). The objective of the discussions with suppliers was to develop a better understanding of what products and technologies were in development, when fully functional models could be supplied, and whether there was interest in securing an LTA through the tender process with SD.

Industry consultation was an important mode of two-way communication between the HLMD Project Team and manufacturers. Firstly, dialogue between UNICEF and industry helps to develop relationships and create alignment on the direction in which manufacturers should push product development. Second, it is difficult for manufacturers, particularly those operating out of non-UNICEF programme countries with little context of field use of their products, to understand what UNICEF needs for a product to be fit-for-purpose for use in the field. Fit-for-purpose in the case of this innovation included product characteristics that would yield reliable measurements (including a digital display), and make the device durable and appropriate for use in ranging settings and climates, child-friendly and easy-to-use for measurers, with limited training requirements.

Dialogue and communication of these needs with industry was important for consideration during product design and development. For example, a manufacturer may not be aware that children are often afraid of the board currently used for household surveys, as they do not typically go to the field and use/test the product themselves; however, presentation of this type of challenge allows industry to respond, bringing new ideas for product design.

Figure 7. Portable height/length measuring board procured by UNICEF, before and after addition of giraffe decal

SD released the second version of the TPP for HLMD in October 2017, following incorporation of feedback provided by industry and internal stakeholders. Updates from internal feedback

included a more accurate representation of the number and value of boards procured by SD between 2012 and July 2016, and considerations for use of the device in high humidity environments. Feedback from industry led to a greater level of detail in the minimum and ideal performance requirements described. The resulting TPP provides manufacturers with a reference for what UNICEF needs and how suppliers can meet and/or exceed those needs.

Development and implementation

Launch of the first tender

Following the launch of the first tender, only six manufacturers responded to the RFP. The limited number of proposals in response to the tender issued is likely reflective of the limited market potential of HLMDs, particularly for low-tech devices. Over the course of this evaluation, several Project Team members expressed that improvements to the design of the current board, while important, are likely to be phased out of field use in the near future, in favour of more portable solutions (e.g., mobile phone-based). The RFP included the market size, which being limited may have been discouraging for some manufacturers, demonstrating low procurement potential compared against costs for product R&D. UNICEF evaluated proposals submitted by manufacturers in three stages. The evaluation of proposals is completed through a points system, through which proposals are awarded a maximum of 100 points. As of June 2018, UNICEF was evaluating technical proposals submitted through the first tender process, based on prototypes provided by manufacturers for two products. One product was already funded by the Centers for Disease Control, while the other product was submitted by a current supplier to UNICEF. Participation of current suppliers in the tender process reflects that manufacturers felt the push to make improvements on their own products in order to maintain the supplier-procurer relationship with UNICEF for that product.

Figure 8. Additions to the revised TPP, based on feedback from industry and the AC

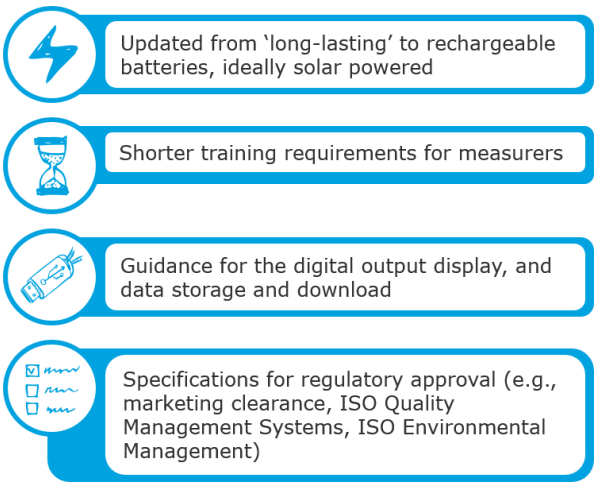


Table 2. SD proposal evaluation process

Evaluation of mandatory criteria (yes/no)	Proposals must meet a **minimum set of criteria**, including must-have features (e.g., digital output, light-weighted). Products not meeting minimum criteria are disqualified.
Evaluation of the technical proposal (70/100 points)	UNICEF evaluates technical proposals across three areas: • **Company profile/capacity** (10/70 points), including years of experience and production capacity. • **Evidence of performance** (25/70 points), including accuracy and precision of measurements. • **Sample evaluation** (35/70 points) of the prototype according to specifications described in the TPP (e.g., child-friendliness, durability, portability). Products must receive a technical score of at least 49 points to proceed to evaluation of the financial proposal.
Evaluation of the financial proposal (30/100 points)	UNICEF evaluates the financial proposal according to **affordability** (i.e., unit price) of the product.

Current state

While suppliers originally anticipated providing product prototypes shortly after submitting proposals, in reality the process of completing prototypes took longer than expected. Further, the number and quality of prototypes sent to SD were lower than expected.

As of June 2018, the Project Team in Copenhagen was evaluating product prototypes, and is expecting to begin field trials in 2018. UNICEF will cover the costs of field trials, which provided another incentive to manufacturers, offsetting the cost of investment in R&D; however, suppliers would be expected to cover the costs of travel to the field. The advantages of following this model for field trials may include an incentive for manufacturers to invest in R&D for HLMDs, an opportunity to refine product prototypes to meet the needs of users in the field, and to provide suppliers an opportunity to see their product used in the field. The opportunity for suppliers to observe use of the physical prototype in the field is a valuable advantage for both the manufacturer (which often does not fully understand the context(s) in which products will be used) and UNICEF (which will likely receive a better end product as a result of product iteration based on field trials, and a stronger relationship with suppliers).

The Project Team is considering two applications for products selected for LTAs, for use in household surveys and/or health clinics, of which MICS and DHS have expressed willingness to pay more for HLMDs but with limited procurement potential for anthropometric devices. Despite low procurement potential through UNICEF, the Project Team is optimistic that once SD approves a device for use, other organizations that implement household surveys, such as the International Committee of the Red Cross and Action Against Hunger, will follow UNICEF in its use of new HLMDs in the field.

Next steps for the HLMD project

As of October 2018, the project has been active for almost three years, and will soon begin field trials. Following field trials and product design iteration, scaling of HLMDs should be relatively simple, as low-tech products will be scaled across use in household surveys, followed by high-tech products several years later. Moving forward, SD and other divisions within UNICEF should consider their role(s) in generating demand and driving scale of new and/or improved HLMDs. For example, if UNICEF decides that it would like to equip every health clinic in a country with a high-tech HLMD, it could work with the national government to develop a policy and guidance at the national level. The Government of Myanmar previously tried to implement a programme through which every health clinic was equipped with a height/length measuring board, indicating potential demand for such a programme.

Facilitating national implementation and scale-up of HLMDs will require careful consideration of regulatory environments and requirements. Regardless of strategy for implementation and scaling of new HLMDs, UNICEF must also consider appropriate and continuous training and supervision of measurers (human error being a key challenge identified in studies of data accuracy)[18] to use the devices to ensure that they are properly used for years to come and yield reliable data. This will be particularly important if working through governments interested in distributing HLMDs beyond use in household surveys (which already have established training programmes) – for example, to clinics.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5. FINDINGS

5.1 Approach dimension

1. How does this innovation contribute to UNICEF country and global strategies?

Reliable measurement of height and length is **critical to monitor the impacts of short- and long-term nutrition and health interventions**, as the basis of indicators of stunting, wasting and overweight among children under age 5 years. Globally, these indicators are important components of tracking progress towards the SDGs.[19] Anthropometric indicators are also used to monitor the progress of nutritional programmes at the local level. Improvements to the accuracy of results of household surveys including the MICS programme (results are a data source for SDG indicators),[20] DHS and LSMS are therefore important to understand progress towards global and local nutrition targets.

2. What is this innovation doing in terms of scaling up and out or working at greater efficiency and economy?

In the case of the HLMD, the innovation project is about doing something new and working at greater efficiency/economy.

- **Doing something new:** The HLMD PIP is driving the development of novel products. SD innovates by identifying unmet product needs in UNICEF programmes, and initiating PIPs to accelerate development of products that do not exist and/or are not in procurable form. The HLMD PIP will drive development of novel products that manufacturers would otherwise not have developed. During industry consultation, one manufacturer indicated that it had initiated product development because of SD's call to the market. Further, both manufacturers expressed that the TPP influenced product development, even for one product that was already in development (e.g., using lighter materials, transitioning from an Apple to Android application). In general, feedback from potential suppliers following the first tender has demonstrated that UNICEF has the ability to stimulate development of products that would otherwise not exist in procurement form.

- **Working at greater efficiency/economy:** A short- and long-term approach to product innovation can accelerate adoption of improved products in the shorter term, while encouraging development of more ambitious novel innovations in the longer term. The TPP developed by the HLMD Project Team included descriptions of both improvements to existing product design, and a novel product. Improvement of the current design is likely to take less time to develop and receive regulatory approval and could potentially replace the current wooden height/length measuring board used in the field, with improvements including a digital output. Development of a novel product is likely to take longer to reach commercial availability for use in the field (i.e., household surveys). The two-tiered approach serves to offer an improved product in the short term and a more innovative tech-enabled product in the long term, based on anticipated time to market availability and capabilities in the field.

3. How are end-user needs identified and considered and how did they shape the innovation?

UNICEF identified end user challenges with the current design of HLMDs through Project Team member expertise and a field mission to five states across Nigeria to observe anthropometric field data collection. The **TPP developed included two use cases, which focused on the contexts in which the primary user groups** (household survey interviewers and health-care providers) measure height and length, including the education and literacy level, and training requirements of end users. The focus on end-user needs in the TPP helped to signal to industry the type of product UNICEF

[19] Development Initiatives, *Global Nutrition Report 2017*s.

[20] UNICEF, 'About MICS', 2018.

required and how, by whom and under what conditions it may be used.
Several interviewees noted that product developers and manufacturers often don't understand what UNICEF needs, and what features would make products appropriate for use in programme countries since they generally have little or no interaction with users in the field (two SD, one developer). UNICEF's ability to communicate design aspects that would improve usability of devices and/or user-friendliness (e.g., portability, output display, training requirements) is therefore an important component of the project.

> *Insights*: One device that was selected through the first tender process to move to field trials was already in the late stages of development when the RFP was released. The device had already undergone field trials in Guatemala, which helped to refine the design of the device and improve user-friendliness; this included changes to consent materials to enable caregivers to better understand the purpose and outputs of the device (one AC, one developer). While end-user needs were considered external to engagement with UNICEF, this demonstrates the importance of field trials and testing products with users, in order to iterate and improve on product usability and acceptability.

4. What challenges were faced during the innovation process and what strategies were used to overcome barriers?

The following challenges were encountered during the innovation process for HLMDs:

- **Regulatory approval:** Regulatory approvals required to begin procurement of novel products can present challenges due to lack of standards and long approval processes; this is further complicated by the potential to introduce new technologies to HLMDs, for example lasers (two SD, two IRB). For HLMDs, there is no global protocol for measurement of height/length in terms of accuracy standards. A lack of international bodies and/or global standards against which new products are tested is challenging for product innovations that are diverse in nature (e.g., low-tech wooden board, high-tech laser) can create delays to moving product innovations forward, as regulatory approval must be obtained as a condition of LTAs. Further, obtaining regulatory approval (e.g., CE marking) for new products can be expensive for suppliers, particularly considering low procurement potential for HLMDs (two SD). See question 8 for details.

- **Restrictions of engagement with suppliers:** Based on feedback from interviewees, the industry consultation process worked well in the case of this PIP (two SD, two developers). However, two Project Team members expressed that there is interest at SD to develop a process for product iteration in coordination with manufacturers. Due to the procurer-supplier relationship and the potential for real or perceived conflict of interest in the procurement process, SD has avoided working closely with suppliers on product development in the past; however, over the course of the HLMD PIP, the Project Team has identified value in working closely with industry on product iteration, an important component of product innovation, while respecting procurement rules (two SD). Greater interaction with suppliers could improve the PIP process for HLMD, and also for other innovations at SD. The IU is currently working on a framework that will enable product development through co-creation with industry as part of the competitive tendering process.

- **Limited procurement potential:** Potential procurement levels for HLMDs are relatively low, and although UNICEF invited approximately 96 manufacturers to submit proposals in the first tender process, only six manufacturers responded. Past procurement levels of HLMDs through SD included in the TPP may have discouraged manufacturers from responding to the RFP (two SD). In the first tender process UNICEF used LTAs to attract suppliers; however, SD is considering utilizing a pull mechanism (e.g., LTAs with Advance Purchase Commitments (APCs)) to motivate manufacturers to invest in R&D for HLMDs. Use of APCs would shift the risk of investing in R&D from the manufacturer to UNICEF (or

another willing third party) and could be appropriate for application to this PIP due to limited market potential.

The HLMD Project Team draws on the diverse technical and logistical expertise of various divisions within UNICEF, which has strengthened the innovation process (two SD, one PD, one DRP, one IRB); however, the internal dynamics of the multi-sectoral team have been complex. The Project Team has encountered several challenges over the course of the evaluation, which include:

- **Time constraints:** Three interviewees (two SD, one IRB) identified time as a barrier to innovation, as other duties are prioritized over work on the innovation project. Since Project Team members contribute to the PIP in addition to their regular operational work, the time that they are able to dedicate to the innovation project is restricted; for example, the MNC does not have an innovation focal point due to time restrictions. For members of the IU who focus solely on PIP development, time remains a challenge due to responsibilities for multiple projects.

- **Communication:** Based on feedback from various members of the Project Team, although the different perspectives have strengthened the TPP and contributed positively to many aspects of the innovation process so far, there are several challenges to effective communication between supply and logistics, data and programme experts (one PD, two DRP). Challenges include information-sharing, clarification of what is needed from Project Team members, and what is needed from HLMDs to meet needs in the field. Communication challenges may have contributed to potential issues with the required and ideal specifications. Although interviewees reported being happy with the language in the TPP and RFP (two SD, one DRP, two developers), some prototypes submitted during the first tender were not what the team expected. Tender responses were from different manufacturers than expected, and only two responses were viable based on the technical and commercial evaluation (two SD, one DRP, one AC). Lack of communication between internal divisions resulted in a missed opportunity for greater value-add to the innovation process.

- **Global distribution:** The global distribution of the Project Team has also presented challenges, as members are located all around the world and most have never met in person (two SD, one DRP). There is limited budget for travel for Project Team members, so several were unable to attend important meetings, including industry consultations. Further, time zones have created challenges to organizing meetings with external stakeholders. As of June 2018, the non-SD Project Team members had not had an opportunity to observe the physical prototypes provided by suppliers in the first tender process; however, as of October 2018 samples had been sent to UNICEF headquarters.

- **Alignment on expectations:** As of October 2018, the HLMD PIP has been active for almost three years, and will soon begin field trials. The perception of SD of the timeline is that the project is one of the fastest moving in SD's PIP portfolio; however, the long process often required for product innovation has been frustrating for several internal stakeholder groups within UNICEF, including the DRP (two SD, one PD, one DRP). Further, there may be a lack of alignment on valuing unit cost over quality (one PD). This indicates lack of alignment of expectations and understanding of the time needed to ensure successful product development.

5. How was scale considered through the process, starting with the initial design of this innovation?

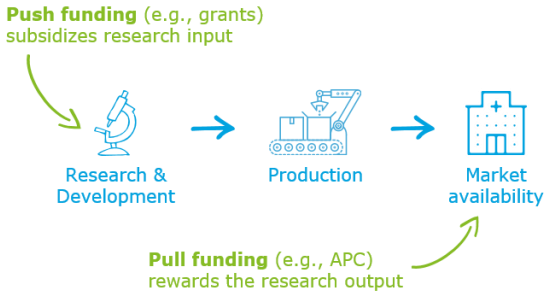
Implementation and scale was a key concern of several interviewees (two SD, one PD), due to limited market potential minimizing the case for investment in R&D and the time it will take for manufacturers to be able to meet demand (e.g., if from a small design lab). For the HLMD PIP, UNICEF used TPPs and potential LTAs to attract manufacturers. However, several interviewees expressed that the **introduction of a pull mechanism for the second tender**

process could improve the number and quality of proposals submitted (two SD, one IRB, one developer). Pull mechanisms, for example the use of an APC, reward the manufacturer for results achieved. SD used an APC to incentivize R&D in novel Zika virus diagnostics in response to the epidemic in 2016, which has generated interest for use in other PIPs.

The use of an APC in the case of the HLMD PIP may be appropriate, as SD cannot yet demonstrate a market for finished products. APCs could facilitate development of novel products and help companies generate investment in R&D, particularly smaller companies, in such a niche area. Further, since devices making improvements to the current model of HLMDs are expected to be phased of use in household surveys in favour of application-based devices, it may be even more difficult to convince manufacturers that there is value in improving on current HLMD models.

An APC is a type of pull mechanism used to incentivize private-sector investment in the R&D of new products for a specific purpose (e.g., improvement HLMDs). APCs encourage R&D and/or a more predictable supply of novel products through a third-party guarantee, including a pre-set price and/or purchase quantities for products that meet a set of predetermined specifications. APCs help to increase the likelihood of cost recovery for manufacturers by guaranteeing purchase of a minimum volume of product, regardless of market demand.

Figure 9. Push funding vs. pull funding



Insights: One interviewee from DRP noted that the two-tiered approach to product development could accelerate development of an improved measuring board that may become obsolete for use in household surveys in the near future, in favour of emerging application-based measurement technologies (tablets are already used for data entry for most household surveys). The resulting market potential for tablet-based tools could therefore be greater, not only for use in the field but also by medical professionals to perform functions similar to those currently executed by the height/length measuring board. However, while the budgets for household surveys to purchase anthropometric equipment will be able to absorb increased costs expected for tablet-based devices, at the health clinic level improved devices and/or less expensive alternatives will likely remain the preferred option (two SD, two DRP, one AC). Implementation and scale-up of more expensive equipment would require partnership at the national level and/or donor assistance.

6. Was a proof of concept and business case developed for this innovation?

UNICEF considered the **value of reliable data** when weighing the cost of investment against the potential impact. While the commercial value for manufacturers is relatively low, the ability to collect and report accurate data has financial value at programme and government levels. Many donor organizations and national governments make **decisions based on reported annual rates of stunting and**

wasting, allocating resources accordingly.[21, 22] Without accurate data on these indicators, it is more challenging to make appropriate programme decisions and allocate resources where they are needed most. This is further complicated by large levels of variation in data reported by indicators year-over-year, which should remain relatively stable but fluctuate due to data collection and reporting challenges. Ultimately, the potential to stimulate R&D in HLMDs without the need for significant financial investment to incentivize manufacturers created a low-risk opportunity for UNICEF to improve anthropometric data quality.

7. How does this innovation complement or build on existing knowledge and work conducted in the country and across programmes?

This innovation will build on existing work conducted by UNICEF and development partners, building on knowledge of challenges with data collection and quality. Data-quality issues recognized at the survey and CO levels at UNICEF, in addition to reviews completed by USAID and Harvard, **identified the main barriers to collecting quality household survey data**, including imprecise anthropometric measurement tools and the need for an improved device(s). New and/or improved HLMDs will **improve the quality of anthropometric data** collected through the UNICEF-supported MICS programme, the USAID DHS programme, and the World Bank Group LSMS programme. This, in turn, will improve the quality of data reported in the Joint Child Malnutrition Estimates database by UNICEF, WHO and the World Bank Group, for which UNICEF collects height and length data in partnership with national governments.

8. How have the local environment/market (including legal, regulatory and technological) considerations influenced the design of the innovation?

Since HLMDs are intended for use across programme countries in household surveys and health facilities, it was important that the regulatory requirements be considered in the design of the innovation, in order to be appropriate for **supply to local markets.** Prior to procurement through SD, HLMD-awarded LTAs are **required to meet several regulatory requirements and compliance with international standards**. The technical evaluation criteria in the RFP (also in the TPP) included compliance with regulatory requirements for marketing clearance, including approval for use by one of the five founding members of the Global Harmonization Task Force Competent Authorities (i.e., GMPALS (Australia), Device License (Canada, Japan), CE Class (European Union), and 510 Device Letter Class II medical device (United States).[23] The Task Force is an international group that includes medical device regulatory authorities and trade associations from the European Union, United States, Canada, Japan and Australia. In addition to regulatory approval requirements, compliance with standards included ISO13485 Quality Management Systems for Medical Devices or ISO9001:2008 Quality Management Systems for Medical Sales and Measuring Systems, ISO 14001: Environmental Management, and IEC 60601-1 general requirements for basic safety and essential performance (or equivalent).

It was understood by UNICEF that not all manufacturers would be able to obtain regulatory approval prior to submitting their response to the RFP. Therefore, while manufacturers with products not meeting regulatory requirements were invited to participate in the tender process, as a condition of LTAs they are required to meet

[21] Food and Agriculture Organization, *Measures of Nutritional Status from Anthropometrics Survey Data*, International Scientific Symposium on Measurement and Assessment of Food Deprivation and Undernutrition, 2003.
[22] Pelletier, D. L., et al., 'Nutrition Agenda Setting, Policy Formulation and Implementation: Lessons from the Mainstreaming Nutrition Initiative', *Health Policy and Planning*, vol. 27, no. 1, 2011.
[23] United Nations Children's Fund, 'Evaluation Assessment Criteria', RFP-DAN-2017-502602, 2017.

requirements prior to procurement through SD (two SD, two IRB). While the regulatory requirements in place set a minimum threshold that HLMDs must meet, potential challenges to quality remain. For example, to receive CE (Conformité Européenne) marking, the manufacturer must sign and submit a Declaration of Conformity, which states that the product meets the health, safety and environmental protection standards for products sold within the European Economic Area; also included in submission for CE marking is documentation of the assessment and/or testing (does not require laboratory testing) completed by the manufacturer demonstrating that the product meets these requirements.[24] Since the manufacturer conducts and submits the Declaration of Conformity in line with the requirements for the medical devices category itself (i.e., the product is self-certified), there is a risk that products may not meet UNICEF and development partner needs; however, the completion of accuracy studies by the Project Team may reduce this risk.

9. What value does UNICEF bring to this innovation and what makes UNICEF suitable to scale it?

The unique value provided by UNICEF was its **procurement power and the provision of a market-shaping TPP**. UNICEF leveraged its procurement power and technical expertise housed at SD, DRP and PD, providing value to manufacturers interested in developing new products.

- The ability to **leverage its significant financial flows (US$3.5 billion)** allowed SD to signal to industry the procurement potential of HLMD, although limited in this case. Despite limited market potential for products developed, UNICEF provided value by releasing the TPP and RFP indicating that it was willing to procure products that met the needs described (two SD, two IRB, one AC, one developer). Further, procurement through SD was identified as valuable due to increased exposure and interest from other development partners (one developer).

- The availability of **TPPs detailing the required and ideal specifications** of HLMDs helped manufacturers to design innovative products. Based on feedback from interviewees (one IRB, two developers), the information included in the TPP provided value during product development (e.g., switching to an Android-based application). Although suppliers may have appreciated greater levels of detail, the less prescriptive nature of the TPP provided manufacturers the opportunity to come up with innovative ideas, according to their technical strengths. Suppliers also indicated that UNICEF was quick to provide additional information as required, if possible.

- SD's **stage-gated innovation process** for PIPs (Annex B) provides structure to innovation, the systemic method being unique within UNICEF (two IRB). The stage-gates ensure that projects do not advance prematurely, from needs validation through to the scale-up phase.

10. What principles or standards have been applied and how?

Application of the Principles for Digital Development are not applicable to this innovation. However, SD follows its **procurement policies**, which are in place to ensure value-for-money, economy and effectiveness, and avoid perceived conflicts of interest and/or the appearance of endorsing one company over another.[25] SD also requires that manufacturers follow the **United Nations Supplier Code of Conduct**, which includes considerations for human rights, the environment and anti-corruption.[26]

[24] CE Marking Association, 'The CE Marking Process', 2018.
[25] United Nations Global Marketplace, 'Supplying the UN System', 2018.
[26] United Nations, UN Supplier Code of Conduct, 2017.

11. What are the steps taken or methods used to assess and mitigate risks to children, users, and markets?

SD has mitigated risks to children and users for this project through regulatory approval requirements for HLMDs, and the completion of accuracy studies (to be conducted in 2018).

5.2 Organization dimension

12. What type of support was received from the leadership to enable the innovation process?

The **Chief of Innovation and MNC** approved the HLMD project as a PIP in December 2015, with the MNC being the Procurement Centre sponsoring the PIP through SD's stage-gated process of innovation (Annex B). Leadership-level support has also been provided through **the IRB** (*see question 13 for details*).

13. What type of support and leadership facilitated the enabling environment for innovation?

A major success in facilitating an enabling environment for innovation at SD has been the **creation of an internal structure for innovation work**. SD has developed a unique, robust methodology for innovation that provides an internal structure to the process of innovation, while simultaneously providing developers and manufacturers with the flexibility needed to develop novel products that are fit-for-purpose, responding to an unmet product need in UNICEF programmes. However, based on feedback collected through this case study, it is difficult to determine whether the IRB and AC's role is more active or procedural.

- Innovations undergo ongoing review at the leadership level, **providing opportunities for critical reflection and input on what is and is not working**, and changes that need to be made. In the case of the ZIKV Dx PIP, the IRB fills this function. In the case of the HLMD PIP, the Project Team makes daily decisions, while major decisions are brought to the IRB. In cases where the board has no longer seen value in a PIP in the past, it has closed projects (one IRB).

  Being composed of Centre Chiefs, the relevant technical centre lead brings in-depth knowledge of the innovation to the group. In addition to providing input on PIPs from a number of perspectives, membership of the board provides leadership support and buy-in to product innovations. In addition to providing input on PIPs from a number of perspectives, membership of the board provides leadership support and buy-in to product innovations. Feedback on the governance structure for the HLMD PIP indicated that the process is working well, and that there are no major leadership-level issues for this project (two SD, one IRB).

- The governance structure of the PIP provides various **entry points for stakeholders with different subject matter expertise to provide insight** on the innovation project**.** The formal stage-gated structure used by SD for PIPs seeks and requires guidance and insight from industry, the IRB and AC at various points over the lifecycle of an innovation. Input from the groups creates opportunities for realignment, challenges assumptions, and improves likelihood for innovation success. However, based on interviewee feedback, decisions made at the level of the IRB may be procedural, and lack the debate and discussion intended through the structures developed (one SD, one IRB), which would reduce the efficacy and influence of the board.

- The AC was established to **share learnings** acquired over the course of the PIP, and **provide input and recommendations on key documents** (e.g., TPPs). Membership of the AC is diverse (e.g., household surveys, academia, external organizations, UNICEF) and provides subject matter expertise on anthropometry. The broad expertise provided by members of the AC has contributed greatly to understanding how products will work in the field, and was particularly important for this PIP due to the significant variability of product prototypes (e.g., low-tech, high-tech) submitted in response to the first tender (two DRP). However, engagement of the AC has been irregular, and could be improved by

providing more regular project updates and more time for members to review materials and contribute input to the Project Team (one DRP, one AC).

14. Who makes decisions with respect to the design and implementation of the innovation?

Decision-making regarding the design and implementation of the innovation is the responsibility of the IRB and Project Team, with input from the AC.

- **AC:** Established in 2015, the AC provides subject matter expert insight to documents and the innovation process more generally. The AC is intended to share learning acquired over the course of the PIP, and provide input and recommendations on key documents (e.g., the RFP). Members of the AC were selected based on their expertise in anthropometry, including members from various household survey programmes (e.g., DHS), academia, external organizations (e.g., International Food Policy Research Institute) and UNICEF Divisions. The AC is consulted on a regular basis and provides expertise on which the Project Team can draw, strengthening its decision-making processes.

- **IRB:** Composed of SD Centre Chiefs (as of 2018; previously the IRB was a smaller group that included representation from the Director and Deputy Directors, Evaluation, and Contracting Centre), the IRB is the only decision-making body in the innovation pathway for HLMD, and has purview of the overall portfolio. The IRB is the governance structure for SD PIPs, controlling advancement through the stage-gated innovation process (Annex B). The board holds session monthly, during which PIPs can be presented to receive feedback during the project or to advance to the next innovation phase.

- **Project Team:** Responsible for day-to-day decision-making for the project, including membership from the IU, MNC, PD and DRP. Major decisions and/or progression through the stage-gated innovation pathway used for PIPs are made at the level of the IRB; the Project Team presents its recommendations and/or gate proposal to the IRB for input and final decisions.

15. What factors were considered when making decisions about governance and ownership of the innovation?

Governance of the innovation follows the standard processes for PIPs. Ownership of the project falls to the IU, in which the Project Manager sits; however, throughout the project responsibility for activities has fallen to a number of different internal groups (e.g., DRP played a critical role in needs identification and validation).

16. How has the governance and ownership model influenced the innovation process?

See question 13 for a description of the governance model and its influence on the innovation process, and question 19 for details on the influence of the ownership model.

17. To what extent was sustainability considered in the plan for the innovation?

The TPP included **guidance for a target unit price** for each of the low- and high-tech products. The target unit price provided to manufacturers of products meeting the minimum performance criteria (which mainly apply to improvements to the design of the current, low-tech device) is appropriate in relation to the current unit price offered through the UNICEF Supply Catalogue, considering feedback collected during the needs validation phase of the project that development partners involved in household surveys were willing to pay a higher unit price. The range provides suppliers an opportunity to compete on unit price, and allows for a higher unit price (compared with current prices) if the product presents significant improvements to the current version (two SD).

Staying within the US$150–200 target range (50 to 100 per cent increase on current unit price) is meant to protect continued procurement of the board for health facility (e.g., hospital) use and household surveys in which UNICEF is not actively involved. Conversely, the unit price of up to US$300 for products meeting ideal performance criteria reflects the likelihood that

products falling within this category require greater investment in R&D and are higher tech, increasing production costs. A higher unit price would therefore allow high-tech devices to compete with their low-tech counterparts (maximum of 25 to 33 per cent more expensive), while also encouraging suppliers to move towards more complex, technology-enabled products.

Since the unit price for improved and novel devices will be significantly more expensive than current HLMDs procured, UNICEF will **consider product durability and value for money** when identifying devices for potential LTAs. The minimum performance requirements for operational life described in the TPP are three years for low-tech devices, and five years for high-tech devices. The durability of the current HLMD used in household surveys is approximately three years; therefore, when selecting products SD should consider HLMDs that exceed this operational life. For novel devices, although the unit price will present a significant increase of a maximum of 200 per cent compared with the infant/child wooden measuring board currently used in household surveys, manufacturers will improve the lifespan of the product by two years (approximately 67 per cent). While conclusions on value for money of novel HLMDs cannot yet be drawn, it is possible that improved operational life, user- and child-friendliness, and measurement accuracy of novel products could create a product that, although more expensive, provides significant value for UNICEF programmes.

18. When will this innovation become mainstream and no longer considered an innovation? What steps has UNICEF taken to move towards that point?

SD use PIPs to drive research, development, availability and scale, and the stage-gated process that is followed moves from the 'explore' through 'scale-up' phases. Therefore, new HLMDs will no longer be considered an innovation when the devices procured through SD are **commercially available and reach scale**.

19. How, if at all, has the innovation team worked across UNICEF offices and divisions to leverage internal and external knowledge and expertise and share learnings?

Diverse Project Teams are common among PIPs, which tend to require input from a variety of internal groups and/or divisions in order to leverage expertise on a variety of topics related to the product innovation (e.g., packaging versus challenges in the field). The **HLMD Project Team includes diverse membership** from the IU, MNC, PD and DRP, and each internal stakeholder group brings unique insight, strengthening the project as a whole (two SD, one PD, one DRP, one IRB). For example, SD provides product development and procurement expertise, while DRP has extensive understanding of the challenges to collecting reliable data in the field. The PM selected to lead the PIP has a background as a technical product designer that has been critical to success of the project, as this individual understands the level of iteration required to develop innovative products, and the logistical requirements that must be considered (e.g., pallet size and packaging optimization). These factors are critical for project success, but may not be top-of-mind for individuals from a programme background.

See question 4 for details on challenges observed related to the Project Team.

> *Insights:* Needs identification is a key moment in the process of innovation, and ideally is generated from the bottom-up; this could be a CO, or a division with significant insight to challenges in the field (two IRB). In the case of the HLMD PIP, the **DRP team identified the challenge of obtaining accurate data** as well as issues related to user-friendliness. Several interviewees indicated that in the future, those working on product innovation should have greater levels of exposure to COs, which in general have little awareness of how they can engage in product innovation (e.g., field trials), to strengthen the innovation process (two IRB). For example, field observations in Nigeria contributed positively to understanding of user needs, the context in which HLMDs may be used and, ultimately, development of the required and ideal characteristics described in the TPP.

5.3 Resources and capabilities dimension

20. How is the innovation funded?

Field trials of products identified for potential LTAs following commercial and technical evaluation during the tender process are to be funded by the IRB.

21. How much time and how many resources were invested at different points in the innovation process?

Limited financial resources have been required for project activities prior to field trials. Project Team members sit within their respective divisions and/or units, and contributions to the PIP are in addition to their regular duties (with the exception of the Project Manager from IU, who is dedicated to working on a portfolio of PIPs).

22. What ongoing resources (human, physical, and financial) are required from UNICEF to manage this innovation?

The human resources required to manage this innovation includes seven Project Team members (one from PD, two from DRP, three from SD, and one innovation focal point from headquarters). This includes the Project Manager, who sits within the IU and is dedicated to working on and advancing multiple innovation projects, which can help to move projects forward more quickly. The professional background of the Project Manager as a product designer has also been critical to project success so far, providing an in-depth understanding of the requirements for products to be procurable. This skillset complements the technical and programme expertise provided by other members of the Project Team, who provide critical insight but are unable to dedicate a significant amount of time to the innovation.

23. How, if at all, have partners external to UNICEF contributed to the innovation process?

UNICEF Project Team representatives indicated that one-on-one consultations with manufacturers (which are not considered partners but are external to UNICEF) worked well to **receive feedback and further develop understanding of the HLMD landscape** (two SD, one DRP, two developers). The Project Team heard from manufacturers that the biggest barriers to R&D of a new and/or improved HLMDs were internal investment and low market payoff, and that an injection of resources for products already in development could accelerate market availability of an improved device and new 'gold standard' for HLMDs. Feedback on minimum and ideal requirements, and further information that would be useful to guide product development from the manufacturer perspective, was also helpful to shape the second version of the TPP, prior to issuing the RFP.

The AC has also provided expertise and input and has contributed to the innovation process. See questions 13 and 14 for details.

24. How are partnerships designed to provide value to partners?

The offer to complete and cover the costs of **field trials for product innovation prototypes provided a positive incentive for manufacturers** to respond to the RFP (two SD). Manufacturers of HLMDs often lack insight on local contexts and how end users will use their product in the field. The field trial component of the technical evaluation of proposals served to incentivize suppliers to develop products according to the TPP.

- There is **uncertainty regarding who should hold responsibility for field trials** of product innovations. In the RFP, SD committed to completing field trials of products selected through the first tender process; however, as of June 2018, the IRB was deliberating whether or not SD should complete accuracy studies (across PIPs), particularly in the absence of recognized standards. Learnings from another PIP, ARIDA, have demonstrated that for innovation for which the global standard/reference is poor, the results of accuracy studies (in the case of ARIDA conducted by a third party) can be inconclusive. For the HLMD PIP, there is a lack of a global standard against which UNICEF can test novel products, making it more difficult to produce reliable test results. However, WHO uses the Harpenden

stadiometer (including a digital output with 0.1 millimetre accuracy) in standard-setting studies.[27] Therefore, UNICEF decided to proceed with accuracy studies for HLMDs, which, as of October 2018, are under way, conducted at UNICEF headquarters. The accuracy studies will begin with measurement of static objects, followed by testing of kindergarten-age children in New York.

- UNICEF participation in all stages of the innovation process could create a **real or perceived conflict of interest**. Procurement protocols are strict, in order to provide all manufacturers with the same opportunities. Two interviewees from SD expressed concern that UNICEF-driven field trials for HLMDs could result in a perceived conflict of interest, resulting in reputational risk. If the results of the accuracy studies are positive, acceptability studies could provide further opportunities for product iteration and understanding of how devices meet end-user needs. Based on previous experience, SD has determined that its core strength is not in designing and conducting field trials; therefore, contracting a third party may be appropriate.

- For some HLMDs developed, **acceptability studies may not be necessary if already completed by development partners**. As of October 2018, one device that met the requirements of the first tender was undergoing field testing in Guatemala and Kenya (one AC, one developer). While it is important that new products be tested in order to understand their application and usability in the field prior to scale-up, if these tests are completed independently by an organization external to the manufacturer, the results may provide sufficient evidence of acceptability.

25. What methods, approaches or tools are used throughout the innovation process?

Previous experience with product innovation has led SD towards **co-creation with industry through competitive procurement processes**, as independent product innovation requires significant expenditure for research, development of a prototype, and field trials, among other activities. As a result, SD takes a **market-based approach to innovation**, communicating its product needs and inviting the market to respond. Outputs of the PIP including TPPs signal to industry the need for product development, creating a business case for R&D.

SD utilizes **RFPs and TPPs** that are **less prescriptive** in order to **stimulate creativity** of product developers and manufacturers (one IRB). The TPP developed for HLMD provided developers with flexibility to develop a wide variety of products, all of which could potentially meet the specifications provided in the RFP. The inclusion of minimum acceptable criteria for diagnostics included in the TPP ensured that products developed would meet the needs of UNICEF and its partners for use in programme countries; these were complemented by the inclusion of ideal product characteristics, which were more aspirational in nature. The ideal characteristics provided gave developers and manufacturers an idea of how products could be designed, but without describing an exact measurement device. The resulting TPP provides space for product development to be done in a variety of ways (e.g., low-tech or high-tech), playing to the technical strengths of each supplier.

> *Insights:* Another interesting observation made by interviewees is that the results of the RFP were not what they were expecting; the proposals submitted were composed of different developers, and were of lower quality than expected, with only two viable responses (two SD, one DRP, one AC). The Project Team had to revise its expectations for product development accordingly, but it was unsure of what factors contributed to the RFP drawing a different group of suppliers than anticipated.

[27] De Onis, Mercedes, et al., 'Measurement and Standardization Protocols for Anthropometry Used in the Construction of a New International Growth Reference', *Food and Nutrition Bulletin*, vol. 25, no. 1 (suppl. 1), 2004.

5.4 Incentives and outcomes

26. What incentives are encouraging/driving and discouraging/deterring adoption of the innovation by users?

Not applicable. HLMDs selected through the tender process have not yet completed field trials required for procurement through SD, and therefore have not yet be tested by end users and/or implemented at the programme level.

27. How were metrics designed and used to inform the development and scaling of the innovation?

The following project outcomes are identified in the Project Charter:

- Anthropometric data collection is represented with an accuracy level of ±3 millimetres.
- Anthropometric data collected from the field are considered valid and reliable.

Project outputs identified in the Project Charter include completion of market screening of existing products, a field mission report, publication of the TPP, development and field trial of prototype(s), and specification of new product(s).

28. At what point were metrics considered? How was impact measured before scaling (or how is it intended to be measured)?

The HLMD project has been included in IU workplans, contributing to strategic outcome targets.

- **IU Workplan 2017:** The expected outcome was a procurable product, with an RFP published to identify solutions for field trialling, monitored in line with the IRB process.
- **IU Workplan 2018:** The HLMD project will contribute to Strategic Outcome Target #34, moving towards 10 innovation products on the pathway to scale in programme countries by 2021 and a further five products by 2025. The project will contribute to this outcome by identifying solutions for field trialling and potential LTAs.

29. How has data generated through the innovation process created value for UNICEF partners?

No data have been generated thus far through the innovation process; however, SD provided potential procurement volumes to manufacturers to assist with decision-making regarding investment in R&D, and the results of field trials will provide important information on product performance.

30. How were workplans, processes, learnings and practices monitored, documented and shared within UNICEF and beyond?

The PIP process requires Project Teams to update the **Project Charter** each time they present the project to update the IRB, or pass through the next stage-gate (Annex B). The HLMD Project Charter includes an overview of the project, intended outcomes and outputs, the strategy, project plan (including a timeline for activities) and resource requirements.

In addition to workplans and progression of the project through the stages of innovation completed within SD, the IU published a blog post in April 2017 describing the need for an innovation project to accelerate development of portable, accurate and child-friendly HLMDs.[28] However, the Project Team does not currently have a plan for sharing learnings and best practices externally.

31. What does the ideal future state of this innovation 'at scale' look like?

The ideal future state for this project at scale would be commercial availability of HLMDs that meet global demand and improve data quality at the household survey and health facility levels. While this is a common goal for product innovations at SD (at which time the device(s) will no longer be considered an

[28] United Nations Children's Fund, 'Providing Portable, Accurate and Child Friendly Height & Length Measurement Devices', UNICEF Supply Division, 28 April 2017.

innovation), it is unclear how UNICEF will facilitate scale-up of HLMDs. According to a member of the IRB, there are examples of innovative products where demand is simply not there (one IRB); demand generation will therefore be an important aspect of facilitating scale-up. One consideration to generate demand proposed is to obtain WHO endorsement of specifications and devices developed as the new gold standard, which would improve buy-in to implement and scale-up devices at the national level (one DRP); however, this endorsement would come further downstream, once product design has been finalized.

32. How has this innovation considered and demonstrated development outcome/impact objectives? To what extent does the innovation contribute (or have the potential to contribute) to equitable results for children?

Although the project has not yet demonstrated development outcome objectives, there are several indicators in place through which SD will monitor progress towards objectives. See question 27 for details.

6. CONCLUSIONS AND CONSIDERATIONS

New and/or improved HLMDs developed and accelerated to commercial availability will contribute to reliable measurement of height and length, which is essential for monitoring the impacts of short- and long-term nutrition and health interventions at national and global levels. Over its first three years of operation the PIP, through which UNICEF is employing an approach of co-creation of devices with industry, has made progress towards its goal to accelerate development of devices and, as of October 2018, accuracy studies for one of two HLMDs have begun. Further, product development has taken a demand-driven and user-centred approach, with minimum and ideal specifications communicated through the TPP intended to improve not only data quality, but also the user (household survey interviewers and health-care providers, with varying levels of education, literacy and training) and child experience in field and health facility settings.

One of the major challenges with the innovation project has been communication and alignment on expectations regarding product needs and timelines. The HLMD Project Team includes membership from the IU, MNC, PD and DRP, which has strengthened the overall innovation process through diversity of expertise and input throughout the project. However, there have been times during which Project Team members have felt that improvements to information-sharing could be made, as well as cross-divisional understanding of device characteristics required to meet needs in the field (as PD, DRP and SD bring different perspectives on ideal device design and target unit price). Communication challenges have also hindered alignment on expectations, for example, the time required for product development. Considering the diverse and global membership of Project Teams, which is an advantage for innovation projects, in the future careful attention should be taken to ensure effective communication between members, for example, through co-development of a long-term workplan at project inception, including estimated timelines for project activities.

While progress towards the intended project outcomes has been made, implementation and scale-up of devices developed will require further consideration in order to be successful. Regarding demand generation, several potential approaches have been identified by interviewees, some or all of which could contribute to successful scale-up of devices. First, acceptability studies could provide evidence of the value and appropriateness of devices for use in programme countries, which could increase buy-in and interest from organizations that purchase anthropometric equipment and/or national governments. These studies could also provide information needed for informed decision-making regarding the suitability of different HLMDs for

use in varying contexts (e.g., health clinic versus field use). UNICEF could also consider approaching WHO for endorsement of product specifications and improved HLMDs as the new gold standard for height and length measurement; however, device design will need to be finalized prior to proceeding with this action, and time to endorsement could be lengthy. Regardless of what approach UNICEF and its partners adopt to scale HLMDs developed through the project, demand generation will be vital to project success, and ensuring that products developed are purchased and used, in order to achieve the intended outcome of improved data quality.

Table 3. Practical considerations for HLMD PIP

Improve communication between Project Team members	UNICEF should improve communication between Project Team members, particularly regarding progress of the PIP over time. Improving the flow of information could help to relieve some of the frustration felt by members, and improve efficiency of the project as a whole. Discussion should include successes, challenges to progress, and next steps in order to align on expectations for PIP progress. Collaborative development of a long-term workplan by the Project Team may improve alignment on expectations and activities.
Consider designing an APC to incentivize manufacturer investment in R&D in programme countries	In advance of the second tender, the Project Team, IRB and AC should consider the use of a pull mechanism to incentivize R&D in HLMDs. Based on SD's Special Contracting Guidance Note developed in May 2018, special contracts should be used only on an opportunistic and catalytic basis to accelerate availability of commodities. While an APC could be appropriate due to the limited market potential of HLMDs, based on response to the first tender, several products have received push funding from other organizations. Therefore, an APC may not be required to enable investment in R&D of new products; however, SD could consider designing an APC to facilitate innovation by manufacturers located in programme countries.
Ensure that devices are ready for field use, including acceptability studies	Members of the AC cautioned that UNICEF should not rush field trials and rollout of HLMDs. Prior to market availability, innovations should be thoroughly validated and tested in the field, making necessary iterations in order to perfect the product prior to launch. This is especially important for high-tech solutions, for which user needs must meet a variety of local environmental and cultural contexts. UNICEF should consider contracting a third party to design and conduct acceptability studies of devices, to understand if they meet user needs in programme countries, and whether they are caregiver- and child-friendly. Evidence from acceptability studies may also increase buy-in for implementation and scale-up of devices.
Consider long-term uses for low- and high-tech measuring devices	As the HLMD project moves through SD's stage-gated process, UNICEF should consider how it and its development partners will implement and scale-up use of new and/or improved devices. One concern for sustainable use of low-tech devices developed through the first tender is that household surveys will replace measuring boards with high-tech devices (e.g., tablet-based) as they become available; however, while household survey budgets may be able to absorb increased unit price, less expensive alternatives (e.g., improvements to the current design) may be appropriate for use at the health facility level. Application will vary depending on the context, and UNICEF should develop procurement and demand generation strategies that reflect this (e.g., explore funding opportunities for implementation at the health facility level) to provide long-term value to manufacturers.

Table 4. Innovation at UNICEF

UNICEF's procurement power and technical expertise can motivate innovators	Manufacturers see UNICEF as an organization with significant procurement power and technical expertise, with an understanding of user needs. UNICEF can leverage these strengths to generate buy-in for existing and future innovations, as has been done by SD for the HLMD PIP through regular consultation with industry, through which the strategic advantage of working with UNICEF is communicated through tools such as TPPs.
Ensure that innovations are fit-for-purpose by identifying how they will respond to a specific need	Design of innovations should include involvement and participation of potential users, with consideration for operational requirements. For the HLMD PIP, UNICEF developed a TPP that described the required and ideal characteristics of an accurate measurement device for use in household surveys and health facilities, to guide development of the ideal product for use in low-resource settings by measurers and health workers with limited training. As the project progresses, it will be important to balance operational and medical/beneficiary needs and requirements (e.g., accuracy, user-friendliness and unit cost).
Leverage expert insight by establishing an Advisory Committee including internal and external stakeholders	Establishing a committee composed of innovation-specific subject matter experts can provide a means through which UNICEF can receive feedback on projects at key stages of the innovation pathway. Advisory groups should include both internal and external stakeholders, taking advantage of UNICEF's diverse expertise along with expertise from academia and partner organizations. Consulting these stakeholders on a regular basis for the HLMD project serves to validate assumptions and provide insight from new information and trends in the field of anthropometry; however, based on interviewee feedback, there may be opportunities to strengthen engagement of the AC to improve informed decision-making
Provide innovators with guidance while allowing the freedom to innovate	Innovators should be given the minimum information and guidance needed to fill the gap and/or address the challenge that the innovation is intended to solve. One of the advantages of UNICEF's approach to co-creation of products with industry is that it avoids being prescriptive in TPPs and RFPs so that innovators are free to come up with novel ideas to meet identified needs. This was noted as a key component of the HLMD project innovation process.
Ensure that learnings and best practices are shared externally	Communication with potential purchasers of devices will be important to facilitate implementation and scale-up of devices moving to commercial availability. For the HLMD project, this includes communication of project status, outcomes and device performance (e.g., accuracy and/or acceptability) to partners, government and academia. Dissemination of progress and lessons learned during development and following commercial availability will be key to encouraging buy-in for use of devices, and could be improved through creation of a knowledge generation and sharing plan.

ANNEX A: METHODOLOGY

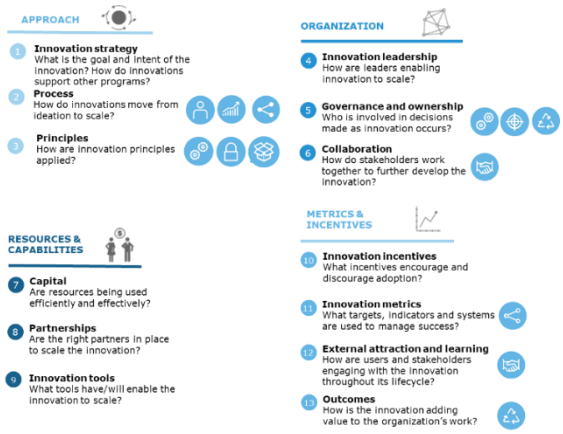
Case study objectives

UNICEF approaches innovation as a strategy to tackle complex challenges faced by children around the world. For this reason, UNICEF identifies, conducts field trials, and uses innovations to address bottlenecks or product gaps, thus **achieving results** that reduce inequities for children.
UNICEF commissioned Deloitte LLP to conduct case studies to examine innovation across the spectrum of innovation types, country contexts, and internal (UNICEF) and external (partner) actors. Cases are **descriptive and explanatory**, identifying how the innovation process has played out in specific instances and surfacing key issues, lessons, challenges and successes. During scoping and development of the Terms of Reference for this evaluation, the UNICEF Evaluation Office (EO) selected cases through a multi-step approach. While diversity across cases was considered as a factor for selection, the sample selected was not intended to be fully representative of innovation at UNICEF. The primary focus of this case is to understand the process of innovation for height/length measurement device (HLMDs), including its challenges and lessons learned.

Evaluation framework

Evaluation questions were structured around a modified version of the Doblin (Deloitte) Framework for Innovation. According to this framework, innovation is seen through four dimensions – approach, organization, resources and capabilities, and metrics and incentives. The four dimensions highlight the elements necessary order to enable successful innovation. They are complementary to other frameworks such as Supply Strategies and Public Procurement Principles, which guide the innovation process at the organization.

Figure 10. Deloitte Doblin Framework for Innovation



Data collection approach

Deloitte employed a mixed methods approach to build a complete picture of the innovation process and identify findings related to the four thematic dimensions of the evaluation framework. Qualitative data were collected through desktop review and case study informant interviews.

Desk review	• **Primary and secondary sources.** Conducted review of demand forecasts, household survey field observations, industry consultation documentation, presentations, workplans, Target Product Profiles, Requests for Proposals, and Innovation Review Board documentation. • **High-level organizational scan.** Reviewed UNICEF Supply Division documentation related to Product Innovation Projects and the stage-gated process of innovation.
Stakeholder engagement	• **Interviews.** Conducted semi-structured interviews, guided by interview protocols, with HLMD Project Team members, Innovation Review Board leadership, the Advisory Committee and suppliers. • **Observations.** Field visit to the Supply Division in Copenhagen, Denmark, to meet with key UNICEF stakeholders and observe prototypes of HLMD.

Description of field visit activities

Two evaluation team members conducted a field visit to Denmark from 11 to 14 June 2018. Scheduling of the visit was completed by the UNICEF Supply Division (SD) based on guidance documents from the evaluation team outlining the desired list of stakeholders for engagement. Activities included interviews with key SD stakeholders across four case studies, one of which was HLMD.

Limitations of this case study

- **This case does not systematically assess the impacts or outcomes of innovation.** The case has captured perspectives on potential outcomes and impacts of innovations, when appropriate. However, given the early stage of development and limited scope of engagement, the evaluation does not make objective conclusions on outcomes or impacts related to HLMD.
- **A single case is not representative of the total population of innovations at UNICEF.** The sampling methodology for selection of cases (i.e., number, type, and field visit locations) was not randomized and, due to the highly qualitative and contextual nature of case studies, findings from this case are not generalizable to innovation at UNICEF. As such, cross-case analysis performed by UNICEF should be done with consideration of this limitation.
- **Field visits were intended to reflect the innovation, rather than SD.** As such, this case study will not make inferences on SD's overall performance in innovation or on the impacts of its innovation function.
- **Due to the nature of innovation, it is expected that some innovations will continue to evolve during case study implementation.** This case presents a reconstruction of the innovation process up to October 2018. Future activities and priorities shared by stakeholders will be captured but cases will not strive to make forward-looking statements or conclusions.
- **Potential for bias in documentation received from UNICEF SD.** SD has a strong documentation process in place for Product Innovation Projects (PIPs). However, the majority of documentation received was developed and used by Project Team members and could be positively biased. Where possible, external sources, including documentation and interviews, were reviewed to validate findings from document review.
- **Potential for bias from case study informants.** Due to the limited nature of this case study, perceptions of stakeholders who were not involved in the process of development of the Acute Respiratory Infection Diagnostic Aid (ARIDA) PIP were not collected. As a result, perspectives of individuals with a stake in positively framing the innovation process are primarily presented. To minimize this bias, external sources of documentation were consulted to verify interviewee statements where possible.

ANNEX B: HLMD STAKEHOLDERS

Key stakeholders for the HLMD PIP include various groups involved in the Project Team, product development, and governance of the innovation.

Table 5. Key organizations, role in development of HLMD, and status of engagement over the course of the evaluation

ORGANIZATION	ROLE IN HLMD	ENGAGED?
UNICEF Supply Division	SD will act as the procurer of HLMD, and the innovation process will follow the stage-gated process utilized by SD for product innovations. Involved in development of the TPPs to guide industry and define requirements for HLMD.	YES
SD Innovation Unit	The IU drives PIPs through the stage-gated process of innovation, to accelerate industry development of novel products. The PM for the HLMD PIP is part of the IU, and is the only dedicated resource on the project.	YES
SD Medicines and Nutrition Centre	The SD MNC is the Procurement Centre responsible for sponsoring the HLMD PIP through the stage-gated process of innovation. MNC contributed a Technical Specialist to the Project Team, who brings valuable technical expertise, suppliers and programme relationships.	YES
Innovation Review Board	Composed of SD directors and section chiefs, the IRB is the only decision-making body in the innovation pathway for HLMD, and has purview of the overall portfolio. The IRB is the governance structure for SD PIPs, controlling advancement through the stage-gated innovation process. The board holds monthly sessions, during which PIPs can choose to present to receive feedback during the project or to advance to the next innovation phase.	YES
Advisory Committee	The AC operates in an advisory role for the innovation, without decision-making abilities. The expert group has provided insight during needs identification and development of the TPP and RFP.	YES
Division of Data, Research and Policy	The Data and Analytics Section of the DRP identified the need for a more accurate HLMD for use in the field. The DRP is included as part of the Project Team for the HLMD PIP, and offers expertise from the perspective of data collection and quality. The Multiple Indicator Cluster Survey (MICS) is a global household survey programme supported by UNICEF, and part of the Data Collection UNIT of the DRP. The MICS team contributed a Technical Specialist to the Project Team, who brings valuable expertise on anthropometric measurement across household survey programmes.	YES
Programme Division	PD has committed a resource to the Project Team for the HLMD PIP, bringing valuable expertise and knowledge of anthropometric measurement in UNICEF programmes.	YES
Manufacturers/Suppliers	Manufacturers/suppliers are expected to improve and/or develop new HLMDs in response to the TPP and availability of LTAs.	YES

Table 6. List of interviews completed for this case study

Name	Organization	Position
Gene Alexander	Body Surface Translations, Inc.	Chief Technology Officer
Bo Robert Beshanski-Pedersen	UNICEF DRP (former)	Consultant
Kenneth Brown	Bill & Melinda Gates Foundation	Senior Fellow, Nutrition
Alison Fleet	SD	Technical Specialist, Nutrition Unit, MNC
Edward Frongillo	University of South Carolina, Arnold School of Public Health	Professor and Chair, Department of Health Promotion, Education and Behaviour
Gian Gandhi	SD	Chief, Markets, Supplier Financing and Innovation Centre
Kristoffer Gandrup-Marino	SD	Chief IU
Jonathan Howard-Brand	SD	Innovation Specialist, IU
Hedy Ip	UNICEF Myanmar	Nutrition Specialist
Natalie Jones	SD	Operations Officer, IU
Julia Krasevec	UNICEF	Statistics & Monitoring Specialist, Data and Analytics
Gemma Orta-Martinez	SD	Chief, Monitoring, Strategic Data and Evidence Unit
Ana Cristina Matos	SD	Evaluation Specialist
Louise Mwigiri	UNICEF	Information Management Specialist, Nutrition Section
Marek Porubský	PKP Bardejov s.r.o.	Chief Executive Officer
Suvi Rautio	SD	Deputy Director Supply Programme
Bo Strange Sorenson	SD	Technical Officer Innovation, IU
Regine Weber	SD	Chief, Strategy, Change and Communications Centre

ANNEX C: LIST OF DOCUMENTS CONSULTED

List of UNICEF files shared with the Evaluation Team

- 05.04.2017 – Chempatex minutes
- 1 – Project Charter – HMD -01
- 1100 – MNC procurement overview including nutrition supplies.pdf
- 2 – HMD TPP V2.0
- 3. HMD – TOR of Advisory Committee
- 5. Suggested Advisory Committee members for the height innovation project
- 14 – IU Workplan 2017 (1)
- 15 – IU Workplan 2018
- 2016.12.13 – Gate 1 – HMD – 01
- 2016.12.13 – Minutes – HMD – 01
- 2016.12.13 – Project Charter – HMD - 01
- 2017.03.22 – PATH
- 2017.04.03 – Minutes PKP
- 2017.04.07 – Allenstick minutes
- 2017.04.07 – Pimolchaisuksakorn
- 2017.04.10 – Arizona minutes
- 2017.04.11 – Minutes VisImage
- 2017.04.19 – Minutes Field Ready
- 2017.05.04 – Damarus
- 2016.05.25 – HMD TOR of Advisory Committee
- 6. Project Officer (Innovation) P2
- 7. MICS field data observations Nigeria HMD
- Child anthropometry
- DHS Methodological Reports No. 16
- Height Length Measuring Boards
- Height Measurement Device – TPP.pdf
- Height Measurement Device – TPP Brief.pdf
- Height Measurement Devices – RFP – FAQ
- HL measurement device – RFP – 502602
- HMD Advisory Committee and Project Team Constellation
- HMD Technical Evaluation Criteria
- HMD TPP V2.0
- MICS field data observations – Nigeria – HMD
- Overview of available boards on market – 8dec2015.docx
- Reliability of anthropometric measurements in the WHO multicentre growth reference study
- TPP QAs Height Measurement Device 03
- Medicines and Nutrition Centre: Procurement and overview including nutrition supplies.pdf

List of external files consulted

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- United Nations, 2017. UN Supplier Code of Conduct.
- United Nations Global Marketplace, 2018. Supplying the UN System.
- USAID, 2015. An Assessment of the Quality of DHS Anthropometric Data, 2005-14. *DHS Methodological Reports 16.*
- USAID, 2016. Anthropometric Data in Population-based Surveys Meeting Report.
- WHO, 2010. Country Profile Indicators: Interpretation Guide. *Nutrition Landscape Information System (NLIS).*
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ANNEX D: THE CONTEXT FOR INNOVATION AT SUPPLY DIVISION

Supply Division (SD) Product Innovation Projects (PIP) are intended to create impact for women and children through UNICEF programmes, and follow a defined process that covers all stages of innovation, from idea to implementation and scale. SD designed the procedure to facilitate an iterative approach to innovation that is valuable and flexible effective governance for each individual PIP.

Innovation process: SD has defined a stage-gated innovation process to cover all stages of the PIP lifecycle, from exploration to scale. The process is meant to be highly iterative at the beginning of the PIP in response to new information and/or lessons learned, with decreasing levels of iteration as the project progresses.

Table 7. Supply Division stage-gated innovation process

	GATE → Phase 0: Explore	GATE → Phase 1: Concept	GATE → Phase 2: Field trial	GATE → Phase 3: Scale up
Description	In this phase, the Project Team will conduct research to assess relevance, complete a needs assessment and user analysis.	This phase explores and tests potential solutions to address the challenge, including detailed analysis of concepts and development of a draft TPP.	In this phase, the physical prototype(s) of the product is developed and tested in the field, and may involve multiple iterations.	In this phase, scaling of the solution(s) begins through increased procurement and close monitoring of implementation.
Level of iteration	High	Moderate	Little	Very little

To advance from one phase of innovation to the next, PIPs must meet the criteria required to pass through a stage gate. A PIP may start and be closed at any gate/phase of the innovation process.

Governance of the innovation process: In order to pass through Gate 0 and enter the exploration phase, the Innovation Chief and Centre Chief must approve a project as an innovation project for the projects. Following approval as a PIP, advancement to the next phase of the innovation process requires the project to pass through a stage gate after presentation of its status to the Innovation Review Board (IRB). The IRB is the sole decision-making body for PIPs, responsible for deciding whether a product should advance to the next stage of innovation, remain in the same stage, or be abandoned. The Project Team presents the status of PIPs at meetings of the IRB at key points in the life cycle of the innovation, for example to obtain resources for field testing, or to receive input on significant decisions.

Documentation: Advancement through the phases of innovation is well documented at each stage of the project lifecycle, and typically includes:

- Project Charter
- IRB Budget Template
- Project updates to the IRB (including meeting minutes)
- Gate proposal (case for passage through each gate)
- Presentation to the IRB (for input and/or passage through each gate.

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