PART 2 – TERMS OF REFERENCE

Terms of Reference

for the

Project: “Promotion of Youth Employment and Vocational Training in Kenya, Phase II”

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1. INTRODUCTION

1.1. Background

Despite economic success yielding growth rates of 5% on average over the last decade, and a favourable demographic situation, Kenya is characterized by high youth unemployment. As such, offering high quality technical and vocational education and training (TVET) for young Kenyans is crucial to increase employment and the supply of qualified skilled workers.

The German development cooperation with Kenya aims at fostering sustainable economic development, decent work and innovations as well as to enable an environment for sustainable development. The education sector is a cornerstone of the cooperation. It is dedicated to provide young people with prospects for the future as well as to foster innovations by offering practice-oriented Technical and Vocational Education and Training (TVET). Kenya and Germany started to extend their ongoing cooperation in the education sector, manifesting in the "**Kenyan -German TVET Initiative**" (KGTI). This new engagement covering both Financial Cooperation (FC) as well as Technical Cooperation (TC) aims to improve the Kenyan youth's employability and to ensure that their skills meet the demands of the labor market. This shall be realized by providing high-quality, practice-oriented TVET that incorporates state-of-the-art, industry-oriented equipment, infrastructure measures, development of practice- and labor-market oriented occupational standards, curricula and training materials, as well as training / advisory support to TVET institution staff. Accordingly, 3 public TVET Institutions located within the greater Nairobi area had been identified to be upgraded as **Centres of Excellence** (CoE) for Cooperative Training in the Phase I of the project. Phase I is currently in implementation and Phase II shall proceed to implementation alongside being targeted at 4 selected institutions at the Lake Basins region.

1.2. FC Project Concept

Bilateral government negotiations between Kenya and Germany took place in December 2018, resulting in the German Government's commitment of EUR 12 million (IDA loan) for the FC Measure of the second phase ("Phase II") of the project. The Loan Agreement for this project has been signed on 30.12.2019. This phase focuses on supporting selected TVET institutions at the Lake Basins region to become CoE (Centre of Excellence). A feasibility study (provided as separate document) was commissioned by the KfW to identify specific demand for this FC TVET project. The feasibility study gives a preliminary assessment of the options. In discussions between MoE, GIZ and KfW the exact occupational areas in which the four selected future CoE shall be promoted have been re-defined. The occupational areas are attached as Annex 2 and form the basis for this assignment.

This included an on-site evaluation of 21 public TVET institutions, 3 Institutes of Technology, 2 National Polytechnics – in different counties of Kenya (Nairobi, Mombasa, Kilifi, Nakuru, 'Lake Basin Region') that had been pre-selected by the MoE and KfW as possible future CoE. Out of these, 10 Institutes were presented to the MoE which in turn shortlisted 5 Institutes and one 1 backup Institution for Phase II of the project. Due to unclear land titles of some of the institutes and the experiences with land titles gained under Phase one, the MoE and KfW agreed that four institutes shall be supported under the second phase, these are:

i. Bumbe Technical Training Institute
ii. Kitale National Polytechnic
iii. Ramogi Institute of Science and Technology
iv. Ekerubu Egeitai Technical Training Institute

The selected Institutions are located at the Coast and the Lake Basin regions. The Ministry of Education (MoE) will be the Project Executing Agency (PEA). To implement the project, the PEA will be supported by an implementing FC Consultant whose services are sought herewith.

1.3. Project Outputs & FC Financed Measures

The following project outputs and measures will be financed from the Financial Contribution:

i. Stakeholder discussion to fine-tune the occupational areas per CoE
ii. rehabilitation and or design and construction of workshops and other buildings (only to the extend necessary).
iii. Procurement and installation of training equipment in the selected occupational areas, initial user training, including a maintenance concept, provided by the suppliers. In particular, the selected institutes shall be equipped as follows:
    - BUMBE TTI shall be developed to a CoE for automotive technicians (approx. EUR 2 million for equipment and building);
    - KITALE National Polytechnic shall be developed into a CoE for commercial & agricultural vehicle mechatronics (appr. EUR 1.9 million for equipment and building);
    - RAMOGI Institute of Advanced Technology shall be developed to a CoE for refrigeration and cold store mechatronics (appr. EUR 2 million for equipment and building);
    - EKERUBO TTI shall be developed into a CoE for plant technician / tea sector (appr. EUR 1.75 million for equipment and building);
    - EKERUBO TTI and KITALE National Polytechnic will also be upgraded in renewable energies (within the given respective budget);
iv. Incubation centers to support entrepreneurial TVET students (approx. 0.75 Mio. EUR)
v. Costs for the FC consultant responsible for managing the implementation (incl. O&M Concepts)

1.4. FC Consulting Services

The Consultancy team will support the MoE and the selected TVET institutes in the implementation of the FC Project. The Tenderer is explicitly encouraged to present a detailed critical analysis and the Tenderer's interpretation of the project's objectives and the ToR. This might encompass critical comments and doubts about the suitability, consistency and feasibility of individual aspects and the concept as a whole, if any. The methodology suggested must take constructive account of these.

2. SCOPE OF WORK OF THE CONSULANT

The following tasks provide the general framework of the Consultant's assignment shall be implemented:

Work Package I	**General Support / Implementation Tasks**
Description	Support the PEA (MoE) and beneficiary TVET institutes in the daily management of the project including administrative tasks , ESHS topics and financial administration / financial management and the regular reporting.
Scope of Work	Project Management / Reporting • Organization of kick-off workshop including introduction to FC procedures (Disbursement, Procurement) • Final confirmation of selected TVET Institutes/Final confirmation of occupational areas per TVET institute/CoE • Take up discussions with the stakeholders about the propositions described in the Feasibilty Study and revised agreements on focal areas (to ensure that the requirements are still valid)

	• Development of concepts for the future CoEs in cooperation with the respective school management, local industry partners, GIZ and MoE;
	• Supporting the identification of adequate local industry partiers for the TVET training which shall be done cooperatively;
	• Confirmation of status quo regarding development of occupational standards and curricula (preferably in cooperation with GIZ)
	• Ensure overall project coordination, supervision and management (including coordination of all consulting measures/ work packages under this assignment)
	• Develop and build-up of an FC Project Management Team (day-to-day management)
	• Coordination of measures under this FC Project with TC measures (GIZ-supported) and other activities of the KGTI (Kenyan German TVET Initiative);
	• Support MoE in its technical and financial project progress reporting to KfW (in accordance with the respective reporting requirements, e.g the timeplan and respective time management)
	Financial Administration and Financial Management
	• Financial management of the project
	  ○ Opening and managing of different accounts (if and where required)
	  ○ Supporting with approvals of payments (and payment releases)
	  ○ Developing and regular updating of procurement plans
	• Develop project financial risk identification and mitigation mechanisms, including staff sensitization on financial risk and fraud, where necessary and applicable

Required Skills and Experience	The PEA (MoE) is looking for a multidisciplinary team of international and local consultants (a mix of long-term and short-term assignments) with a strong profile in the TVET sector which will bring the necessary expertise to support the MoE and beneficiary TVET institutes in the most efficient way when implementing the FC projects. Please see 4. REQUIRED EXPERTISE for details.
Expected Results	• Refined and detailed project implementation plan as part of inception report, including milestones, tasks and responsibilities • FC Project Management Team established • Cooperation with GIZ ongoing and regular exchange • Quarterly Project Progress Reports (including financial reporting)
Estimated Workload	Approximately 24-30 expert months (international and local)

Work Package II	**Civil Works / Construction / Rehabilitation**
Description	Support the PEA (MoE) and beneficiary TVET institutes during the following stages: Stage 1: Preliminary/Detailed Design and Tender Documents Step 1.1 Inception Phase Step 1.2 Preliminary and Detailed Design Step 1.3 Preparation of Pre-Qualification (PQ) and Bidding Documents Stage 2: Assistance during Tendering Step 2.1 Prequalification Process Step 2.2 Tender Process Step 2.3 Bid Evaluation Process, Pre-Award Discussions and Award Stage 3: Supervision of Construction Works and Supplies Stage 4: Services During Defects Liability Period and Closure of Project
Scope of Work	Stage 1: Preliminary/Detailed Design and Tender Documents Step 1.1 Inception Phase The services of the Consultant shall start with a thorough evaluation of available data, information and planning documents as well as from a critical review of the approved Feasibility Studies in order to trace critical issues and clarify key problems. The database and the evaluation of the actual current situation compared to the ToR, the Feasibility Studies and the Consultant's proposal shall provide a reliable basis for an update of the further planning including updates of the implementation schedule, the work plan and staffing schedule based on the schedules included in the Consulting Contract. Step 1.2 Preliminary and Detailed Design The details of the Design Documents shall be worked out based on the Feasibility Studies and include specific ESHS aspects, as required for qualified execution and fair Tender Process of Works and Goods. The documents shall be composed of a com-prehensive Design Report, supportive annexes, not limited to: layout and structural drawings presented in an appropriate scale and to an appropriate degree of detail and a cost estimate per component. For guidance/assistance (please see Annexes 3 and 4), which could be considered where applicable. Step 1.3 Preparation of Pre-Qualification (PQ) and Bidding Documents The Prequalification Documents shall be compiled in accordance with KfW Procurement Guidelines "Guidelines for the Procurement of Consulting Services, Works, Plant, Goods and Non-Consulting Services in Financial Cooperation with Partner Countries". This includes the definition of the qualification criteria, evaluation grid and minimum requirements for technical, financial and ESHS capacity of the Bidders. Criteria should be commensurate with the assignment requirements and shall not be formulated in a manner unnecessarily restricting the competition. The Bidding Documents shall be compiled in accordance with KfW Procurement Guidelines and the respective valid version of KfW's Standard Bidding Documents (SBD) for Procurement of Works, based on FIDIC Pink Book including the standard ESHS requirements. Works and supplies shall be subdivided into appropriate lots as defined in the agreed and approved procurement concept and in line with PEA's Procurement Plan. Furthermore, the tendering procedures and contract awards shall follow the national regulations and standards in Kenya. Stage 2: Assistance during Tendering Step 2.1 Prequalification Process • Preparation of advertisement for invitations to prequalify; ensure that the procurement notices are advertised on the website Germany Trade and Invest (www.gtai.de) [in case

	of Inter-national Competitive Bidding] and in at least one newspaper of national circulation in the Employer's Country or in the official gazette, or on a widely used website or electronic portal with free national and international access (such as www.dgmarket.com); • Ensure that the notification shall be given with adequate days' no-tice to enable prospective Applicants to obtain Prequalification Documents and prepare and submit their applications; • Assistance to the Employer in promptly responding to requests for clarifications from Applicants; • Assistance to the Employer in evaluating the applications according to the pre-defined criteria and proposing a short list of qualified Applicants; • Assistance to the Employer in preparing an Evaluation Report in accordance with the relevant reporting requirements of KfW. • Assist the Employer in informing the unsuccessful Applicants. Step 2.2 Tender Process With regard to Tendering and Contracting of works and goods, the Consultant shall assist the Employer in finalizing the final Bidding Documents ready for publishing, and in organizing the whole tendering process for construction and supply including the preparation of pre-bid meetings if necessary. • Preparation of advertisement or invitations for qualified Bidders to prepare a bid; • Ensure that the procurement notices are advertised on the website Germany Trade and Invest (www.gtai.de) [in case of International Competitive Bidding] and in at least one newspaper of national circulation in the Employer's Country or in the official gazette, or on a widely used website or electronic portal with free national and international access (such as www.dgmarket.com); • Ensure that the notification is given in sufficient time [45 to 60 days] to enable prospec-tive Bidders to prepare and submit their Bids • Assist the Employer in preparing and implementing the pre-bid meeting(s) • Ensure that ESHS specific issues are emphasized and inform that upon contract award, the successful Bidder must comply with the agreed Code of Conduct • Assist the Employer in promptly responding in coordination with the Employer and KfW to requests for clarifications from Bidders Step 2.3 Bid Evaluation Process, Pre-Award Discussions and Award Support the Employer in awarding Procurement and Construction Contracts through the evaluation of Bids and pre-award discussions with regards to technical, financial and ESHS aspects: • Assist in Bid opening procedures and advice during bid evaluations according to the KfW's Procurement Guidelines • Assist the Employer in evaluating the bids according to the pre-defined criteria, determining whether the bidder is substantially responsive (i.e. without deviation, reservation or omission) to KfW´s requirements • Assist the Employer in proposing the most advantageous bidder • Assistance to the Employer in preparing an Evaluation Report in accordance with the rele-vant reporting requirements of KfW. Ensure that the report is transparent and sufficiently in-formative instead of merely stating "complied", "yes" or "no" and complies with KfW's format requirements (including e.g. KfW's Bidders Information table [Excel-upload sheet] • Assist the Employer in preparing the agenda for pre-award discussions and assistance to the Employer during pre-award discussions and preparation of minutes of meeting • Assist [Add. please clarify what "assist" in this context means] the Employer in preparing contract documents including all annexes • Assist the Employer in informing the unsuccessful Bidders.

Stage 3: Supervision of Construction Works and Supplies

The Project Supervision includes general and Site Supervision of Works, the preparation of initial operation activities, continuous project management and monitoring, periodic reporting and participation in the preliminary acceptance. General supervision and site supervision of Works shall be performed on a continuous basis.

- Coordination and liaison with the Employer, Contractor(s) and other relevant institutions including:
  - Organisation of regular site-meetings with the Contractor(s), the Employer's representatives and other key-stakeholders concerned; incl. Preparation and circulation of minutes of meetings;
- Take over the role of the Engineer and carry out all tasks of the Engineer in accordance with the FIDIC Pink Book including among others:
  - Contract and claim management;
  - Control of the validity of the Contractor's documents such as insurance policies, bank guarantees, transport documents, etc.;
  - Quality and quantity control for all works and supplies via day-to-day inspection of the Contractor's work;
  - Provide guidance to the Contractor to conform to the specifications;
  - Ensure that the Contractor is only using permanent and temporary construction material in compliance with the technical specifications and works requirements;
  - Time and expenditure control;
  - Review and approval of the Contractor's invoices and issuance of the corresponding "Payment Certificates" to the Employer;
  - Reporting on project progress and risks in accordance with the reporting requirements of KfW;
  - Assistance to the Employer in dealing with any variation orders to the Works Contract;
  - Ensuring visibility according to donors' requirements;
  - Review of the Contractor's reports, shop drawings; as-built drawings, operation manuals, maintenance plans, etc.;
  - Supervise the Contractor's testing and commissioning of the constructed works and Contractor's supply;
  - Preparation of a snag list and assistance to the Employer in the preparation of provisional acceptance;
  - Participation in the reception of works.

Stage 4: Services During Defects Liability Period and Closure of Project

The assistance during the Defects Liability Period (DLP) and Closure of Project, after the issuance of the Taking Over Certificate, shall address all post-construction activities up to the final acceptance of works through the Performance Certificate. The Consultant shall carry out regular inspections during the DLP in order to ensure the execution of all remedial works by the Contractor. Prior to Project Completion the Consultant shall check that also all EHSH related tasks of the Contractor are completed and the areas of activities have been reinstated by the Contractor. On expiry of the DLP the Consultant shall assist the Employer in issuing a Certificate confirming that the constructions/installations were completed successfully in accordance with the specified performance level (Performance Certificate).

ESHS related topics

The Consultant shall in the respective phases, follow the requirements stipulated in the "ESMP+ESCOP Guidance"-package attached to this RfP. This includes but is not limited to providing guidelines and implementation advice regarding:

	• Construction site safety when buildings partially are still in use for school activities including adjustment of escape routes and structural stability of buildings at all times • Safe use of scaffolding based on OSHA 3150 • Grievance Mechanism to ensure that all stakeholder comments, suggestions and objections are captured and considered. The Grievance Mechanism should be specifically efficient in addressing gender-based violence. • Safe handling of hazardous materials including PPE requirements, qualification/certification requirements of contractors, certification requirements of dumping sites. National requirements such as the National Guidelines On Safe Management And Disposal Of Asbestos by NEMA have to be respected. • Applying a Due Diligence checklist provided by KfW in case additional land is acquired.
Required Skills and Experience	The PEA (MoE) is looking for a multidisciplinary team of international and local consultants (a mix of long-term and short-term assignments) with a strong profile in the TVET sector which will bring the necessary expertise to support the MoE and beneficiary TVET institutes in the most efficient way when implementing the FC projects. Please see 4. REQUIRED EXPERTISE for details.
Expected Results	General: all Results/Documents shall consider respective ESHS aspects. Stage 1 • Minutes of the Meetings (Kick-off Meeting) • Inception Report • Drawings • Design criteria • Procurement concept • Confidential cost estimate • Design Report including cost estimation, time schedule, etc. • PQ-Documents • PQ Evaluation Matrix • Bidding Documents • Bid Evaluation matrix • KfW checklist Stage 2 • PQ-Evaluation Report • Publication of PQ results • Evaluation Report • Publication of Bidding results • Contract Documents Stage 3 • Progress Reports

	Stage 4 • Progress Reports • Final Project Report
Estimated Workload	Approximately 80-100 expert months (international and local)

Work Package III	**Equipment and Furnishing (incl. Training)**
Description	Support the PEA (MoE) and beneficiary TVET Institutes in planning, procuring and installation of necessary equipment for the respective Centres of Excellence (as per 1.3 above).
Scope of Work	• Determine with private sector participation the equipment needs of each institute in close coordination with GIZ and developed and approved CBET curricula • Coordination and supervision of procurement[7] of equipment and furnishing: Specification of necessary technical and non-technical equipment and furnishing, development of tender documents including technical specifications, execution of the tender including evaluation and contract award; formal acceptance of procured equipment for workshops and training facilities, preparation and supervision of delivery services and installation of delivered goods; monitoring of instruction sessions (by the manufacturer) for teaching staff regarding technical equipment • Contract management of delivery contracts for equipment and furnishing including quality assurance and approvals of payments (and payment releases) • Coordination of supply and installation of technical training equipment and equipment related vendor training • Management of service contracts for equipment supply (release of payments etc.) • Elaboration of an operation and maintenance (O&M) concept documented in a guideline, incl. adaptation for each selected institute / training in application of the O&M concepts – preferred as digital concept with offline back-up
Required Skills and Experience	The PEA (MoE) is looking for a multidisciplinary team of international and local consultants (a mix of long-term and short-term assignments) with a strong profile in the TVET sector which will bring the necessary expertise to support the MoE and beneficiary TVET institutes in the most efficient way when implementing the FC projects. Please see 4. REQUIRED EXPERTISE for details.

[7] Procurement executed in compliance with KfW procurement rules and in accordance with Kenyan rules and regulations. Kindly refer to Work Package II for a detailed description of the respective procurement steps.

Expected Results	• Complete Tender documents (incl. evaluation reports and contract document) for procurement of equipment and furnishing • Written standard operating procedures and governance structure for the maintenance and updating of the new equipment at all beneficiary TVET institutes • Trainers are well acquainted with new equipment and pedagogically capable to transfer technical know-how to TVET students • Sound and transparent financial reporting, including cash projections and timely withdrawal requests • Enhanced capacity on financial risk management within beneficiary TVET institutes and MoE
Estimated Workload	Approximately 16-20 expert months (international and local)

Work Package IV	**Incubation Centres and Development of Business Models**
Description	Support the PEA (MoE) and beneficiary TVET Institutes in developing and establishing of incubation centres on enhancing entrepreneurship curricula taking a differentiated approach when it comes to entrepreneurship training depending on the entrepreneurial spirit of the beneficiary. The incubation centres shall enhance entrepreneurial spirit as well as entrepreneurial skills and knowledge beyond the current existing structures. It shall especially help to identify young entrepreneurs at early stages and help them with targeted support from early stages to make their entrepreneurial idea to prosper. It is expected that the management of the incubation centers will be transferred step-by-step to the local partners.

Scope of Work	• Develop a report with work plan based on stakeholder meetings and interviews, and desk reviews of related documents
	• During the Inception Phase:
	  ○ Provide options to the team in identifying suitable locations within the TVET Institutes to set up incubation centres
	  ○ Organize discussions with the identified TVET Institutes and seek interest in operating incubators (external or internal solution)
	  ○ Engage relevant TVET Institutes as a strategic partner for running the incubation centres
	  ○ Develop the Terms of Reference of the identified agency that will set up the incubation centres (existing facilities or separate facility within the newly designed buildings)
	• During the Design Phase:
	  ○ Develop guidelines and criteria for the design and operation of incubation centres
	  ○ Develop task / job description for partner personnel operating the centre and design a capacity development and / or mentoring plan

	○ Specify the roles of the project and partner agencies (centre, facilitator and concerned stakeholders) • During the Incubation Phase: ○ Design and implement a mentoring process ○ Support the prospective start-ups to develop their business models, and assist them in the validation and assessment processes ○ Support the start-ups in presenting their business models to potential identified sponsors ○ Alignment with GIZ • During the Implementation Phase: ○ Prepare Memoranda of Understanding to formalize business incubation agreement ○ Develop standard operating procedures for running the incubation centres that include the following: ▪ Management roles, incubation centres, and start-ups ▪ Guidelines and criteria for operating incubation centres ▪ Advertisement for business incubators ▪ Monitoring and evaluation c. Run the incubation centres (alignment with GIZ) ▪ Identify start-ups, resource persons, co-facilitators ▪ Prepare physical space and centres ▪ Conduct mentoring ▪ Costing • Design of business models for the incubation centers at the TVET Institutes ○ Engage in discussions with staff members to conceptualize business models and assess its value proposition ○ Conduct meetings and interviews with relevant stakeholders to evaluate the business models, and support its finalization after review and revision ○ Provide support and relevant material where necessary in the preparation of a business plan to include financial plan, HR, marketing, communication, etc. ○ Prepare a comprehensive report apart from the specific deliverables as outlined in the scope of work, finalize and submit the required hard and soft copies
Required Skills and Experience	The PEA (MoE) is looking for a multidisciplinary team of international and local consultants (a mix of long-term and short-term assignments) with a strong profile regarding enterprise development and with familiarity with the enterprise landscape of Kenya which will bring the necessary expertise to support the MoE and beneficiary TVET Institutes in the most efficient way. Please see 4. REQUIRED EXPERTISE for details.
Expected Results	• Delivery of a report with work plan based on document reviews, interviews and desk research

	• Contractual logistical arrangement of all 4 incubation centres completed • Incubation materials developed and process rolled out in incubation centres • Business models for the incubation centers are defined and agreed with the stakeholders • Management of the incubation centers has been transferred step-by-step to the local partners • Delivery of a final report
Estimated Workload	Approximately 10-12 expert months (international and local)

Work Package V	**Monitoring and Evaluation**
Description	Support the PEA (MoE) and beneficiary TVET Institutes in developing and establishing of an M&E framework including the internal capacity building for its ongoing management. The framework shall in preference be digitally supported with remote access and in line with Kenyan requirements.
Scope of Work	**Project Evaluation and Impact Assessment** • Establishment of a Monitoring and Evaluation System - might include Baseline Studies, Midterm Review • Develop a project M&E framework together with MoE and beneficiary TVET institutes (proposed to take place by quarterly analyses of trainees, graduate figures, etc. e.g. by annual surveys) • Capacity needs assessment for MoE and TVET institutes regarding ongoing project M&E systems • Provide data for the monitoring of project success in line with the agreed project results • Preparation of a graduate tracking system • Strengthen MoE and TVET institute management's capacity regarding ongoing project M&E systems
Required Skills and Experience	The PEA (MoE) is looking for a multidisciplinary team of international and local consultants (a mix of long-term and short-term assignments) with a strong profile in the TVET sector which will bring the necessary expertise to support the MoE and beneficiary TVET institutes in the most efficient way when implementing the FC projects. Please see 4. REQUIRED EXPERTISE for details.
Expected Results	• M&E framework in place and actively being followed by all TVET institutes / CoEs • Management of TVET institutes is well acquainted with M&E system • MoE is equally well acquainted with M&E system
Estimated Workload	Approximately 12-15 expert months (international and local)

2.1 Deliverables

The Consultant shall deliver all tasks as described in Work Packages I to V above. The reporting shall be in line with the reporting principles agreed between MoE and KfW in the respective Annex of the Separate Agreement. The successful delivery shall be documented in a suitable way and regularly reported to MoE and KfW as follows:

No.	Deliverable	Content	Scope	Deadline
1.	Kick-off Workshop	Meeting locally with all stakeholders in the Project. Introduction of key staff of the Consultant's team, presentation of the work plan, the milestones and the implementation plan taking into consideration all four TVET institutes.	1-2 days	Within three weeks after commencing the assignment.
2.	Inception Report	Detailed work plan for the assignment, summarizing milestones and the implementation plan.	Limited to 15 pages (plus annexes)	First draft two months after commencing the assignment.
3.	Quarterly Progress Report	Comparison "planned" and "actual" (original time schedule vs. actual time passed / original disbursement schedule vs. actual disbursements / etc.): All activities performed and results achieved within the reported period; any problems that have been encountered or are foreseen and how they have been or shall be solved.	Limited to 15 pages (plus annexes)	Quarterly, at the end of each calendar quarter, starting three months after delivery of the Inception Report.
4.	Final Report	Comparison "planned" and "actual" (original time schedule vs. actual time passed / original disbursement schedule vs. actual disbursements / etc.): All activities performed, covering all aspects of the scope of work, deliverables, results and indicators; recommendations relevant to MoE and other stakeholders in the Project.	Limited to 25 pages (plus annexes)	Four weeks after the end of the assignment.
5.	Ad hoc Reports	Information on the relevant ad hoc event.	Adequate scope	In case of important developments and severe challenges or on request of MoE or KfW.

For successful delivery the Consultant shall take into consideration that no provision will be made by the Employer with regards to office space, transportation, etc.

3. TIMELINE

The total duration of the consultant's assignment is scheduled for up to 36 months. Commencement of consulting services is expected directly after the award and signing of the consulting contract. However, it is the responsibility of the bidder to critically assess the estimated duration of the services, and to establish his own detailed work program and time schedule in accordance with his professional judgement of the complexity of the project and under consideration of the local conditions. This should

show how the tasks will be performed in parallel, as management and coordination of a variety of experts and teams for the different tasks will be a major challenge. A tentative work plan is provided in the feasibility study which has been provided with the tender document. Generally, Consultants are tasked to optimize the work streams and to align the procurement / tender processes.

4. REQUIRED EXPERTISE

The Implementation Consultant shall dispose of profound project experience in concept development for institutional support of TVET institutes to also liase them with private sector players, implementation of FC-funded investment projects including equipment procurement and building construction measures for TVET schools, and substantial national / regional experience. Furthermore, knowledge of the cooperative training approach is desirable in order to facilitate more private sector engagement.

The PEA (MoE) is thus looking for a **multidisciplinary team** of international and local consultants (a mix of long-term and short-term assignments) with a **strong profile in the TVET sector** which will bring the necessary expertise to support the MoE and beneficiary TVET institutes in the most efficient way when implementing the FC projects.

It is the responsibility of the Consultant to propose a team of international and national experts according to his own assessment of the needs of the assignment. The indication of workload for each work package is indicative, preliminary and flexible within the two work packages. It is preferred that the suggested experts simultaneously cover different of the below mentioned fields of expertise, thereby allowing for efficiency gains in design, execution and financial terms. **For all positions fluency in both written and spoken English is obligatory.**

At the minimum, the Consultant should propose a team of experts with the following fields of expertise:

4.1. Team Leader

- Demonstrated working experience (minimum 10 years) in the education/ TVET system in Kenya or regional countries (regional countries = countries of Sub Saharan Africa, preferably East Africa) in similar projects
- Excellent interpersonal skills required for high level engagement with government ministries, departments and agencies, school management and teaching staff, private sector representatives, development partners and a wide range of TVET stakeholders
- Profound experience in leading a diverse team
- Experience in quality control in the different areas of the envisaged consultancy services
- Proficiency in writing and presentation skills, and ability to communicate effectively to diverse audiences.

➔ It is expected that the Team Leader also covers professional tasks of specific work packages of the assignment, thereby economising on staff cost.

4.2. Procurement Expert (position preferably executed by the Team Leader)

- A post-graduate degree in educational science, social science, economics or project management
- At least 10 years relevant working experience
- Profound experience in TVET projects (design and implementation) including substantial experience in capacity building and delivery of TVET programs (preferably in developing countries, experience in Kenya is a plus);

- Experience in the inclusion of private sector companies and future employers into technical training;
- Proven understanding of the Kenya education system, in particular the Kenyan TVET system
- Excellent interpersonal skills
- Proficiency in writing and presentation skills, and ability to communicate effectively to diverse audiences.
- Profound experience, proven track record in carrying out procurement assignments or projects

4.3. Financial Experts/Accountant

- Degree in Finance, Financial Management, Statistics or related fields
- At least 5 years of professional experience in development cooperation projects
- Good understanding of development project planning and costing
- Added advantage: Experience in implementation of FC Projects, ideally in handling disposition funds

4.4. Engineering and Technical Experts (either position alternatively executed by the Team Leader)

- Post-graduate degree in civil engineering / architecture
- Profound expertise in civil engineering with not less than 10 years' professional experience in similar internationally funded construction / engineering projects and familiar with requirements of workshop construction, its surroundings and equipment
- Proven ability to manage the detailed planning, tendering as well as implementation and work supervision of projects of this nature. Proven track record in the field of civil engineering, particularly in developing countries (preferably East Africa)
- General knowledge about ESHS topics (to be supported by ESHS Expert)
- Technical training experts for analysing CBET standards / curricula, elaborating workshop layouts and equipment lists Inspection of installation and final acceptance who will provide specific experience in selection and specification of modern training equipment, tools, teaching aids and didactic materials for the trades selected

4.5. Environmental, Social, Health and Safety Expert (ESHS)

- Profound experience with environmental and social risk management, socio-economic issues, health and safety, and labour is a must.
- Knowledge in environmental and social laws and.
- Experience in working with ESHS Standards is obligatory, familiarity with the respective Kenyan standards is obligatory.
- Candidates shall present experience in the development and implementation of stakeholder engagement strategies and - plans

4.6. Monitoring and Evaluation Expert (M&E)

- Professional qualification/certificate in Monitoring and Evaluation
- Profound experience, proven track record to have set up sound M&E systems
- Excellent interpersonal skills
- Good writing and presentation skills, and ability to communicate effectively to diverse audiences.
- Experience in capacity building and training of partners in the roll out and implementation of M&E systems

4.7. Incubation and Entrepreneurial Expert (with special knowledge on TVET entrepreneurs and setting up a TVET entrepreneurship support scheme at school level)

- At least Master's degree in economics, social science, entrepreneurship or related disciplines
- At least 7 years of professional experience including 5 years of international experience in providing support to entrepreneurs and other interested persons in developing business models or similar cases
- Previous experience in successfully establishing and coordinating business incubation support services including technical assistance and mentorship programs
- Prior work experience in East Africa or neighboring countries or similar environments in enterprise development projects

4.8. Pool of Short-Term Technical and Education Advisors

- Pool of short-term experts able to respond to various requirements as per the Consultant's own assessment or as back-up / additional resources for the experts as mentioned above (please see required qualifications above), e.g. for
    - development and adjustment of training and assessment material and tools
    - developing procurement lists from technical perspective for the respective occupation fields
    - focused technical training of teachers
    - additional experts for ESHS or M&E topics

4.9. Administrative Support Staff and Backstopping Services

- Efficient management and proven backstopping services preferably at the Consultant's headquarter

Annex 1: LIST OF ABBREVIATIONS

CBET	Competency-based education and training
CoE	Center(s) of Excellence
DLP	Defects Liability Period
ESHS	Environmental, Social, Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EUR	Euro
FC	Financial Cooperation
FIDIC	Fédération Internationale des Ingénieurs Conseils / International Federation of Consulting Engineers
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IDA	International Development Association
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
KGTI	Kenyan-German TVET Initiative
M&E	Monitoring and Evaluation
MoE	Ministry of Education, Kenya
O&M	Operations and Maintenance
PEA	Project Executing Agency
PQ	Prequalification
RAP	Reconciliation Action Plan
SBD	Standard Bidding Document
SEP	Stakeholder Engagement Plan
TC	Technical Cooperation
ToR/TOR	Terms of Reference
TTI	Technical Training Institution
TVET	Technical and Vocational Education and Training

Annex 2: OCCUPATIONAL TOPICS

Topic 1: Vocational Profiles for cooperative training courses

- Busia County, Bumbe TTI: Automotive technician
- Kisumu County – RIAT: Refrigeration and cold store mechatronics
- Nyamira County – Ekerubu Gietai TTI: Plant technician / tea sector
- Trans-Nzoia County – Kitale Polytechnic: Commercial & agricultural vehicle Mechatronics

Topic 2: Short term trainings:

For all vocational profiles short term trainings will be developed to:

- Cover needs of the industry for shorter qualifications
- Develop income streams for training institutions
- Increase the outreach of the project

Topic 3: Renewable energy

- Renewable energies will be promoted in at least 2 training institutions (Ekerubu Gietai and Kisumu)

Topic 4: Incubation and promotion of self-employment

Although entrepreneurship is already a "basic unit of competence" in the CBET curricula efforts for this aspect should be increased by the establishment of incubation facilities and / or entrepreneurship development advice in at least two TTIs. Starting point for this can be also the three TTIs in Nairobi/Kiambu.

Division of work – GCC		
Topic	**Technical Cooperation**	**Financial Cooperation**
Cooperative Training CoE	Develop and pilot cooperative training	Investment measures (where required)
Short term training	Support CoE / TTIs to develop market and implement.	
Renewable Energy (Short term trainings)	Support TTIs to develop and implement	
Incubation. Promotion of self employment	Support TTIs to develop and implement measures.	Establish incubator facilities.

Annex 3: CHECKLIST FOR THE SUSTAINABILITY ASSESSMENT OF BUILDINGS

1. Location quality

Criteria: 1.1 Site conditions

1. Groundwater

Is attention paid to ensure that no mixing of the groundwater layers or permanent alteration of the groundwater flow occurs during the course of the construction or use throughout the planning process?

2. Risks of environmental influences

Does the planning process examine the site with regard to the risks posed by earthquakes, avalanches or floods and, if necessary, take measures to protect the building fabric and the users?

3. Soil investigation

Is the building ground examined by a soil expert with regards to its suitability for construction, groundwater, contaminated sites, impurities, explosives, etc. and taken into account accordingly during the planning phase?

4. Noise pollution of the environment

Is the planning optimized with regard to the protection of the environment against permanent noise pollution during the construction project or through the use of the building?

5. Outdoor air

Are the outdoor air conditions of the site (e.g. dust, air pollution) investigated and a negative influence on the building or the users and the operation excluded?

Criteria: 1.2 Supply

1. Supply of media

Does the planning pay attention to the development of the site with media such as electricity, heat, water and wastewater?

2. Social facilities

Is the proximity of facilities such as schools, kindergartens and other public facilities taken into account in the planning?

3. Rainwater utilisation

Is the possibility of rainwater utilization investigated in the planning phase?

4. Use of groundwater

Is the possibility of use of groundwater investigated in the planning?

5. Power supply

Is the possibility of power supply, if necessary also by grid-independent systems (e.g. photovoltaics) at the location investigated in the planning?

Criteria: 1.3 Transport accessibility

1. Accessibility

Is the location checked with regard to accessibility via footpaths, cycle paths, bus and train connections and selected accordingly and, if necessary, are measures taken to optimise accessibility?

2. Design & Building

Kriterium: 2.1 Exterior quality

1. Planting

Is the planting home-grown and appropriate for the location?

2. Utilization

Can the outdoor areas be used for socio-cultural purposes?

3. Sun protection

Are trees and surrounding hedges available on the site as natural shade providers?

4. Diversity

When designing outdoor areas, is attention paid to various outdoor facilities such as playgrounds and sports facilities, seating, sun protection elements, protection against precipitation, bicycle parking, etc.?

Criteria: 2.2 Creative building quality

1. Variant studies

Are different design variants/ alternatives created in the planning phase and examined with regard to urban integration?

2. Competition

Will a design competition be held to improve the quality of the architectural and technical design of the building?

Criteria: 2.3 Microclimate

1. Heat island effect

Is the "heat island effect" (reflection, absorption, emission and transmission capacity) investigated during facade design and, if necessary, measures such as optimization of the surface structure, color or material properties of the building materials taken in order to optimize the microclimate?

3. Socio-cultural and functional quality

Criteria: 3.1 Accessibility

1. Accessibility in the building

Does the planning pay attention to a barrier-free design of the building?

2. Accessibility on the site

Are the grounds and outdoor facilities designed to be barrier-free and without obstacles or obstructions during the planning phase?

Kriterium: 3.2 Cycling comfort

1. Bicycle parking facilities

Are sufficient and theft-protected bicycle parking facilities on the premises taken into account in the planning?

Kriterium: 3.3 Usability

1. User influence

Is the user influence taken into account with regard to aspects that can be influenced room by room such as: Air exchange, sun and glare protection as well as daylight and artificial lighting?

Criteria: 3.4 Public Accessibility

1. Outdoor facilities

Are the outdoor facilities of the district accessible to the neighborhood?

2. Diversity of use

Is the public area designed according to the social and cultural needs of the neighborhood?

Kriterium: 3.5 Safety & security

1. Path guidance

Does the planning pay attention to a clear and well-illuminated route guidance?

2. Perimeter fence

Is the site protected from encroachment and damage by safety precautions such as fencing?

3. Escape and evacuation possibilities

Does the planning pay attention to a barrier-free execution of the buildings and the terrain? Are escape and evacuation options for emergencies taken into account and are evacuation plans and collection points indicated?

Criteria: 3.6 Interior quality

1. Building materials

Are low-emission building materials included in the planning for the construction of the building in order to reduce volatile organic compounds (TVOC, formaldehyde)?

2. Distance to sources of dirt

When planning the buildings, is attention paid to an adequate distance between the windows (natural ventilation) and external sources of dirt?

4. Technical quality

Criteria: 4.1 Heat and moisture insulation of the building envelope

1. Energy requirements

Are the buildings examined and optimized with regard to energy requirements during the planning phase?

2. Moisture protection

Is a moisture protection proof carried out in the planning phase in order to protect the building from moisture damage?

3. Heat transfer coefficient

Are the component-related average heat transfer coefficients optimized for specific locations during planning?

4. Solar input index

Is the solar input index taken into account in the planning?

Criteria: 4.2 Fire protection

1. Building materials

Are building materials with an increased fire resistance included and are building materials which promote a strong smoke development and a rapid spread of the fire renounced during the planning phase?

2. Fire extinguishing systems

Does the planning take into account that fire extinguishing systems (e.g. fire extinguishers) are installed in the buildings and are clearly marked?

Criteria: 4.3 Cleaning and maintenance

1. Accessibility of the construction

Is an easy accessibility of the primary structure for maintenance measures taken into account in the planning?

2. Inaccessible corners, niches

Are inaccessible and therefore difficult to clean and maintain corners, niches and spaces inbuildings?

3. Floor covering

Is a floor covering that is easy to clean taken into account in the planning?

4. Concept for cleaning and maintenance

Is a cleaning and maintenance concept created in the planning phase?

Criteria: 4.4 Room acoustics

1. Sound isolation

Are the requirements for sound isolation against external noise taken into account and complied with in the planning?

2. Airborne and impact sound isolation

Is airborne and impact sound isolation considered in the planning in relation to the working areas in the building?

3. Reverberation time

Are the rooms of the building examined during planning with regard to the reverberation time and, if necessary, are measures taken to reduce the reverberation time?

Criteria: 4.5 Lighting & visual comfort

1. Visual connection

Does the planning pay attention to ensure that there is a visual connection to the outside?

2. Daylight supply

Does the planning pay attention to sufficient daylight intensity and daylight supply for the usable area?

Criteria: 4.6 Thermal comfort

1. Heating installation

Is the feasibility and necessity of a heating system examined and taken into account in the planning due to the climatic situation of the location?

2. Thermal insulation

Is the feasibility and necessity of a thermal insulation layer to reduce the heating requirement
in winter and for cooling in summer investigated and taken into account accordingly in the planning phase?

3. Sun protection

Is sun protection provided in the window area to provide shade in direct sunlight?

4. Orientation of the building

Is the orientation of the building adapted to the climatic conditions of the location?

5. Thermal storage masses

Are the thermal storage masses of the building materials, e.g. in the form of a night cooling used?

5. Ecological quality

Criteria: 5.1 Surface sealing

1. Fallow field use

Does the planning pay attention to the use of a fallow, already sealed or infrastructure and medially developed property?

2. Sealing

Does the planning pay attention to ensure that no forest or arable land is destroyed and sealed for the construction of the building?

Criteria: 5.2 Building materials

1. Regional building materials

Are regional building materials important in the planning?

2. Controlled timber production

Is only wood from controlled cultivation used in construction to prevent uncontrolled overexploitation in tropical, subtropical and boreal climate zones?

3. Equipment

When planning, value is placed on robust materials for the building equipment in the first place?

Criteria: 5.3 Power requirements

1. Energy efficiency measures

Are energy efficiency measures being taken during planning to reduce energy requirements?

2. Lighting

Is energy-saving indoor and outdoor lighting planned?

3. Renewable Energy

Is the use of regenerative energies to supply the building taken into account in the planning (e.g. photovoltaic system / solar thermal)?

Criteria: 5.4 CO2 emissions, ozone formation

1. Ecological balance

Is a life cycle assessment carried out in the planning phase in order to examine the environmental impact of the building?

2. Variant studies

Are variant studies carried out in the planning phase on the basis of the ecological balance when selecting building materials or operating processes?

Criteria: 5.5 Water

1. Supply

Does the planning pay attention to the drinking water supply of the site?

2. Disposal

Does the planning pay attention to the controlled discharge of process water or the construction of a waste water treatment plant?

3. Water-saving measures

Does the planning include water saving measures to limit water consumption?

4. Rainwater utilisation

Is the possibility of using rainwater investigated in the planning phase?

Criteria: 5.6 Waste

1. Waste disposal concept

Is a waste disposal concept taken into account in the planning?

2. Waste separation

Are waste separation and recycling integrated in the waste disposal concept?

3. Composting

Is composting of the biowaste planned?

6. Economic quality

Criteria: 6.1 Space efficiency

1. Space efficiency

Are buildings being investigated and optimised in terms of space efficiency in order to reduce construction and operating costs as well as space sealing?

Criteria: 6.2 Life cycle costs

1. Life cycle analysis

Is a life cycle analysis carried out during the planning phase, taking into account the building's manufacturing, maintenance, repair and operating costs?

2. Variant analysis

Is a variant analysis based on the life cycle analysis carried out in the planning phase in order to improve/ optimise the sustainability of the building?

7. Process quality

Criteria: 7.1 Project planning

1. Planning team

Does the planning team consist of demonstrably qualified local and western planners in order to better integrate the local conditions into the planning and to enable a transfer of knowledge between the western and the local planners?

2. Demand planning

In the planning phase, is a demand plan drawn up to determine the site-specific requirements, the needs and objectives of the investor, the operator, the users and the residents?

Criteria: 7.2 User/operating instructions

1. Manual

Are user manuals, operating, maintenance and care instructions for the building for the efficient operation and maintenance of the building drawn up in the planning phase?

Criteria: 7.3 Construction site/ Construction process

1. Low waste construction site

Are measures taken in the planning stage to separate the waste generated on the construction site directly on site and subsequently dispose of or recycle it in an environmentally friendly manner?

2. Environmental protection on the construction site

Are measures considered in the planning to avoid damaging the soil during the construction process by mechanical or chemical influences, e.g. to prevent a change in the groundwater flow or mixing or contamination of the groundwater layers?

3. Industrial safety

Is an occupational health and safety concept drawn up in the planning stage to protect the health of those involved in construction?

Annex 4: PRINCIPLES FOR DESIGN AND PLANNING OF SCHOOLS

Planning and Design of Schools: Principles to be Observed and Recommended Design Details

The following Principles and Design Details are to be observed in the implementation of this Programme – in so far as the various climatic / geographic criteria are applicable to the individual school sites.

A. Essential Design Principles

It needs to be understood that schools are not merely "shelters" within which children "are educated" and schooling takes place. Rather – school buildings are an integral part of the educational process itself. Indeed, the **quality of the environment** created by the architect and all involved engineers will impact on the **quality of the education** to take place.

A school must be a **place where a child feels free and can develop, mature, grow up**. Only in a peaceful and democratic environment can concepts of peace and democracy flourish!

On a more specific level, attention needs to be given to the following aspects:

1. **Urban design**: in developing design concepts for a given site, it is necessary to take into consideration all neighbouring buildings, existing and future developments, topography, landscape areas, streets and access paths. These have to be included in the surveys and considered for any new design.

2. **Masterplan Approach:** possible **future extensions** have to be considered from the beginning in the design of a school. Priority should be given to horizontal extensions as they will not disturb any school function during the term. Another effect will be the reduction of the overall construction costs if the extension goes vertical. To this end a "master-plan-approach" should be pursued, whereby initial design conceopts and design alternatives are to be developed for the overall site, including adjacent areas (ideally, this can be supported by using "*Google-Earth*" pictures of the respective sites).

   Such "master plans" will consider: a) all existing structures, vegetation, topography – including those of neighbouring / adjacent sites; b) all planned extensions / new constructions; c) all likely / possible future extensions. A minimum of three alternatives need to be developed for purposes of preliminary discussion.

3. It is a necessary and very important issue that **existing vegetation**, especially trees, has to be maintained and it has to be taken into consideration for placing the school building on site and for designing the school yard and the vegetation has to be protected during the construction.

4. An important focus has to be made on the **functional layout** of a school building. It can support an easy external and internal orientation of the pupils and other users. A functional layout will also reduce the investment costs if rooms with technical equipment will be more gathered together.

5. **"Standard designs" vs. "Design Standards":** there is no benefit or advantage in using "**standard designs**", "model designs" or "prototype designs", indeed, there are considerable disadvantages in following such readymade blueprints. Certainly, they will not, by themselves, result in a reduction of costs. Fur purposes of cost-reduction it would be more useful to develop "**standard details**" or design standards which could be replicated in different schools and where economies of scale would result in lower prices, if a central procurement for such "typical elements" could be managed. In fact this factor is not only important for the architectural design it is also in the same way important for the structural design and for other engineering related matters.

6. **Economic design:** care shall be taken in the design to minimize any cut-and-fill by developing designs which follow the existing topography rather than contradicting it.

7. **Energy efficiency:** in view of latest developments it is essential that the design of all school facilities is strongly influenced and determined by the need to achieve improved energy efficiency. This will include both passive and active measures, including technologically appropriate alternative technologies, renewable energies, etc. A main focus will be on orientation of buildings, prevention of heat infiltration, solar water heating and / or solar underfloor heating. However, rainwater harvesting, utilisation of grey water, etc must also be considered.

8. School layouts need to be so developed, that no classrooms will have large **east- or west-facing rooms**. Where this is inevitable it is necessary to provide for such classrooms external shading devices (not mechanical!) and / or shading through appropriately located trees.

9. It is absolutely essentially to allow for **adequate distances** between a boundary wall and adjacent buildings (or between adjacent buildings themselves) in order to provide good lighting and ventilation conditions in classrooms and in order to allow for adequate space for green areas (e.g. trees) to be developed, which may be necessary to mitigate the impact of the sun. The distance to the boundary has to be increased with the height of the building (number of storeys). The minimum distance to any boundary should be not less than 5 m and for each storey above ground floor a further 1m should be provided. An adequate distance will provide access for escape purposes, rescue services and for any maintenance services.

10. All designs need to focus not only on the quality and atmosphere of interior spaces, but also on the design of **high quality external spaces**, a well-considered landscaping concept with natural and artificial shading of spaces and appropriate surface runoff water retention areas.

11. It is very important to create a clearly recognisable “heart” or **centre of a school**, preferably with a central, multi-purpose-hall combined with spacious stairways and an administrative area as it is the communication, distribution and multipurpose area for the school. This can be either a completely closed area or only a covered area or even an open space like a market square.

12. **Disabled access** has to be provided as much as possible to a certain number of rooms and to the external areas. A suitable and functional range of rooms has to be provided at ground floor level.

13. Location and **orientation of external corridors** should not be chosen only according to the often cited “*need for control*”. More important are aspects such as orientation, communication and climate (shading of classrooms), sources of noise, and other aspects related to the urban fabric. Applying patterns or coloured tiles in the floor designs will improve the appearance of the corridors. Equally, shapes and sizes of window-openings may be varied.

14. All classrooms need to have the **main source of natural light from the left side**. This is so because we commonly use our right hand for writing (irrespective of the direction of writing).

15. **Classroom-windows** shall be – at least to one side – large and allow students to look outwards. This is necessary in order to improve concentration and learning ability of students. On the “inward side” windows should also be as large as possible – so as to improve natural lighting and the sense of “openness”.

16. It is necessary to develop and clearly define for schools both a **colour scheme and a materials scheme**, i.e. it needs to be accepted that both colours and materials are of essential importance to the quality of a completed school. All materials of any construction, fitting out and equipment have to be from local or national sources, as a first priority. Wherever possible, brighter, child-friendly colours are to be used in the schools – e.g. with different colours used to identify different uses – or class groups. Colours can also be used liberally externally – e.g. on furniture (benches), ‘sheds’ etc.

17. The issue of maintenance and **maintenance-friendliness of infrastructure** is of paramount importance in the design of schools and the architect-planner must exert utmost care to develop for schools design details, which will facilitate the maintenance of any given building in the long term.

18. In order to avoid any “*detention atmosphere*” and psychological dysfunction, **steel protection** in front of the windows of classrooms and other habitable rooms should be avoided as far as possible.

Only rooms, like labs, special rooms etc. with a high risk of theft need to be protected by well-designed steel guards - if the rooms are placed on ground floor level. Ideally, the "security" will be integrated into or form part of the shading / sun-breaker system.

Where, however, such "*security*" is considered essential, care needs to be taken in the design – using e.g. some of the rich ornamentic design typical of the rich heritage of Islamic architecture [8]

Furthermore, such "*security*" can easily result in a building which becomes inescapable in case of fire as result of such **steel protection** in front of the windows of classrooms and other habitable rooms. Designs have to resolve these requirements, i.e. "*security*" must:

a. Aways allow for easy escape, especially from higher stories
b. Be well designed as appealing / attractive handicraft.

B. Climatic Design Principles

In addition to the above more general disgn principles, it is very necessary to consider various aspects with a view to reduce or avoid discomfort due to room-temperatures. The respective applicability of the principles discussed below will, of course, depend very much on the respective climatic and geographic characteristics of a given site.

1. High Temperatures

In regions where the climate is predominantly dry and hot from April to October, with plentiful sunlight on most days, the hottest months will be July and August - with regional variations due to elevation and proximity to the sea. Comfort levels are naturally somewhat higher than would be the case in temperate climate populations, due to natural adaptation. However, outside air temperatures **in the low to mid-30's C** will be a limit for comfortable school work and with adequate air movement by natural air flow from open windows and fans, these levels can usually be achieved in general classrooms during the teaching year, provided that control measures described under para. 3 below are implemented in the design of the buildings.

However, in specialised rooms such as **computer laboratories** with a class-sized number of monitors operating (20 – 25 monitors), the temperature can exceed 40°C and **cooling** shall be necessary. Other laboratories and workshops will also require cooling by reason of heat generating activities raising internal temperatures above 35°C, or a need to limit the rate of ventilation below 4 air changes per hour. Where necessary, cooling is best achieved by means of split-unit air-conditioners, and it will be good design practice to provide these to all laboratories if no adequate **passive climate regulation** can be achieved. There may also be a case for a/c units for certain administration rooms.

The occupancy pattern in school use will also be a significant factor for the hotter season. The school year of the includes a vacation for July and August, the hottest months.

The design / construction of **external walls** at schools in such climatic zones needs to have a high thermal capacity, which means a slow passage of heat through external walls so that radiation to the interior is delayed until into the afternoon, when normal school occupation ends. A generally high diurnal temperature range means that with **regular nightly opening** of external windows and internal doors, the school can be ventilated during the low temperature period at night and be cool for the start of the school day. This will have an effect on the design of windows and any internal fanlights. In this context it should be noted that **double glazing** is effective at keeping heat in, not at keeping solar radiant heat out.

[8] As produced, for example, by Abdel Haleem Sader & Com., P.O.Box 907, Amman 11732, Jordan (Fax.: 00962 6 4769962)

2. Low Temperatures

There is no longer a debate over whether a school in cold areas (which occur in parts of Lebanon, Syria, Jordan, Palestine, Yemen) needs some heating in the cold season. A reference to temperature records indicates that some areas will be below comfort level during the last part of November to mid-March, a total period of up to 17 weeks. Because in some areas the climate varies according to elevation and North to South and because there is generally a significant diurnal temperature range everywhere, it is difficult to state a definite heating season.

Comfort level at the lowest extreme can be taken as being 18C for stationary work activity and 15C for circulation areas. The heat input to bring the interior environment to these levels will normally not be very high and certainly not consistent. However, reference to temperature records will show that much lower minima can occur in any of the months of the "*heating season*" and a system needs to be able to respond to these lows.

The pattern of occupation for schools is also a factor affecting the practical solutions to thermal comfort. The school working week is Sunday to Thursday and the working day is 08:00 to 14:00, generally. There is a cold season vacation of 3 weeks in January. There are evidently periods when input of heating is not required, but against this is the high thermal capacity of usual construction in the Region, which gives slow warm-up and cool-down times.

The conclusion is that the **heating systems** should be low capital cost, have a quick response, be locally and automatically controlled on time-switches and thermostats, and above all, have low maintenance requirements. The system most readily meeting these criteria will be electrical and provide warmed air. An alternative system using oil-fired hot water circulation to radiators is also in use. The designer should select the most appropriate type, bearing in mind maintenance and running costs.

3 Passive Climate Control Measures

By the appropriate design of the building envelope, control over heat ingress and build-up can be minimised naturally. The source of the heat is the sun and therefore exclusion of direct sunlight from the interior is essential. As has been indicated - the solid exterior walls can be neglected as a significant source of interior heat build-up during the school day.

This means that **windows** are the elements requiring attention. This is achieved in two ways, viz. by orientation and by sun shading: ***it is essential to stop the sun from striking the glass***.

In this context it should be noted that sun shading devices inside a window are ineffective as the material is heated and re-radiates inward, i.e. heat is not re-radiated out through the glass[9] - which is e.g. the reason for green-houses to heat up!

It must furter be noted that the use of double-glazing is ineffective in stopping solar heat gain an that it is only effective at preventing heat loss outwards.

3.a Orientation for sun (and breeze)

The best compass direction, or orientation, for the essential daylight admitting windows is due **North**, which will mean that there should be no direct sunlight on the pane of the window.

The next best orientation is due **South**, which will mean that the sun that does strike the window pane will have the smallest angle of incidence during the course of the day. During the hottest hours of the day, the sun will be at its highest and the angle of incidence to the South-facing window will be at its smallest. Sun from this orientation is the easiest to screen out.

Low angle sun is most difficult to screen out, so late morning sun from a **South-East** orientation is to be avoided in favour of a **North–East** orientation - if planning allows a choice.

[9] Because its wave-length has changed

Low angle sun from the **West** is less of a problem for the teaching day as schools close at 14:00 hrs. Nevertheless, this orientation is to be avoided for large glazed areas as the heat build-up will be more difficult to dissipate over night.

Orientation for breeze in hot, dry climates is not usually a significant factor. In many areas, cross-ventilation will be a natural comfort factor for part of the year, but in the higher elevations the need is more likely to exclude air that has been heated by passing over hot dry ground. In any case, a building group (such as a school) will not be planned with single-banked rooms with the option of openings both sides, for economical reasons; though at very hot locations the single-banked plan may be the optimum. A school, like any building mass, will have a pressure gradient over it in any wind condition and direction, so that air will flow through the building from positive pressure to negative, to the extent that internal divisions and spaces permit. This is how the overnight potential cooling benefit will be assisted by exterior high-level window opening lights and the interior open-able fanlights above doors.

3.b Sun Screening

Effective sun screening devices can be designed to operate in any orientation, since sun angle is entirely predictable. Computer programmes exist to do this, although sun-path diagrams are sufficient. However, owing to seasonal change in elevation, round the year full exclusion requires movable elements in a screen. In practice, screening is usually a compromise, although if the optimum orientation has been selected, then screening will be effective.

Assuming a **South orientation**, a window will be screened by an external horizontal shelf at the level of the top of the window, with a projection depending on the duration of the year that it is desired to exclude the sun from penetrating the room or from striking the glass. In higher areas there will be a benefit in the cold season from some sun penetration, so the sun angle to be excluded should be from April to October. It is essential to stop the sun from striking the glass - as the heat is very effectively transmitted inward and the glass itself is heated thus accentuating the effect. It must be repeated that the use of double glazing is ineffective in stopping solar heat gain, it is only effective at preventing heat loss outwards.

An alternative to the window-head louver screen is to incorporate a shelf into the structure of the window at the level of the transom, i.e. about 2,000 mm above FFL, with an external and an internal projection from the window pane. This works by the internal projection screening from the floor the sun entering from above the transom and the external projection screening out the lower incidence sun. The top of the shelf is a solid reflector which acts to reflect light onto the ceiling and so to the back of the room, thus optimising the daylight distribution. This device is less effective at excluding heat since the transmission through the upper part of the window is permitted. This might be an advantage in very deep classrooms of 8m or more, but in the standard model of 6m depth the daylight penetration has been observed to be more than adequate.

In exceptional circumstances the **East-West orientation** of classrooms may be necessary. Elaborate measures are then necessary to reduce or exclude the effects of solar radiation using shading elements, vegetation and ventilation.

3.c Site Vegetation Cover and Planting of Trees

Their effect is very important and needs to be well planned, also as concerns the type of tree to be planted (deciduous or not, etc.).

Vegetation can influence the micro-climate of a school's site by shading and by reducing reflected glare from the ground surface. It is important to note the differing impact of trees that loose their leaves in winter vs. trees that are green / have leaves all your round. The former may be used in spaces, where the impact of the warm winter sun is desired!

C. Recommended Design Details

In developing the designs for the schools, it is recommended to consider the following detailed recommendations. The elements identified may only be ignored with sound justification.

1. **Shaded areas** are required in schoolyards and on playgrounds - where sunsihine is intensive in the morning hours of a day. Such shaded areas can be provided with cost-efficient light-weight structure – or, where regionally appropriate – with vegetation ("umbrella-tree"!!). All shaded areas need to be equiped with (simple) seating / benches. Care needs to be taken with the orientation of sheds: this should be East - West (not North – South)!!
2. **Workshop**: in order to allow for the proper maintenance of schools an additional, small workshop is to be provided for - to be located e.g. under a staircase. This will have a workshop table, various power plugs, lighting and shelving (for the storage of spare parts). The space will be lockable.
3. **Staircases**: spaces under staircases need to be closed off – ideally to be used as lockable storage spaces. In most staircases – no closeable windows are required; window-openings which allow for adequate ventilation are sufficient.
4. **Parapet walls**: their height needs to be minimised as far as possible. Ideally, they can be replaced by more transparent and more cost-efficient railings / metal barriers.
5. **Acoustics**: care needs to be taken in large halls or multi-purpose spaces to achieve a good acoustic quality of MPHs – without 'echo'.
6. **Equipments / Fittings**
   a. **Protective Boards:** all classrooms shall be provided with protective boards of adequate width (to cater for both high and low student desks).
   b. **Pinboards**: schools are to be equipped with pinboards as follows:
      (a) Every classroom: rear wall of classroom in full width;
      (b) Every classroom: 2 pinboards at front of classroom (next to door and next to blackboard)
      (c) 1 pinboard outside each classroom.
      (d) Pinboards throughout corridors and at entrance areas (also serve to improve the acoustic performance of spaces)
   c. **Computer labs:** they shall be fitted with fortified / strengthened doors (to reduce danger of theft / break-in). All computer labs need to be fitted with air-conditioning.
   d. **Donor signboard:** all schools shall be provided with a plaque / signboard showing at least (a) name of school; (b) names of donors / funders; (c) month of completion.
   e. **Spare Parts Kit**: all schools shall be provided with a '*spare parts kit'* – which will contain basic repair tools, essential spare parts (for e.g. furniture, fittings such as lights, door handles, taps, door stoppers; spare windows; etc.
   f. **Solar Water heating:** this will be placed only where required and only in appropriate dimensions.
   g. **Heating units**: improve the wall-fixings of the units – and provide for necessary tools / keys. Ensure that aeration-valves are "child-safe".
   h. **Rubbish bins**: provision of fixed) rubbish bins in adequate numbers throughout the school and the schoolyard.
   i. **Fire-alarm system:** the appropriateness is to be questioned – in nearly all schools visited it has been disabled to avoid misuse by the children. Equally – the placement of fire-extinguishers needs to be questioned – in many instances these had been locked away in a 'safe storage' by the school management!!
   j. **Windows**: the quality of windows should ensure that – in classrooms – the lower portions of such windows are fixed (to avoid harm to students as result of opened windows). Window-stoppers need to be considered.

7. Landscaping / External

a. Seating: simple seating to be provided alongside walls, preferably interspersed with green areas or trees.

b. Courtyard: a graphic design of the tile-patterns in the courtyard would improve the atmosphere – e.g. "*leading to the entrance*", or similar.

c. Trees: it is essential to provide as many (shade-giving) trees as possible (with a stem-diameter (h = 120cm) of not less than 5 cm! Recommended species: *Morus Alba; Morus Nigra; Terminalia Brownii; Polyscias Fulva*; and others. Dendrologist is to be involved.

d. Irrigation System: where possible, trees and green areas (of limited size) need to be provided with a simple irrigation system (drip-irrigation). At the least, there will be a water tap (lockable - near the main planted areas).

e. Parking areas: As a matter of principle – parking areas should be outside the playground area. Where parking areas need to be provided – minimize "*sealed areas*" and intersperse with green areas / shade-giving trees.