



# Proceedings of **e-AGE 2017**

The 7<sup>th</sup> International Platform on Integrating  
Arab e-Infrastructure in a Global Environment



## **“EDUCATION, SCIENCE AND INNOVATION”**

League of Arab States, Cairo, Egypt  
3-4 December, 2017

[asrenorg.net](http://asrenorg.net)





## Committees

### Program Committee

- Ahmed Hassan, Egyptian Universities Network (EUN), Egypt.
- Boubakar Barry, West and Central African Research and Education Network (WACREN), Senegal.
- David West, GEANT, UK.
- Federico Ruggieri, GARR Consortium, Italy.
- Florencio I. Utreras, UTTICA, Chile.
- Helga Spitaler, GEANT, UK.
- Johnathan Chapman, Internet2, USA.
- Pascal Hoba, UbuntuNet Alliance, Malawi.
- Salem Al-Agtash, German Jordanian University (GJU), Jordan.
- Yousef Torman, Arab States Research and Education Network (ASREN), Jordan.

### Organizing Committee

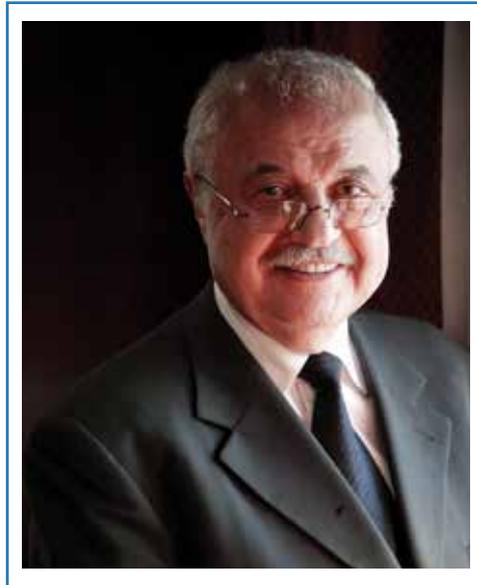
- Dina Barakat, Egypt University Network, Egypt.
- Hayam Alsallal, League of Arab States (LAS), Egypt.
- Mohamed Samir, Talal Abu-Ghazaleh Organization, Egypt.
- Sherine El-Maghraby, Talal Abu-Ghazaleh Organization, Egypt.
- Yasmeen Al-Kouz, Arab States Research and Education Network (ASREN), Jordan.
- Yousef Torman, Arab States Research and Education Network (ASREN), Jordan.

### Scientific Committee

- Ahmed Dabbagh, Emirates College of Technology, UAE.
- Ahmed Hassan, Egyptian Universities Network (EUN), Egypt.
- Boubakar Barry, West and Central African Research and Education Network, Senegal.
- David West, GEANT, UK.
- Enrique Arias Antúnez, Universidad de Castilla-La Mancha, Spain.
- Federico Ruggieri, GARR Consortium, Italy.
- Florencio Utreras, UTTICA, Chile.
- George Ghinea, Brunel University, UK.
- Habib Yousef, CCK, Tunisia.
- Ibrahim Fathy Moawad, Ain Shams University, Egypt.
- Johnathon Chapman, Internet2, USA.
- Khalid Elbadawi, Sudan Research and Education Network, Sudan.
- Majid M. AlSadek, Egyptian National Scientific and Technical Information Network, Egypt.
- Markus Baumann, Asia Pacific Advanced Network, Australia.
- Ognjen Prnjat, GRNET, Greece.
- Pascal Hoba, UbuntuNet Alliance, Malawi.
- Paul Lefrerre, OPEN UK University, UK.
- Rainer Herpers, Bonn-Rhein-Sieg University of Applied Sciences, Germany.
- Rami Iskander, SCU, Egypt.
- Roberto Barbera, University of Catania, Italy.
- Salem Al-Agtash, German Jordanian University (GJU), Jordan.
- Walid Karam, Balamand University, Lebanon .
- Yousif Asfour, American University of Beirut, Lebanon
- Yves Poppe, APAN/ A\*Star, Singapore



**All copyrights reserved and may not be translated or re-used wholly or partly for the purposes of reading or radio or copies on microfilm or in any other way, except with a certified permission from the owners of these rights.**



## Chairman's message

"ASREN is the pan-Arab research and education network contributing to boosting scientific research, innovation and education across the Arab world.

The practice of scientific research is changing dramatically. Long gone are the days in which researchers working in isolation contributed to technological innovation and social development. Only through multidisciplinary collaborations among research centres, industry and public entities knowledge, innovation, and exchange of know-how can be facilitated. e-Infrastructures play a major role in making such collaboration possible and enabling institutions to "boot up" and join the globalizing developed world.

ASREN has been founded in 2010 with an objective to establish an Arab Regional Network to interconnect existing Arab National R&E networks (NRENs) with each other and to their counterparts across the globe, and to act as a catalyst for e-Infrastructures in Arab countries where they are not yet available".

**Chairman**  
**Dr. Talal Abu-Ghazaleh**

## Contents:

1	The cybersecurity ontology platform: the POC solution .....	1
2	Research, education, and conservation in developing countries in a networked global ecosystem .....	14
3	The role of libraries: Dissemination of technology in the education process .....	27



# The cybersecurity ontology platform: the POC solution

Elisabetta Zuanelli

*University of Rome "Tor Vergata", Italy*  
[elisabetta.zuanelli@uniroma2.it](mailto:elisabetta.zuanelli@uniroma2.it), 39 348 3333682

**Abstract:** The paper deals with the presentation of POC (Piattaforma Ontologica della Cybersecurity) developed by Pragmema, a cybersecurity ontological platform on Liferay technology. POC is the first 'tool' capable to represent cybersecurity data and correlations (events, incidents, etc.) as needed for cyberattacks analytics, prevention and resilience. POC is also meant for cybersecurity risk assessment and evaluation as mandatory activities for companies and institutions, according to recent EU legislation. The presentation recalls and comments briefly on general approaches to ontology development and cybersecurity domain ontologies in present literature on the subject; it recalls examples of taxonomies and classifications as developed in the international context, that need further classification and representation in a shared ontological perspective; and, finally, it motivates methodological solutions designed and realized in the POC platform for application purposes. On the grounds of linguistic and cognitive theoretical assumptions in the field of linguistics as applied to AI different levels of ontological representation and logical semantic relations including a pragmatic cybersecurity ontology, are presented as the POC solution.

**Keywords:** cybersecurity ontologies, threat vulnerability taxonomies, cybersecurity analytics, semantic memory, Artificial Intelligence.

## I. INTRODUCTION

Some twenty years ago Guarino [11] postulated the increasing relevance of ontology in the fields of Artificial Intelligence, Computational Linguistics and Database Theory and mentioned specific research fields such as knowledge engineering, knowledge representation, qualitative modelling, language engineering, database design, information modelling and integration, object oriented analysis, information retrieval and extraction, knowledge management and organization, agent-based systems design.

At the methodological level he stressed the main peculiarity of an ontology as its being a highly interdisciplinary approach where philosophy and linguistics play a fundamental role.

At the terminological level, he defined conceptualization as a set of conceptual (intensional) relations on a domain space as non specific to a state of affairs. A formal ontology can be defined as a set of logical axioms designed to account for the intended meaning of a vocabulary.

The logical distinction between intension and extension is useful at a twofold level to identify classes of entities and their properties, the logical language of formal ontologies and information systems, whilst intensional features have to do with the cognitive aim of common understanding of events and phenomena in digital worlds representations such as data bases and intelligent platforms.

The logical semantic description of a domain ontology must refer to the verbal identification of concepts and relations that cannot be automatically implied only by an abstract logical vocabulary. A domain ontology is therefore language dependent in the sense that logical semantic relations must be verbally represented and interpreted in an intensional perspective.

Two basic problems consist in the ontological definition of abstract words/entities and their contextualization for a proper representation.

As for the philosophical implications of the representation of abstract words/entities in semantics, Carnap's conclusions [4] on the usefulness of abstract words in different fields, including scientific communication, appear to be the case with a cybersecurity domain ontology as referred to digital terminology required by digital analytics and communication.

Finally, the role of context for determining meanings/values in an AI perspective, that is loosely defined in general [2], is properly faced in textual and pragmatics linguistics [3,19,22].

## II. CYBERSECURITY TAXONOMIES AND ONTOLOGIES

The ability to prevent and detect cyberattacks, the definition of methods and technologies for risk assessment and the application of remedial, technological and behavioral systems, the standardization of safety automation and of semantic controlled vocabulary, etc. ask for the knowledge, definition and representation of all the constituent elements of potentially or factually recorded events and incidents, the typological variables that define events and incidents, data representation models, and so on. "The domain of information risk can be visually represented as four intersecting landscapes of Threat, Asset, Impact, and Control. The organization's ability to understand and manage the risk requires information from each landscape. Security metrics, then, should create knowledge that improves management's ability to make decisions and execute on them "(Veriscommunity.net).

The definition, which is obviously a possible component of a cybersecurity ontology, requires a reference to specific contexts of information security and a conceptual and terminologically shared representation.

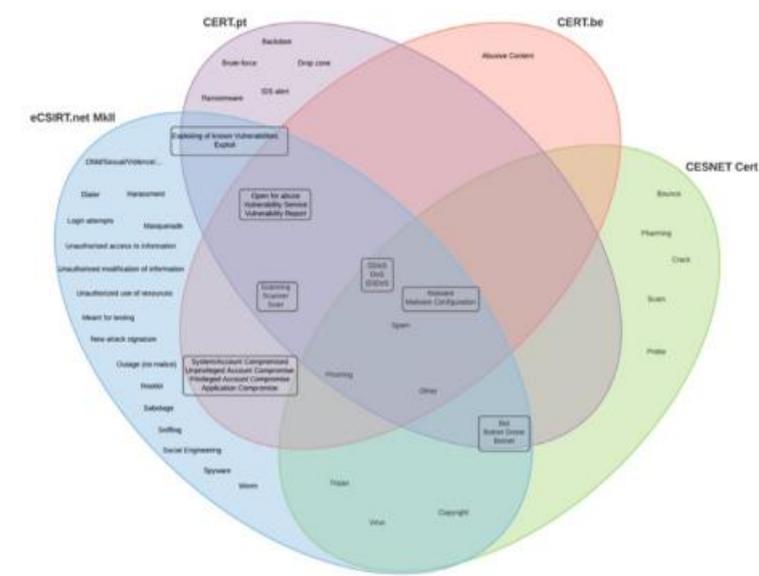
It therefore requires a context analysis and the definition of the domain within which to place sources and themes of risk, events and incidents. In other words, it calls for the definition and modeling of taxonomies and categorizations, which can be further implemented into ontologies of cybersecurity. The absence of clear specifications of the concepts evoked in general and in particular senses makes the interoperability of the systems themselves precarious.

The quest for an ontological architecture of cybersecurity, long since to the attention of the American NIST and other institutional and multinational corporations, is timely news in the exponential growth of threat scenarios.

Recent comparative analyses of taxonomies by Enisa [10] on CERTs and CSIRTs (national, international, private and institutional, etc.) reveal that "there is currently no consensus on concepts and definitions related to taxonomies" and that, at present, "existing taxonomies lack of terms to properly handle the impact of an incident, incidents with no malicious intent, explicit fields for ransomware, whether the incident is confirmed, and the differentiation between intrusion attempts and intrusions." [10]

The ENISA documentation and the following Venn diagram summarize the correlative incongruity of the taxonomies analyzed: terminology superposition, over and sub-categories, lack of terminology, conceptual and linguistic shortage. As an example, technology denominations are confused with the outcome of the attack and semantic fields such as cybersecurity and cybercrime are overlapped.

In the international context, moreover, the English terminology for non-native English speakers is often used with defective interpretations due to the lack of perception of concurrent language correlations.



**Fig. 1.** Venn diagram comparing the terms of the eCSIRT.net MkII, CERT.pt, CERT.be, and CESNET Cert taxonomies. Similar concepts with different wording are grouped in squares (Enisa [3])

Conceptual and terminological inconsistency is a limitation both for performance measurements and for the definition of impact, analysis and description of events and incidents, system response capabilities, prevention and prediction of impact.

Correspondingly, the availability of an adequate taxonomy is a prerequisite of a general categorization and a comprehensive ontology that is needed for developing technological solutions in cybersecurity.

Recent approaches to the ontological modelling of cybersecurity reveal an enlarged wide comprehension of its usefulness and a simplification of the theoretical core, in most cases [17,19,20]. Namely there is a loose connection between the theoretical definitions of an ontological foundational approach [11,14], taxonomies and classifications [8,9,10], data architecture and the articulation of a cybersecurity domain ontology [16,18,20]. No attention is paid to the implications of a domain ontology for a pragmatic cybersecurity ontology, capable of releasing digital applications.

In general, the applied contributions to the definition of a cybersecurity ontology propose either frameworks describing useful processes to be activated by an organization to manage cybersecurity [15] or “operational” information articulated into IT asset domain, Incident handling domain as related to Product & Service KB, Cyber risk KB, Countermeasure KB [19]. In a structured methodological representation of general and specific criteria for developing an ontology of the cybersecurity domain [33], the authors emphasize the reuse of existing ontologies, classes and properties and equivalent relations. As for the final product they distinguish upper ontologies, high level and domain-independent, from mid-level and domain ontologies that specify particular concepts. The application includes a number of so-called separate ontologies that do not appear to be integrated amongst them: typologies of criteria such as foundational representation, persons, Net ops, role. They also mention schemas and standards such as malware categorization, attributes and enumeration, languages for describing and sharing information, attack patterns and process models.

An enormous effort to produce enumerations and lists of contents to be associated with an ontological architecture has been produced by MITRE since 2010 [26,27,28,29,30,31,32] and the NIST Vulnerability Ontology [17].

### III. THE PLATFORM OF CYBERSECURITY ONTOLOGY (POC): ARCHITECTURE AND STRUCTURE

The task of defining the logical architecture and structure as models for the development of a digital ontological platform for cybersecurity has required preliminary specification of verbal entities and logical semantic relations in POC.

#### A. The POC architecture

In order to specify the conceptual definition of lexical entries of a natural language (technical) vocabulary in an ontology, the application of a range of semantic relations including predicative relations (propositions) was faced. The task has connected the definition of semantic relations to research on logical semantic features in the modelling of semantic memory where verbal entities have been analysed and related by means of interconnected links, including hierarchical and non hierarchical classifications, as in the revised spreading activation theory [5,6] on one side; on the other relations were leveraged by a textual/contextual specification.

The effort for the specification of lexical entities/concepts and their relations in the domain of cybersecurity has led us to the articulation of their definitions by means of features such as class, attribute, property and predicative specifications (can, does) of categories as related to contextual meaning.

In our perspective, the decision to include syntactic representations of entities derives from the structure of vocabulary definitions that correspond to a contextualized text defined as a set of phrases linked by words connected by semantic attributes, properties and predicative relations. In other terms, lexical entities in the field of cybersecurity terminology refer to a definition that specifies the particular textual world within which words have a specific correlative value as related to a text/context/domain.

If we consider a definition in a vocabulary as a set of phrases endowed with coherent (logical semantic) and cohesive features called textuality [3], the textuality of definitions allows us to apply the notion of primary and secondary concepts [3,23] to the representation of the domain ontology.

If we define ‘malware’ as the typology of noxious software whose malicious installation in a computer is capable to cause negative impact on its use by a subject (person, company, institution, etc.), we realize that semantic relations in this definition have to do with conceptual entities that stand for multiple digital actors (agents, patients), situations, events, state, objects, time, space, instrument, ends in view, cause, result; attributes such as noxious, negative, etc.; properties such as can/does, namely predicative features, etc.

The conceptual network of the POC cybersecurity ontology, then, is provided with an ‘abstract’ specification of entities and types of relations as well as the representation of specific domain entities and relations, hierarchical and non hierarchical, as contained in a semantic controlled vocabulary the definitions of which must be unambiguous and univocal. Univocity is implied in technical terminology that should not include polysemy or metaphorical verbal usages.

From these perspectives, the definitions of a controlled cybersecurity vocabulary (CCV) imply the reference to a domain ontology on one side and to specific textual/contextual meanings and/or implications/applications on the other. Pragmalinguistics and text linguistics supply evidences and motivations for the need of contextualized meaning [1,3,19,22].

The POC ontology is a linguistic/cognitive based representation of cybersecurity knowledge that provides the pragmatic contextualization of the domain entities as well, in order to specify implied meanings/senses.

An implied link of ‘malware’, for instance, has to do with ‘remediation techniques’ that is actions needed for damage resilience connected with the noxious impact of malware.

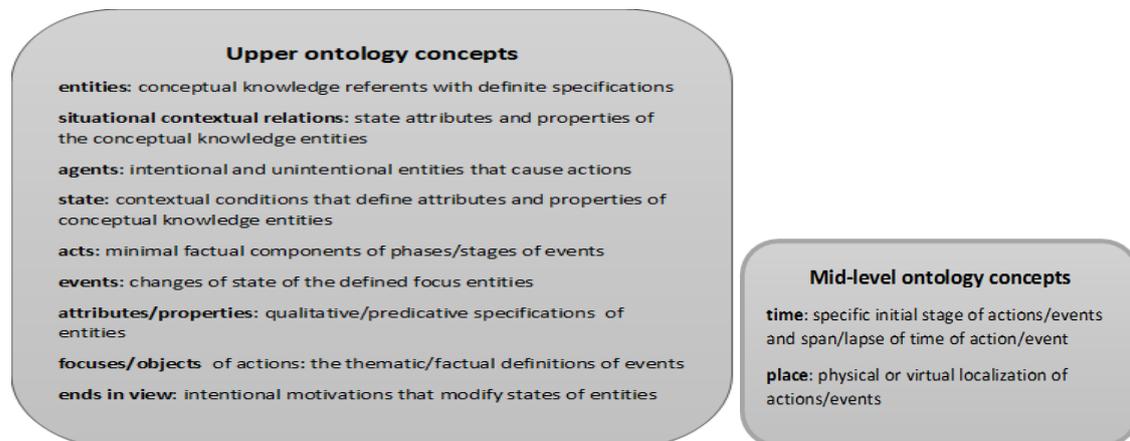
To conclude, the POC ontology is grounded on the abstract levels of definition of contextualized entities as specified by pragmatic components.

A domain cybersecurity ontology is, in fact, a specification of one of the possible ‘worlds’ implied by the abstract ‘reality’ representation whereas the pragmatic cybersecurity ontology is a context specification of the domain ontology in its performative implied actions/activities.

The Pragmema's POC, is a three-step realization, taxonomy, categorization, ontological modelling of cybersecurity: events and incidents, threat and vulnerability entities etc. that allow risk management and the related technological implementation of analytics.

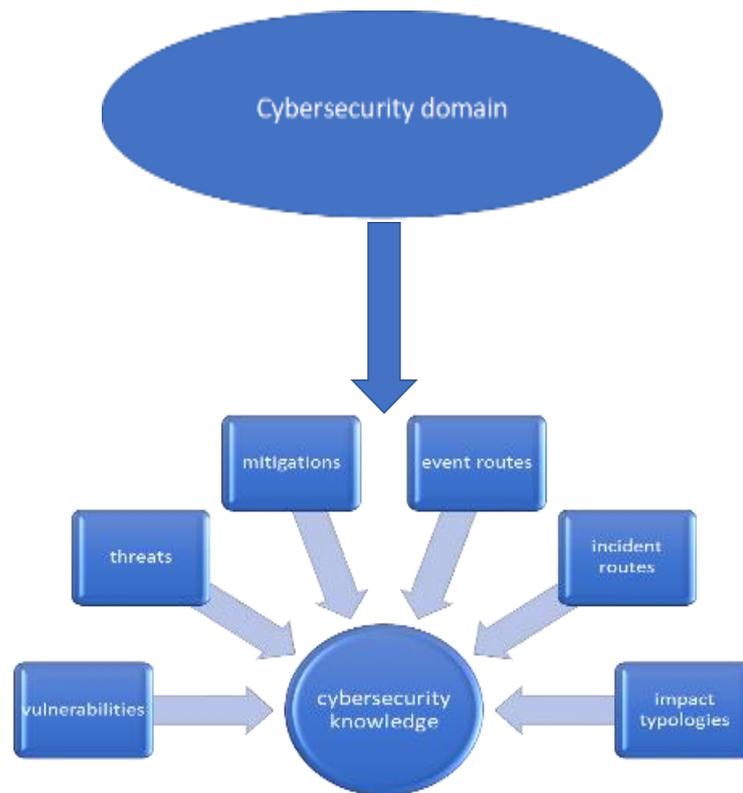
The three types of representation, taxonomy/vocabulary, categorization, and ontology are the base of big data analytics for cybersecurity. Present tools to face cybersecurity so far are inefficient and the innovative development of analytics software is expected.

The abstract layer of architecture is based on the general definition of primary and secondary centres of control or concepts (Fig.2) corresponding to an upper ontology and a mid-level ontology.



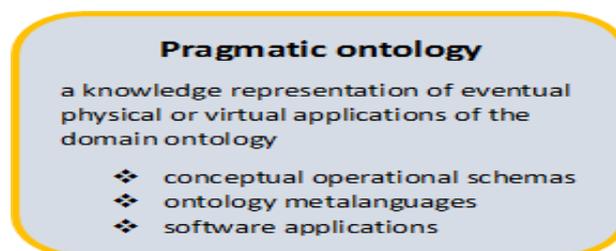
**Fig. 2.** The upper and the mid-level ontology concepts

The digital development of the cybersecurity domain ontology was done on the basis of corpora of lexical entries of lists, vocabularies, ‘taxonomies’, as realized in different experiences, Enisa, Mitre, that were redefined according to the intensional articulation of the domain ontology (Fig. 3)



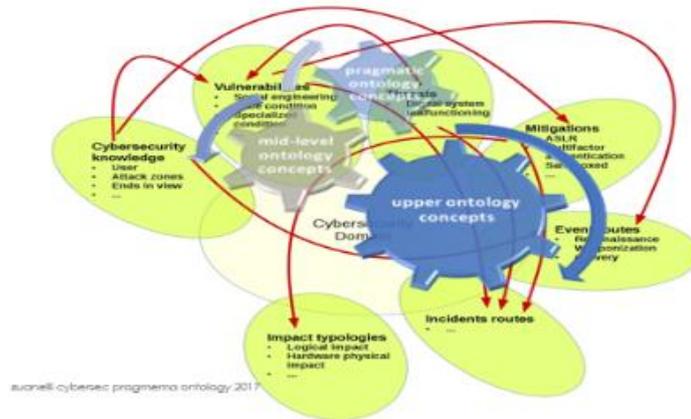
**Fig. 3.** The cybersecurity domain ontology

The cybersecurity domain ontology implies the contextual activities of the cybersecurity pragmatic domain and related application tools (Fig. 4)



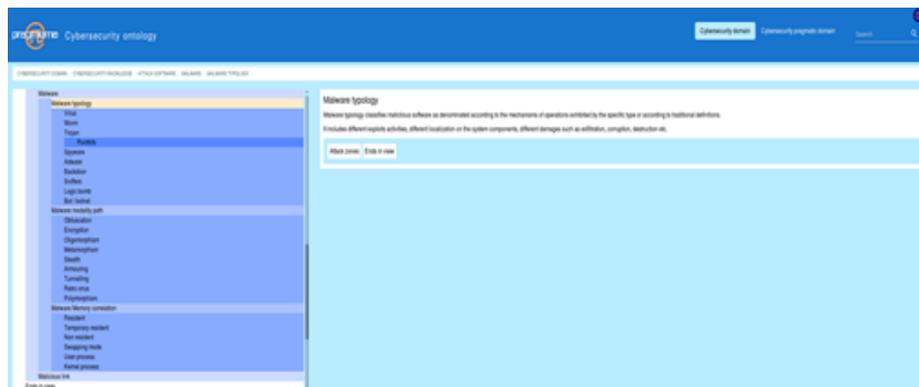
**Fig. 4.** The cybersecurity pragmatic ontology

The overall design of the networked entities of the cybersecurity domain ontology includes hierarchical and non hierarchical relations, at different levels of structure, as well as pragmatic ontology entities: diverse functionalities such as conceptual operational schemas/frameworks of risk assessment and evaluation, the utilization of cybersecurity metalanguages, the analytics of structured and unstructured data for cybersecurity alarms, prediction and prevention.



**Fig. 5.** The cybersecurity ontology: domain and pragmatic levels ontology

Current activities such as data logging analytics from multiple sources (big data analytics), automatic data disambiguation/homologation, external export, aggregation potential and event search, reporting management, shared standardization are among the expected and possible results.



**Fig. 6.** POC Malware typology

Lastly, consistent data corpora analytics with an innovative statistics approach can lead to future predictive technology solutions.

## B. The POC structure

The POC platform has utilized a "middle out" approach that recovers bottom-up and top-down sources as redefined in POC's architecture technology.

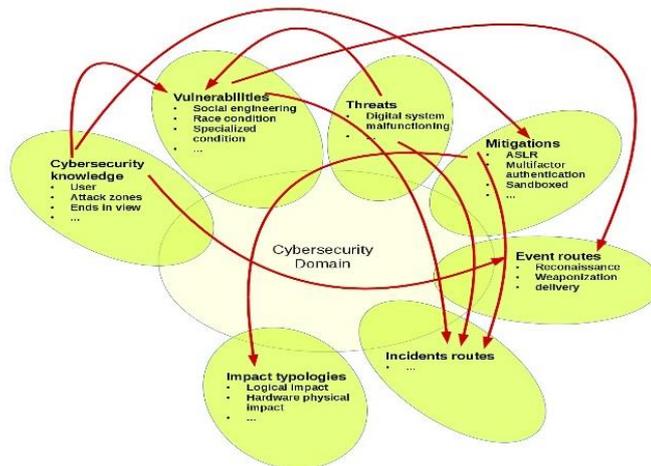
POC is based on three ontological levels: an "abstract" upper ontology on a semantic logical level, a mid-level ontology and a cybersecurity domain ontology. A fourth level, the pragmatic cybersecurity ontology, allows several interconnected applications: operational grids/forms, ontology metalanguages, cyber-security remedial software, industry specifications.

The distinctive features of POC can be summed up in:

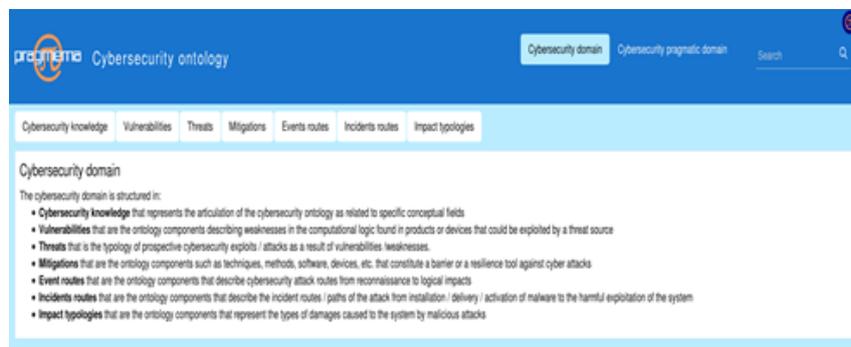
- a uniform application of the concepts of representation, entities and relations as identified by the upper and mid ontologies
- sub-ontologies as inter-functional constituents: the domain cyber-security ontology, the pragmatic cybersecurity ontology, cybersecurity knowledge, the semantic vocabulary
- different level entities interconnected with logical, semantic and pragmatic relations.

The model includes a totally new component, namely a pragmatic cybersecurity ontology as a context based related development of the cybersecurity domain that governs the suite of cybersecurity services supplied by the platform.

The cybersecurity domain ontology is a system of linked entities and relations that comprise seven fields and over 600 entities. It is open to eventual integrations as needed by the evolution of the system. POC includes cybersecurity knowledge, vulnerabilities, threats, mitigations, event routes, incident routes, impact typologies.



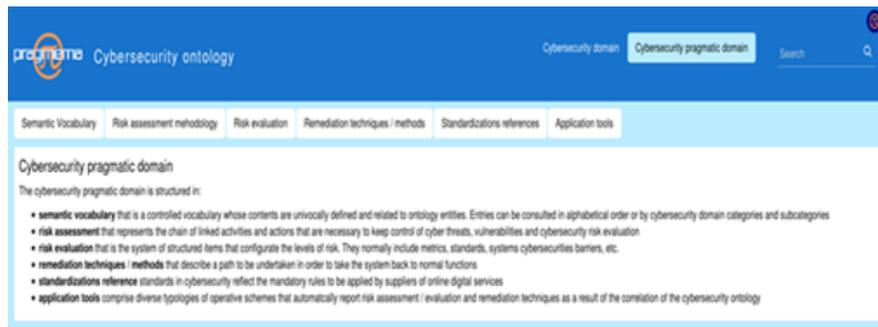
**Fig. 7.** The cybersecurity domain ontology



**Fig. 8.** POC cybersecurity domain ontology

The pragmatic ontology is based on the domain ontology and displays a suite of six digital services: the semantic vocabulary, the risk assessment and the risk evaluation fields, remediation techniques, standardization references and application tools.

The application tools include virtual ontological forms to be filled in and archived in customizable data bases.



**Fig. 9.** POC cybersecurity pragmatic ontology

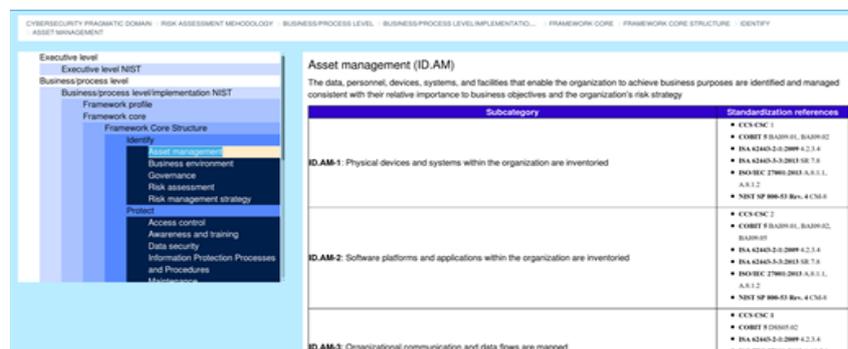
POC ‘s pragmatic ontology releases services that are grounded on the cybersecurity domain ontology as follows:

- the controlled semantic vocabulary (CSV) of cybersecurity (and generic vocabularies) is the information and data definition service for unambiguously managing cybersecurity activities
- risk assessment: the service allows to check the state of the cybersecurity system and to trace the evolution of security risks of a company or institution data and technologies. At customer's request, the check template can be customized and interrelated with corporate/institutional cybersecurity technology systems
- risk evaluation: the service allows to assess the company's economic risk in cyber attacks. It can be customized
- remediation techniques: the service allows to define resilience activities in case of attacks. It can be customized
- standardization references: the service offers the range of international standards required for cybersecurity. It is linked to forms/application tools
- application tools contain forms/schemas to be compiled and stored on the company's or institution's database for the security services in the IT system and carry out the following activities: reporting events and incidents, statistics, metrics, risk assessment, risk evaluation , etc. It allows automation of the service and risk signals

### C. The customization of services

Services accessed in POC allow for:

- the back up and archiving data bases related to trends of assessment, evaluation and incident reporting such as statistics, metrics, standards
- the comparison of data referring to events and incidents
- big data analytics with preventive and predictive functions.



**Fig. 10.** POC Cybersecurity risk assessment

## IV. MARKET APPRAISAL

The POC cybersecurity domain ontology and the pragmatic ontology represent two interrelated tools with different market values.

They can be used separately. Together they represent an added value tool: the domain ontology supports the services and the services work within the domain ontology base.

The two address the needs of a number of private and public stakeholders. On the public/private side, governmental entities and activities such as those released by CERTs, CSIRTs, SIEMs, SOCs appear to be the natural addressees. All the suite of services/activities are the object of EU norms that address critical infrastructures and digital services vendor companies.

In general, whatever the size of companies, risk evaluation, assessment and prevention need specific applications as supplied by POC.

Specific applications to the stock market and the insurance companies are implied stakeholders.

### A. Other valuable features

POC presents a double interface: the administrator's interface and the customer's interface. The usability of POC by experts and non expert stakeholders makes it a flexible and scalable tool.

It also allows for data sharing and deduplication of items in a univocal perspective.

Finally, multiple implementation of categories and insertion of new entities are envisaged in POC and the application of machine learning and complete automated acquisition of data are prospective results.

## V. TECHNOLOGICAL ARCHITECTURE AND INFRASTRUCTURE

POC is realized on Liferay, a horizontal portal written in Java; Post-gres, relational database and Elastic search: a search engine written in Java.



**Fig. 11.** Liferay architecture

The POC architecture presents the following strengths. The structural feature based on three main components:

- the application server. Liferay is built on Java micro-services and designed to be a clustered persistence server;
- the Postgres relational database designed to be replicated;
- the index and search server: Elastic search, designed to manage distributed searches

The architectural feature. The components are scalable and offer a wide margin of growth. The characterizing feature. Single aspect strengths are available such as:

- internationalization: it manages multiple languages for navigation and content;
- language independent categorization: any category has an identifier and a multiple description in various languages so that the category based selection gives the same result irrespective of the language used;
- integrable: based on standards, it can be integrated with almost any legacy system
- granular role management: sophisticated user management for duty and visibility separation; the internal management system can be integrated with external systems as single sign on systems or identity systems.

The platform's functional proposal lies in the primary interests of institutions and companies, both public and private, and country systems in general in areas such as the defense of government structures invoked by NATO and the EU and critical infrastructures.

Current technological defenses, which do not have satisfactory formalized solutions for data management, can be implemented in the perspective of risk analysis and assessment, providing the basis for the prototype development of further technology solutions.

## CONCLUSIONS

Current activities such as data logging analytics from multiple sources (big data analytics), automatic data disambiguation /homologation, external export, aggregation of potential and efficient event search, reporting management, shared standardization are among the expected and possible results.

Lastly, consistent data corpora application with an innovative statistics approach can lead to future predictive technology solutions.

## REFERENCES

- [1] Austin J.L., How to Do Things with Words, The William James Lectures delivered at Harvard University in 1955, J.O. Urmson, M. Sbisà (eds.), London, Oxford University Press, 1976
- [2] Calisi D., A.Farinelli, G.Grisetti et alii, "Uses of Contextual Knowledge in Mobile Robots", in R.Basili, M.T. Paziienza (eds.), Artificial Intelligence and Human-Oriented Computing, Berlin, Springer, 2007
- [3] De Beaugrande R.A, W.U. Dressler, Introduzione alla linguistica del testo, Bologna, Il Mulino, 1994
- [4] Carnap R., "Empirismo, semantica e ontologia", in L.Linsky (ed.), 1969, pp. 261-284
- [5] Collins A.M., Quillian M.R., "Retrieval Time from Semantic Memory", Journal of Verbal Learning and Verbal Behavior, 8, 1969, pp. 240-47
- [6] Collins A.M., E.F. Loftus, "A Spreading Activation Theory of Semantic Processing", Psychological Review, 82, 1975, pp. 407-28
- [7] van Dijk T. A. , Testo e contesto, Bologna, Il Mulino, 1980
- [8] ENISA, Ontology and taxonomies of resilience, Dec. 2011, pp. 1-59
- [9] ENISA, Threat Taxonomy: A Tool for Structuring Threat Information, Jan. 2016, pp. 1-24
- [10] ENISA, A Good Practice Guide of Using Taxonomies in Incident Prevention and Detection, Dec. 2016
- [11] Guarino N. (ed.), Formal Ontology in Information Systems, IOS Press, Amsterdam, 1998
- [12] Guarino N. "Formal Ontologies and Information Systems", in Guarino (ed.), 1998

- [13] Guizzardi G., "On Ontology, Ontologies, Conceptualizations, Modeling Languages, and (Meta)Models", Proceedings of the 2007 Conference on Databases and Information Systems IV: Selected Papers from the Seventh International Baltic Conference DB&IS, 2006, pp. 18-39
- [14] Kalinichenko L., M. Missikoff, F. Schiappelli, N. Skvortsov, "Ontological Modeling", Proceedings of the 5th Russian Conference on Digital Libraries RCDL2003, St.-Petersburg, Russia, 2003, pp. 1-7
- [15] Linsky L. (ed.), *Semantica e filosofia del linguaggio*, Milano, Mondadori, 1969
- [16] Martin R.A., "Making Security Measurable and Manageable", The MITRE Corporation, Military Communications Conference, 2008, pp. 1-11
- [17] NISTIR 8138, *Vulnerability Description Ontology 2 (VDO)*, Sept. 2016, pp.1-45
- [18] Oltramari A., L.F. Cranor, R.J. Walls, P.McDaniel, "Building an Ontology of Cyber Security", *Ceur-ws.org/Vol-1304/STIDS*, 2014, pp. 54-61
- [19] Searle J.R., F. Kiefer, M. Bierwisch (eds.), *Speech Act Theory and Pragmatics*, Dordrecht-Boston-London, Reidel, 1980
- [20] Takahashi T., Y. Kadobayashi, "Reference Ontology for Cybeseurity Operational information", *The Computer Journal*, Vol. 58, N.10, 2015, pp. 2297-2312
- [21] Zareen Syed, A. Padia, T. Finin, L. Mathews, A. Joshi, "UCO: A Unified Cybersecurity Ontology", *The Workshops of the Thirtieth AAAI Conference on Artificial Intelligence*, Phoenix, Arizona, 2016, pp. 195-202
- [22] Zuanelli E., *La competenza comunicativa. Precondizioni, conoscenze e regole per la comunicazione*, Torino, Boringhieri, 1981
- [23] Zuanelli E., *Manuale di linguaggio, comunicazione e applicazioni digitali*, Roma, Colombo, 2006
- [24] Zuanelli E., *Comunicazione digitale. Un approccio semiologico linguistico*, Roma, Colombo, 2009
- [25] Zuanelli E., *Architetture digitali e comunicazione digitale*, Roma, Aracne, 2016

#### **MITRE REFERENCES**

- [26] "The Common Vulnerabilities and Exposures (CVE) Initiative", MITRE Corporation, (<http://cve.mitre.org>)
- [27] "The Open Vulnerability and Assessment Language (OVAL) Initiative", MITRE Corporation, (<http://oval.mitre.org>)
- [28] "The Common Platform Enumeration (CPE) Initiative", MITRE Corporation, (<http://cpe.mitre.org>)
- [29] "The Common Configuration Enumeration (CCE) Initiative", MITRE Corporation, (<http://cce.mitre.org>)
- [30] "The Common Weakness Enumeration (CWE) Initiative", MITRE Corporation, (<http://cwe.mitre.org>)
- [31] "The Common Attack Pattern Enumeration and Classification (CAPEC) Initiative", MITRE Corporation, (<http://capec.mitre.org>)
- [32] "The Consensus Audit Guidelines (CAG)", SANS Institute, (<http://www.sans.org/cag/print.php>)
- [33] Obrst L., P.Chase, R.Markeloff, "Developing an Ontology of the Cybersecurity Domain", The Mitre Corporation, 2012

## AUTHOR(S) BIO



### **Elisabetta Zuanelli**

- Since 2016 Docens Turris Virgatae, Emeritus, Full Professor
- Since 2016 Coordinator of the National plan for training and education in cybersecurity, cyberthreat, privacy ( [www.cybersecurityprivacy.it](http://www.cybersecurityprivacy.it))
- Since 2013 Coordinator of the steering committee on information Security (University of Rome “Tor Vergata”, CNR, Guardia di Finanza)
- Since 2012 Expert for the Ministry of Education and University in Industrial Research Projects (Ministerial Decree n. 30 / Ric. February 2, 2012)
- Since 2012 Scientific Director of the online platform for the Ministry of Health [www.multiplicalavita.it](http://www.multiplicalavita.it)
- (THE PRESIDENT OF THE REPUBLIC GIORGIO NAPOLITANO HAS ACCORDED THE PROJECT THE MEDAL OF REPRESENTATION)
- Since 2010 Member of the Scientific Committee/ International Referee for IEEE / MEEM (Institute of Electrical and Electronic)
- EU Expert 2005-2006 in the European Union on eContent Plus and security project/Evaluator of projects 2005-2006
- Since 2007 President of the Center for Research and Development on EContent (CRiSEC [www.cresec.com](http://www.cresec.com), University of Roma “Tor Vergata”)
- Head of the Department of organizational-computing sciences/international-communicational sciences at the School of Economy and Finance (SSEF), Ministry of Economy and Finance from 1993 to 2004
- Professor of Public Communication at the Higher School of Economy and Finance (SSEF), Ministry of Economy and Finance 1993-2004
- Since 2005 Full Professor, Chair of Glottodidactics / Digital Communication at the University of Rome “Tor Vergata”, Department of Management and Law
- Counsellor on Public Communication at the Presidency of the Council of Ministers 1987-1992
- Associate Professor University of Venice “Ca’ Foscari”, 1970-2004
- Since 2000 President of Pragmema srl (elearning platforms, search engines, AI platforms, [www.pragmema.it](http://www.pragmema.it))
- Author or editor of 22 books and over 100 essays/articles
- General editor of the Web series, Aracne, Rome since 2016

# Research, education, and conservation in developing countries in a networked global ecosystem

Mazin B. Qumsiyeh<sup>1</sup> and Zuhair S. Amr<sup>2</sup>

<sup>1</sup>*Palestine Museum of Natural History (PMNH) and its Palestine Institute of Biodiversity and Sustainability (PIBS) of Bethlehem University*

[mazin@qumsiyeh.org](mailto:mazin@qumsiyeh.org), [info@palestinenature.org](mailto:info@palestinenature.org)

<sup>2</sup>*Department of Biology, Jordan University of Science and Technology, Irbid, Jordan*

**Abstract:** Our species faces twin threats of nuclear war and climate change. To meet challenges that are global require global integrated responses. The UN 2030 six key sustainable development goals addressed the need and committed to act collectively. To translate these lofty plans into action requires practical steps. We explore how we can respond in the areas of environmental conservation and sustainability by “thinking globally and acting locally”. We demonstrated effectiveness with a case study from Palestine. A Palestine Institute of Biodiversity and Sustainability (PIBS) quickly connected (plugged in) globally and locally managed to achieve success in less than three years since it was founded. PIBS promotes research, education, and conservation. We highlight six key successes of PIBS and six key reasons for achieving these successes in such a short time even under difficult situation of colonization and economic deprivation. We highlight the tools for leveraging information technology (such as ResearchGate and scholar.google.com), the importance of involving people of various backgrounds including local regional, and global networking. Lessons learned from our successes can be applicable to other developing countries. The tools and methods are easily learned and are applicable for fundraising, getting donations in kind, research publications, environmental education, innovation, conservation of natural resources, and improving local economies (by permaculture and ecotourism among others). We offer these experiences learned sometimes with trial and error to fellow Arabs interested in a more sustainable development in line with the UN’s millennial goals, Arab Development goals, and local sustainable development in villages and towns throughout the Arab World.

**Keywords:** Global networking, email lists, databases, sustainable development goals.

## I. INTRODUCTION

In 2012, a significant global meeting in Brazil committed world governments to a set of sustainable development goals (SDGs) and included a time table for adoption and beginning of implementation in 2015. The biggest incentive for acting is that research has accumulated that shows that if current trends continued, the earth’s system could not continue to function as it did before which will create massive starvation, dislocation, and political upheaval. While the UN focused on poverty reduction before, the agenda has shifted to a more holistic approach including rethinking integrated ecosystem services [1]. The six goals for the UN 2030 sustainable development are:

- Thriving lives and livelihoods. End poverty and improve well-being through access to education, employment and information, better health and housing, and reduced inequality while moving towards sustainable consumption and production.
- Sustainable food security. End hunger and achieve long-term food security including better nutrition through sustainable systems of production, distribution and consumption.
- Sustainable water security. Achieve universal access to clean water and basic sanitation, and ensure efficient allocation through integrated water resource management.
- Universal clean energy. Improve universal, affordable access to clean energy that minimizes local pollution and health impacts and mitigates global warming.

- Healthy and productive ecosystems. Sustain biodiversity and ecosystem services through better management, valuation, measurement, conservation and restoration.
- Governance for sustainable societies. Transform governance and institutions at all levels to address the other five sustainable development goals.

These goals are important social priorities for global mobilization but the biggest challenge in implementing these is that they require significant economic restructuring as stated in the SDG 2 “from 2015 to 2030, all nations will adopt economic strategies that increasingly build on sustainable best practice technologies, appropriate market incentives, and individual responsibility” [2]. Now at the end of 2017, few nations (and fewer Arab countries) have even begun to contemplate the significant changes we must make.

The Convention on Biological Diversity adopted at the Earth Summit Conference in Rio de Janeiro, Brazil, in 1992 highlighted three key principles: conservation of biological diversity, sustainable use of nature, and fair and equitable sharing of the benefits. In fact, in 1948 the Universal Declaration of Human Rights had already declared that “Everyone has the right freely to.. share in scientific advancement and its benefits” (The Universal Declaration of Human Rights, UN 1948). Can we say that we are adhering to these lofty ideals? Our dominant species *Homo sapiens* (the wise) may lead itself to extinction by either dramatic climate change or by nuclear weapon proliferation. There is some talk of what will become of our small planet after humanity or of even colonizing new planets just in case we finish this one off. Less cynical forces work to remedy the situation via enhanced environmental education and environmental stewardship. Science and technological advances are double edge swords which can be used for destruction or for building up sustainable communities. In developed countries with good economies, these discussions are advanced and people generally can afford to protect the environment more than in the case of under-developed or developing countries [3]. Many nations are unable to advance their regulatory and enforcement standards to protect their environment in an increasingly globalized system under difficult economic situations [4].

Most people now realize that we cannot wait on governments to address pressing issues. One can cite hundreds of examples of the short-sightedness and greed driven corporate-governmental-military alliances that threaten our very existence. Most environmentalists were not happy with the inadequate, hesitant and non-binding steps agreed to at that climate summit in Paris. But recently, the US administration under President Trump announced withdrawing from the accords. Again and again governments do not seem capable or willing to address these existential issues. This has become common sense conclusion. Accurately diagnosing the problems we face based on good reading of social and human history is essential. However, this must be followed by offering therapy based on logic and ensuring a relatively good prognosis for us and our planet.

Most of the seven billion people on earth live in developing countries with limited resources depleted by decades of colonization and Western usurpation of their resources. The situation is even worse in developing countries still under occupation and/or in politically and socially difficult circumstances like Palestine. Networking and leveraging knowledge to effect behavioral change can be a key factor in our response (see discussion).

Since the beginning of the information technology revolution, a number of databases dealing with conservation and sustainable development in developing countries were developed to enhance access to available information and integrate it in decision-making [5]. For example, the IUCN Red Data lists assessed many species at the global and regional levels to help conservation agencies to manage endangered species. The Global Biodiversity Information Facility (GBIF: <http://www.gbif.org>) has millions of records of critical importance to conservation [6, 7]. These databases and networking groups aim to serve biodiversity and ecosystems services research in order to develop and promote policies towards conservation measures and sustainable use of biodiversity elements and pristine ecosystems [8]. The question that lingers is how do we in the Arab world plug into a global system more effectively? Here we address this using a case study from Palestine.

## II. CASE STUDY

### A. Setting in Palestine:

Before the Zionist project in the late 19th century, Palestine had some 1300 villages and towns each with small and manageable population. The total population then was 850,000 with various religious persuasions (3% Jewish, 13% Christian, 80% Muslim, 4% other). The land was owned or operated by those local people. Since the first Zionist congress in 1897, this structure was radically shifted with mostly European Jews migrating and taking over the land. Initially there were very small land purchases and removal of local peasants who farmed the land for centuries but who were forced out because of Ottoman collusion with Zionists and very wealthy elite Arabs who illegally sold the land. This was a small percentage of no more than 7% of supposed privately owned land.

It was only in 1948-1950 when Israel was founded by military rule that a large wave of ethnic cleansing happened and Zionists took control of the much of the land of the local Palestinians [9]. Nearly 500 villages and towns were destroyed and their land re-cultivated mostly with European pine trees which damaged the local environment. In 1967 Israel occupied the remaining 22% of historic Palestine (plus the Sinai and the Golan) and built settlements throughout the occupied territories in contravention to International law (4th Geneva Convention) [10, 11]. Rules were introduced that prevented Palestinians not only from doing much of their usual agriculture but also from managing forested lands or building in open spaces. Alon Tal, Founder of the Israel Union for Environmental Defense, acknowledged that: "...it's a Zionist paradox..we came here to redeem a land and we end up contaminating it" [12].

Currently 750,000 Israelis live in the West Bank or the Occupied Palestinian Territories (OPT). The OPT are also subdivided into areas; some annexed to Israel, some under Israeli civil and military control (61.1% of the OPT), some under Israeli military control only (18.3%) and a small area under Palestinian civil and partial security control (17.7%) [13, 14]. The system of occupation and colonization creates significant issues for the local people and the local environment. We can cite dozens of example in detail but let us just list key challenges:

- Draining of the Hula wetlands (key biodiversity area, especially for migratory birds),
- Israel's diversion of the headwaters of the Jordan Valley that resulted in significant impact on the valley system and drying the Dead Sea,
- The planned Red Sea – Dead Sea canal, a joint project between Israel, Jordan, and the Palestinian Authority,
- Israel's practice of putting some of the worst polluting industries in Palestinian areas,
- The colonies and the walls, built with little environmental impact assessment, that scar the biblical and natural landscape,
- Settler attacks on Palestinian property, including but not limited to burning trees and dumping sewage on farm land.
- Israeli colonies were built on stolen Palestinian lands and concentrated on the high grounds (hills and mountains) [15, 16]. Due to this peculiar arrangement, a runoff of wastewater, pollution from industrial colonists in declared "industrial zones", and soil erosion on the hills directly impacts Palestinian communities located in the lower areas adjacent to these colonies [17].
- There is uneven distribution of water between the natives and the Israeli colonizers [18-20].

There are many other issues where the occupation can effect sustainable development and protection of the environment [21]. For example, a main problem facing the tourism sector in general (including ecotourism) is the policies of the state of Israel to destroy means of livelihood of the local population [22, 23]. Another example is that as Israel tries to change the bounds of the semi-arid regions to make them arable land, it is pushing the Bedouins further south. As climate changes, the desertification increases and the semi-Nomadic Bedouins are caught in the middle [24].

Besides colonization, other issues effect environmental conservation in Palestine. Rapid natural and unnatural (via migration) growth of population places much pressure on our limited space and overtaxed water resources. The industrial consumerist agriculture imported from the West exacerbates things (use of pesticides, monoculture etc). Law enforcement related to nature conservation remains marginal and the society remains largely unconnected from nature, focusing on mere survival.

Finally, we can state that research and development efforts were very meagre because of this complicated stressful situation in Palestine [25].

### **B. Palestine Institute of Biodiversity and Sustainability (PIBS): a case study in localization and globalization**

In 1989, Bethlehem University developed an Institute of Community Partnership that worked with marginalized communities to achieve economic empowerment. In moving more towards sustainability, we at the university saw the need to initiate an institute that develops new techniques and knowledge relating to sustainability (especially food security while protecting health and the environment) and knowledge transfer to marginalized communities. This includes also research best methods to ensure community buy-in and ownership of local initiatives. We are especially focused on adaptation and mitigation of the adverse effects of climate change, desertification, and Israeli occupation. Using largely volunteer efforts and local donations but with significant networking globally (see below), PIBS and the Palestine Museum of Natural History of Bethlehem University were established in 2014 and focused on research, education, and conservation of our natural world, culture and heritage and the use of knowledge to promote responsible empowered human interactions with all components of our environment. We endeavored to work locally, regionally and globally to achieve the above mentioned UN SDGs. In the past three years, PIBS:

- Published 25 applied research papers on issues ranging from environmental health to biodiversity to sustainable livelihoods, to education, and more (see <https://www.palestinature.org/research/>).
- Developed an agricultural research station and botanical garden (including aquaponics) and use them to empower marginalized local farmers (production, research, and knowledge transfer) [26,
- Developed educational programs that benefited thousands [28]
- Hosted thousands of local and international visitors who gained knowledge of local challenges and opportunities,
- Built partnerships with local and global governmental and non-governmental entities resulting in benefit to environment and sustainability [27, 29]
- Developed databases and other resources including collections, photo library, digital library, local biodiversity database, and a seed bank.

This is an integrated system for research, education, and conservation to address areas in need in Palestine, a country under stresses of occupation. Our motto is RESPECT (first for ourselves, then other human beings, then the environment with all its components). The museum grounds and its botanical garden (integrated ecosystem) is an oasis for wildlife in Bethlehem and an oasis for young people seeking alternatives and a new way of looking at themselves and their environment (empowerment and nature conservation).

PMNH/PIBS developed educational modules relating to waste reduction, recycling, upcycling, composting, permaculture, and aquaponics. These modules were developed in partnership with university students and stakeholders in the community and were tailor-made to suit specific target communities especially focusing on marginalized villages, women, and youth. Partner organizations and institutions in these ongoing efforts include the Environmental Quality Authority, Ministry of Agriculture, Ministry of Health, Ministry of Education, local NGOs, and local community councils.

PIBS started reducing organic solid waste in the Bethlehem area with household of volunteers and staff at the museum. We then expanded with school project (eight schools). Then involved some food markets including the central vegetable market in Bethlehem (overseen and in cooperation with the Bethlehem Municipality). We are now expanding this in the Bethlehem District and moving into the second district (Salfit District). Already many people involved tell us how happy they are with the project success. Some food markets actually withdrew from the program and started composting their own waste and using it in the gardens of owners and employees. This has minimized the environmental impact of dumping organic material with other solid waste but also and due to increased interest in planting organically resulted in improvement to our environment.

60% of solid waste generated in the Palestinian territories under occupation is composed of organic material that can be composted to produce garden and farm fertilizers. The composting project initiated and ongoing at PMNH/PIBS collects household, restaurant, and food market organic "refuse" and through enhanced composting (knowledge based) produces organic fertilizers. The first step to achieving this project was tailoring traditional composting methods to local situations (e.g. using local earthworms to enhance composting). The knowledge was transferred to households through the work with women's groups, school environmental clubs, mosques and churches, and other civic society groups. This is spreading and is already having an impact (which is only set to increase) on health (reducing solid waste) and on food security (people encouraged to have family and community gardens) despite shrinking land availability (due to occupation and population growth) and other natural resources including water.

Our own community garden at PMNH/PIBS is flourishing and many households report successes to us in their gardens. These gardens also increase plant cover thus mitigating climate change and improving the environment protecting biodiversity (e.g. by reducing dependency on industrial food production). In our museum gardens, we have seen significant growth in volume of composted material. We started from little or no composting and in the past year have gone to composting several tons of organic products. We anticipate this volume to double every year in the Bethlehem District and now to move to a new district (Salfit). The scalability is very high. The botanical garden and experimental agriculture research station develops modules that are expanding (a ripple effect). It has been well received and replicated in other places. Already in Nablus and Hebron initiatives are under way to create a similar project. PMNH/PIBS published papers that suggest to other developing countries that they could do similar projects and already received some inquiries and interests on these even before some our experiences are fully out and shared. For a short video of general accomplishments, see <https://youtu.be/BPhFLOsEIM0> (English) and <https://youtu.be/uMQ9Rs85CjQ> (Arabic), and for one dealing with educational activities, see <https://youtu.be/AZOoOzXU7tQ> (Arabic with English subtitles).

A simple google search for Palestine Museum of Natural History yields 603,000 hits highlighting other accomplishments and this is for a project that is less than three years old. How did we manage to do all of that with limited funds (\$250,000 donated by Professor and Mrs. Qumsiyeh plus some \$100,000 in donations), short period of time (<3 years), and largely volunteer cadre of dedicated people? The answers can be summed up in six key issues:

- The project was built bottom up and involved both local and international volunteers. Funding was largely local and from participants a fact that gives local and international legitimacy (transparency is key). We leveraged significant interest and volunteers using a large base of email addresses collected over the years (some 50,000 emails) via meticulous record keeping. Volunteers in the past three years came from over 25 countries and from many parts of Palestine
- The research projects developed were collaborative involving both local and international scientists and students. It has been shown that increasing contribution to world knowledge from developing and even developed countries can come from collaboration [30]. Most of our listed successes above are due to collaboration.
- In building our research, education, and conservation projects and in fundraising we made maximum use of internet resources including available databases and search engines (see discussion). We leveraged the internet which allowed us to do science easier than at any time before. The knowledge of science and ancillary resources are now easily available with no cost or minimal effort and negligible cost which can be eliminated by emailing the principals or using other electronic data mining tools.
- We leveraged local and international university students and from several universities (not just Bethlehem University where PIBS is located) who find here amazing and interesting research and intellectual and other support they need to do the work and publish. Even undergraduate students were able to publish with us and be first authors.
- In a related vein, PIBS focused its research on areas that promote sustainable economic development (Applied Biology, ecosystem services, permaculture and more) and in a trans-disciplinary way [27, 31].
- In building its staff and selecting volunteers, PIBS was cognizant of human diversity which has been shown to be critical in science [32]. The top two scientists (the authors), the administrators, the top staffers, and volunteers are mix of Christians, Muslims, Buddhists, young and old, male and female, and followers of various political ideologies. We consider this human diversity a strength of human ecosystem as is biodiversity a strength of natural ecosystems [33].

Like other countries, conservation does carry economic benefits to local populations in Palestine through improved local economies and standards of living [34]. To global and local volunteers, the experience at PIBS/PMNH enriches their lives and resumes. The defeat of Arab regimes in 1967 forced remaining Palestinians both in the areas occupied in 1948 and those occupied in 1967 to develop self-reliance mechanisms to cope with Israeli occupation [25]. In the wake of these upheavals, NGOs proliferated in the region. Initially there were few NGOs dealing with environment or sustainability issues in Palestine. Those that were established had good agendas but the Palestinian political developments caused the situation of volunteerism and the spirit of giving to diminish. Many NGOs became, like Palestinian Authority ministries, more concerned with salaries than with achieving their mission [35, 36].

PIBS has started to experiment in providing benefit sharing to local people and this increased our involvement in permaculture (including aquaponics and aquaculture) as well as in ecotourism. But again here this could not be done in isolation. We worked with GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) to bring agricultural engineers from Gaza to Bethlehem and train them in aquaponics. With UNDP, US, and Canadian support, we developed a series of environmental education and conservation efforts that strengthened local community resilience and introduce sustainable methods to local communities led by school students [28].

Staff and volunteers traveled to Europe and North America and learned new skills which are then transferred to local people. These exchanges are very important not only for local resilience efforts but also to develop collaborations that work to address global challenges. For example, the experiments on aquaponics were carried out for a master thesis by an exchange visitor from Zurich, Switzerland [37].

Key to success was collaboration with international groups like the International Union for Conservation of Nature, UN Development Program and local groups like the Environmental Quality Authority, Ministry of Agriculture, and universities. Individual collaborations were also very fruitful. Dr. Faysal Bibi came to use on a Palestinian American Research Council (PARC) fellowship from the Natural History Museum in Munich and we benefitted from his experience to develop our paleontology section and we published one manuscript with him [38]. But we should note the exceptional case of collaboration with Professor Zuhair Amr of the Jordan University of Science and Technology which produced 4 or 5 papers every year. For example in the last academic year we published several papers thanks to three visits from Prof. Amr across the border [38-43].

### III. DISCUSSION

It is now recognized that climate change that causes resource depletion (e.g. water) can contribute to conflict, thus connecting the two main threats facing our societies [44]. Palestine is a case in point where 7.2 million Palestinians are refugees or displaced people and the long conflict [11, 35] continue to have a severe negative impact on the environment, and instability prevents people from rationally advocating solution to existential problem [45, 46]. As climate changes and population growth increases, the practices described above become even more critical to sustainable development. Having people grow food and herbs literally in their backyards gives them empowerment and increases their incomes and food security. The project also improves both physical (through better and more organic nutrition) and psychological (through gardening and fresh air and plants) well-being of marginalized communities especially in the difficult circumstances of occupation and marginalization [46, 47]. Increased vegetation cover while recycling nutrients via composting also reduces effects of global warming (mitigation and adaptation for sustainability).

Palestine has been an occupied territory for decades and our situation remains intractable. Outside interventions have done both good and bad for Palestinians attempting to eke out a life on their land. PIBS developed out of a need to empower our young people ourselves. With the international community focusing on politics, interlopers actively undermining our sovereignty, and our own communities focusing on survival, just use of the environment has not been prioritized. PIBS's mission is focused on research, education, and conservation of our natural world, culture and heritage. We emphasize the use of knowledge to promote responsible empowered human interactions with all components of our environment. We achieve our vision by thinking globally (and leveraging global resources) while acting locally. The answers in the modern era to achieve sustainability can only come from transdisciplinary work [31] which is what we excelled in utilizing global and local networking. This has been the key to success.

Environmental justice is now considered essential aspect to include in areas of conflict zones. There is also now the concept of integrating environment in peace building efforts. A good example of this is <http://environmentalpeacebuilding.org/> as a positive approach instead of the negative one of normalization. Normalization activities (also in environment) involve cooperation between the occupiers and occupied with assumptions of normalcy of the situation. Real peacebuilding requires facing hard realities and for the occupiers who wish to work with the oppressed to challenge the system and genuinely join in the struggle of the oppressed including on environmental justice issues in an area that is the cradle of civilization and key to peace and justice in other parts of the world.

The Palestinian environment is suffering from loss of natural resources, neglect of the environment, environmental pollution, low water quality, depletion of water sources, and other human impacts leading to habitat loss and decline in biodiversity. The Israeli occupation made addressing these issues more difficult and added more challenges to the Palestinian environment. Addressing these and global challenges like climate change requires a grassroots effort and not a top-down approach [48]. This is precisely what PIBS tries to do even under the difficult situation of conflict. Working and adapting to changing landscapes is based on diversity whether in natural world (Darwinian evolution) or in human societies (cultural evolution). This is a key to survival but the reverse is also true: most isolationist ideologies that refused to accept concepts of diversity are extinct or almost extinct. When one's physical environment is threatened constantly and one's physical existence is undervalued, the very act of existence is a form of resistance. We have taken this philosophy and applied it to the field of environmental education and stewardship. By celebrating and defending endemic biodiversity, educating our community, and informing the outside world of our actions, we reject the malaise and apathy that would be easy to adopt. As our current situation is unconscionable, we overcome the innate human tendency to adapt. Instead, we resist and PIBS leveraged local and international resources to form a pillar of resistance in Palestine [46].

There is some debate about whether some nations are able to advance their regulatory and enforcement standards to protect their environment in an increasingly globalized system [4]. Developing countries are at a particular disadvantage because of the lack of economic resources. There is a direct correlation between the GDP and level of environmental interest [3]. The GDP of Palestinians is 1/8 that of Israelis who share with them the space of historic Palestine but this gets more distorted during the cyclical uprisings against the occupation [49].

The modern information age and the ease of networking and communication have already revolutionized science [50]. "Google scholar" is now the top ranking search engine for scientists [51] and most of the published literature is freely available on the web (and there are ways to freely get the parts that are not!). Here we need to take a moment to recap an issue of significant which is that since 1948, the name of Palestine has been diminished in the scientific literature at the expense of "Israel" as a new political reality. Israeli scientists make it a point of including the word Israel in all their publications. It is thus not surprising to see data like what is shown in Table 1.

Keywords	Hits
Israel biodiversity	93,800
Palestine biodiversity	10,700
Israel sustainable agriculture	102,000
Palestine sustainable agriculture	22,800

**Table 1.** Using the search of scholar.google.com with different keywords and number of hits (carried out 1 October 2017)

The explanation for these data include several factors: 1) the over use of Israel in all publications coming out from Israeli institutions, 2) significant investment in research in that area, 3) significant destruction of Palestinian research potential under occupation and poor management [25]. The good news is that with increasing numbers of Palestinian Universities (now over 13) and establishment of research centers like the one used as a case study here, we anticipate the picture to change. It must also be noted that while Israel spend much on R&D, over the past few decades that has mostly focused on military R&D not on the expense basic sustainable development R&D [52].

There are also databases and specialized social networking platforms for different disciplines. For example systematic biologists (taxonomists) started taking advantage of this technology by compiling data in computers (biodiversity informatics really commenced in the 1970s). Scientists collecting data on biodiversity now deposit them in scientific portals to facilitate communication between scientists, but do so only based on proper identification and standardized taxonomic identification and naming [53]. Portals like <http://www.gbif.org>, <https://www.earthobservations.org>, <http://www.geoportal.org/> have become crucial not only for scientists but for societal planning for sustainable development. Symbiota (Promoting bio-collaboration) are “web tools [that] strive to integrate biological community knowledge and data in order to synthesize a network of databases and tools that will aid in increasing our overall environmental comprehension” (<http://symbiota.org/docs/>). These and many other resources have made life so much easier to many scientists and can if used correctly allow us in developing countries to quickly catch-up to the developed world.

There are also informal citizen science web portals that gather non-scientific observations from anyone who has access the internet and the curiosity about their surroundings. Two examples are <http://www.inaturalist.org/> with over 2.7 million observations and <http://www.observations.org>. These can help increase societies’ appreciation of the natural world and the importance of conservation and sustainability. There are also editable information portals unfortunately poorly used in Arabic and by Arabs like Wikipedia and the more specialized “Wiki Species” [https://species.wikimedia.org/wiki/Main\\_Page](https://species.wikimedia.org/wiki/Main_Page). There are dozens of other projects and there was a non-profit organization set up to standardize use of information databases. The Biodiversity Information Standards, also known as the Taxonomic Databases Working Group (TDWG), “is a not for profit scientific and educational association that is affiliated with the International Union of Biological Sciences” (see <http://www.tdwg.org>).

But even when books and articles are not available on any publicly available database, we found that we could get them by contacting people in our network which include thousands on social science networks. Everyone has a standard scanner and can scan small articles and chapters of books quickly. But we also now have ability to use newer book scanners. Through networking, we at PIBS got a donation from Dany Qumsiyeh of a simple but very effective linear book scanner (see <https://linearbookscanner.org/>) which allows us to scan many books and articles and share them with researchers at Palestinian Universities and many other research facilities. We suggest that an Arab network of such facilities can significantly reduce costs to research centers to near zero for information gathering because computers and access to internet is now ubiquitous throughout the world.

The social networking also allows us to get almost immediate support from colleagues and stranger across continents. One has to guard not to spend too much time on social platforms but they could allow for fruitful collaborations and networking if done properly. We have managed to recruit significant support, meet potential collaborators and donors through such platforms as FaceBook and LinkedIn and ResearchGate. We also encourage our researchers to register in other places like <https://orcid.org/> (standardized database of researchers) and <https://www.academia.edu/> (network of academics). We started to use Twitter but there are concerns [54]. Some platforms like ResearchGate are now heavily used by many scholars including us but maybe avoided by others [55, 56]. We find use of ResearchGate very effective for increasing citation index and sharing published work with professionals. Social media if used correctly by scientists and based on data analysis can be very significant [57]. Caution must be exercised not to spend too much time on these platforms.

Our experience with PIBS shows that even in very difficult circumstances (colonization and economic deprivation), these new tools handled carefully and methodically give us the ability to develop at an accelerated pace and even compete with the best research, education, and conservation centers in the world. At the other end of the spectrum, most journals now also have electronic submissions of papers and expedited review which means we can go quicker from study design to publication. But as noted above and especially in our impoverished Arab world, our research and all our work must focus on applied area that allow us to meet the millennial goals of sustainable development. We go down the

path of biodiversity conservation and eradication of poverty simultaneously [58]. Hard work, collaboration, networking, trans-disciplinary work, and a bit of humility can go a long way.

Our recommendations following this brief study is that we need more centers like PIBS in Arab and other developing countries that build on availability of electronic sources of information for data mining, networking and collaborations in ways that can quickly build-up R&D in our countries but with a global context (thinking globally and acting locally). We are cautiously optimistic not only that this is feasible but that it is also inevitable and essential for sustainable development.

## REFERENCES

- [1] Griggs, D., M. Stafford-Smith, O. Gaffney, J. Rockström, M.C. Öhman, P. Shyamsundar, W. Steffen, G. Glaser, N. Kanie and I. Noble. 2013. Policy: Sustainable development goals for people and planet. *Nature*, 495(7441):305-307.
- [2] Sachs, J.D. 2012. From millennium development goals to sustainable development goals. *The Lancet*, 379(9832), pp.2206-2211.
- [3] Mills, J.H. and T.A. Waite. 2009. Economic prosperity, biodiversity conservation, and the environmental Kuznets curve. *Ecological Economics*, 68(70):2087-2095.
- [4] Vogel, D. 1997. Trading up and governing across: Transnational governance and environmental protection. *Journal of European Public Policy*, 4:556-571.
- [5] Muvunankiko, G. and S. Alweny. 2017. ARCOS Network: A sustainable mountain development hub for Africa. *Mountain Research and Development*, 37(2):228-231.
- [6] Thomas, C. 2009. Biodiversity databases spread, prompting unification call. *Science* 324, 1632–1633.
- [7] Huang, X. and Qiao, G., 2011. Biodiversity databases should gain support from journals. *Trends in ecology & evolution*, 26(8), pp.377-378.
- [8] Bonine, K., J. Reid and R. Dalzen. 2003. Training and education for tropical conservation. *Conservation Biology*, 17:1209–1218.
- [9] Pappé, I. 2006. *The Ethnic Cleansing In Palestine*, One World Publication. Oxford.
- [10] Masalha, N. 1992. *Expulsion of the Palestinians: The Concept of "Transfer" in Zionist Political Thought, 1882-1948*. Institute for Palestine Studies
- [11] Qumsiyeh, M.B. 2004. *Sharing the Land of Canaan: Human Rights and the Israeli-Palestinian Struggle*, Pluto Press, London.
- [12] Tal, A. 2002. *Pollution in a Promised Land: An Environmental History of Israel*. University Of California Press.
- [13] Isaac, J. and J. Hilal. 2011. Palestinian landscape and the Israeli–Palestinian conflict. *International Journal of Environmental Studies*, 68:413-429
- [14] ARIJ (Applied Research Institute-Jerusalem) 2015. Status Of Environment In Opt 2015 (But Actually Published In 2016) <http://www.arij.org/latest-news/779-the-status-of-env-2015-2016.html>
- [15] Benvenisti, M. 2002. *Sacred Landscape: The Buried History of the Holy Land since 1948*. University of California Press.
- [16] Etkes, D. & H. Ofran. 2007. Construction of Settlements and Outposts on Nature Reserves in West Bank. *Peace Now*. <http://peacenow.org.il/eng/content/construction-settlements-and-outposts-nature-reserves-west-bank>
- [17] Hammad, K. and M.B. Qumsiyeh. 2013. Genotoxic effects of Israeli industrial settlement pollutants on Palestinian residents of Bruqeen Village (Salfit). *International Journal of Environmental Studies*, 70(4):655-662.

- [18] Gasteyer, S., J. Isaac, J. Hillal and K. Hodali. 2012. Water grabbing in colonial perspective: land and water in Israel/Palestine. *Water Alternatives*, 5:450.
- [19] Al-Haq. 2015. Environmental injustice in Occupied Palestinian Territory: Problems and Prospects.
- [20] Messerschmid, C. and J. Selby. 2015. Misrepresenting the Jordan River Basin. *Water Alternatives*, 8(2): 258-279.
- [21] MOPAD. 2014. State of Palestine National Development Plan 2014-2016. [http://www.mopad.pna.ps/en/images/PDFs/Palestine%20State\\_final.pdf](http://www.mopad.pna.ps/en/images/PDFs/Palestine%20State_final.pdf)
- [22] Shay, T. 2016. The ethnocracy of the Palestinian urban space and the indigenous approach: Praxis and theory. *Archaeologies*, 12:73-90.
- [23] Isaac, R., C. M. Hall and F. Higgins-Desbiolles (Editors). 2016. *The Politics and Power of Tourism in Palestine*. Routledge, New York
- [24] Weizman, E., L. Jobey, S. Sheikh & M. Komem. 2015. *The Conflict Shoreline: Colonization as Climate Change in the Negev Desert*. Göttingen: Steidl. See also Weizman, E., 2012. *Hollow Land: Israel's Architecture of Occupation*. Verso Books.
- [25] Qumsiyeh, M.B. and J. Isaaq. 2012. Research and Development in the Occupied Palestinian Territories: Challenges and Opportunities. *Arab Studies Quarterly*, 34(3):158-172.
- [26] Anabtawi, Ruba H and MB Qumsiyeh. 2017. Sustainable Development under Political Stress: Permaculture in Palestine as a Model. submitted.
- [27] Qumsiyeh, M.B., E. Handal, J. Chang, K. Abualia, M. Najajreh and M. Abusarhan 2017. Role of museums and botanical gardens in ecosystem services in developing countries: Case study and outlook. *International Journal of Environmental Studies*, 74(2): 340-350.
- [28] Abualia, K., R. Saeed, and M.B. Qumsiyeh. (In Press). Environmental education and awareness for behavioral change in a developing country under the stresses of occupation. *Pacific Ecologist*.
- [29] Qumsiyeh, M.B. 2017. Nature museums and botanical gardens for environmental conservation in developing countries. *Bioscience*, 67: 589–590.
- [30] Maisonobe, M., Eckert, D., Grossetti, M., Jégou, L. and Milard, B., 2016. The world network of scientific collaborations between cities: domestic or international dynamics?. *Journal of Informetrics*, 10(4), pp.1025-1036.
- [31] Pulselli, F.M., S. Bastianoni, N. Marchettini and E. Tiezzi. 2008. *The Road to Sustainability*. WIT Press, Southampton, UK.
- [32] Abraham, J.K. and Reynolds, J.A., 2013. Human diversity in science. *Frontiers in Ecology and the Environment*, 11(3), pp.115-115.
- [33] Qumsiyeh, MB and Handal, EN 2017. Beauty in Bio(diversty) . This week in Palestine 232(Aug 2017): 84-86. <https://thisweekinpalestine.com/wp-content/uploads/2014/07/Beauty-in-Biodiversity.pdf>
- [34] Görlach, B., Möller-Gulland, J., Bar-On, H. & Atrash, I. 2011. Analysis For European Neighbourhood Policy (Enp) Countries And The Russian Federation Of Social And Economic Benefits Of Enhanced Environmental Protection–Occupied Palestinian Territory Country Report. *Occupied Palestinian Territory Country Report*.
- [35] Qumsiyeh, M.B. 2012. *Popular Resistance In Palestine: A history of hope and empowerment*, Pluto Press, London.
- [36] Majdalani-Azzeh, N. 2012. Mapping of Environmental Actors in the Palestinian Civil Society Sector. Heinrich-Böll-Stiftung. [https://ps.boell.org/sites/default/files/downloads/Mapping\\_Study\\_FINAL](https://ps.boell.org/sites/default/files/downloads/Mapping_Study_FINAL)
- [37] Kessens, S. 2016. Growth rate and health aspects of leafy vegetables produced in small-scale aquaponic systems with fish fed on conventional and insect-based fish food. Institut für Agrarwissenschaften / Institute of Agricultural Sciences (IAS). Masterarbeit. ETH Zurich. Available here: <https://www.research-collection.ethz.ch/handle/20.500.11850/155901>

- [38] Amr, Z.S., E.N. Handal, F. Bibi, M.H. Najajreh, and M.B. Qumsiyeh. 2016. Change of diet of the Eurasian Eagle Owl, *Bubo bubo*, suggest decline in biodiversity in Wadi Al Makhrouh, Bethlehem Governorate, Palestinian Territories. *Slovak Raptor Journal*, 10:75-79.
- [39] Abusarhan, M.A., E.N. Handal, M.M. Ghattas, Z. Amr and M.B. Qumsiyeh 2016. Some records of butterflies (Lepidoptera) from the Palestinian Territories. *Jordan Journal of Biological Sciences*, 9(1):11-23.
- [40] Abusarhan, M., Z.S. Amr, M. Ghattas, E.N. Handal and M.B. Qumsiyeh. 2017. Grasshoppers and Locusts (Orthoptera: Caelifera) from the Palestinian Territories at the Palestine Museum of Natural History. *Zoology and Ecology*, 27: 143-155.
- [41] Amr, Z.S., M.H. Najajreh, M. Zawahreh, E. Neubert, E.N. Handal, M.A. Abu Baker and M.B. Qumsiyeh. Diversity and ecology of the land snails of the Palestinian Territories. Submitted.
- [42] Handal, E.N., Z.S. Amr and M.B. Qumsiyeh. 2016. Some records of reptiles from the Palestinian Territories. *Russian Journal of Herpetology*, 23(4):261-270.
- [43] Qumsiyeh, M.B. and Z.S. Amr. (In Press). Protected Areas in the Occupied Palestine Territories. *Jordan Journal of Natural History*
- [44] Nordås, R. and N.P. Gleditsch. 2007. Climate change and conflict. *Political Geography*, 26(6): 627-638.
- [45] Qumsiyeh, M.B. 2013. The coming environmental Nakba. Pp 57-59 in the 3rd Palestinian Environmental Awareness and Education Conference. EEC, Bethlehem.
- [46] Qumsiyeh, M.B. 2017. Nature and Resistance in Palestine. *Active Arab Voices*. <http://www.activearabvoices.org/uploads/8/0/8/4/80849840/qumsiyehpmnhresistance-rm.pdf>
- [47] Qumsiyeh, M.B. 2017. Ethnoecology of Palestine: Preserving Culture Heritage of Palestine's Natural History. Conference Proceedings. 4th Hyperheritage International Seminar (International Conference): Smart Heritage.
- [48] Beck, U. 2010. Climate for change, or how to create a green modernity? *Theory, Culture & Society*, 27(2-3):254-266.
- [49] Hever, S. 2010. *The Political Economy of Israel's occupation: Repression beyond exploitation*. Pluto Press, London.
- [50] Van Noorden, R., 2014. Scientists and the social network. *Nature*, 512(7513), p.126.
- [51] Orduña-Malea, E., Ayllón, J.M., Martín-Martín, A. and López-Cózar, E.D., 2015. Methods for estimating the size of Google Scholar. *Scientometrics*, 104(3), pp.931-949.
- [52] Abu-Bader, S. and Abu-Qarn, A.S., 2003. Government expenditures, military spending and economic growth: causality evidence from Egypt, Israel, and Syria. *Journal of Policy Modeling*, 25(6), pp.567-583.
- [53] Sarkar, I. N. 2007. Biodiversity Informatics: Organizing And Linking Information Across The Spectrum Of Life. *Briefings In Bioinformatics*, 8, 347-357
- [54] Goff, D.A., Kullar, R. and Newland, J.G., 2015. Review of Twitter for infectious diseases clinicians: useful or a waste of time?. *Clinical Infectious Diseases*, 60(10), pp.1533-1540.
- [55] Kraker, P. and Lex, E., 2015, June. A critical look at the ResearchGate score as a measure of scientific reputation. In *Proceedings of the Quantifying and Analysing Scholarly Communication on the Web workshop (ASCW'15)*, Web Science conference.
- [56] Thelwall, M. and Kousha, K., 2017. ResearchGate articles: Age, discipline, audience size, and impact. *Journal of the Association for Information Science and Technology*, 68(2), pp.468-479.
- [57] Wilson, M.J., Ramey, T.L., Donaldson, M.R., Germain, R.R. and Perkin, E.K., 2016. Communicating science: Sending the right message to the right audience. *FACETS*, 1(1), pp.127-137.
- [58] Adams, W.M., R. Aveling, D. Rockington, B. Dickson, J. Elliott, J. Hutton, D. Roe, B. Vira and W. Wolmer. 2004. Biodiversity conservation and the eradication of poverty. *Science*, 306:1146-1149.

## AUTHOR(S) BIO



**Mazin B. Qumsiyeh<sup>1</sup>**, Professor Mazin B. Qumsiyeh teaches and does research at Bethlehem and Birzeit Universities. He is director of the main clinical cytogenetics laboratory and director of the Palestine Museum of Natural History and the Palestine Institute for Biodiversity and Sustainability at Bethlehem University. He previously served on the faculties of the University of Tennessee, Duke, and Yale Universities. He published over 150 scientific papers on topics ranging from biodiversity to cancer. For more, see <http://qumsiyeh.org> and <http://PalestineNature.org>.

**Zuhair S. Amr<sup>2</sup>**, Professor Zuhair S. Amr is professor at Jordan University of Science and Technology, Irbid Jordan. He is author of over 160 scientific papers and many books and is a consulting scientist at the Palestine Museum of Natural History and the Palestine Institute for Biodiversity and Sustainability.

# The role of libraries: Dissemination of technology in the education process

Suzanne Samir

*Head of the Educational Services Section, Bibliotheca Alexandrina*  
[suzanne.samir@bibalex.org](mailto:suzanne.samir@bibalex.org), 03483999 ext. 2620

**Abstract:** There is an increasing awareness about the prospective and important role of e-learning. It is a must not only in the elementary education but also in the continuing education for professionals and in applying innovative services in order to reach new communities. Implementing powerful e-learning strategies in librarianship, academic, and practical sectors makes us think about the libraries' call to action. This call to action urges information technology personnel to work on the infrastructure for connecting all available and needed platforms serving this area. E-learning is a noteworthy tool for education and training in general and especially for librarianship and information science fields. Nowadays, the Internet is the best tool of information production in general; the education field has experienced significant gains due to the wide connections offered by the Internet. It currently facilitates a variety of services ranking from a quick virtual lecture to a comprehensive course or program that can offer new perspectives for scholars, professionals, and community members. Libraries must have a great input in this regard and must provide complementary coverage of new techniques, infrastructure to respond to the new needs.

**Keywords:** challenges, education, e-learning, infrastructure, libraries, technology

## I. INTRODUCTION

The importance of the library in the life of an individual varies according to the surrounding culture. Many debates revolve around the fundamental problems related to the culture of reading in different countries. Numerous factors are linked to these debates: cultural, economic, sociological and temporal. These debates on the evolution of the culture of reading had an almost stable rhythm of theoretical view during the different periods. But after the rapid development of electronic technologies, special emphasis is placed on the culture of reading today. Reading has undeniably maintained, along the course of human history, an impeccable system which marked the harmony between logic, spirit and way of life. This deduces that the culture of reading must be seen as an indication of the spiritual and intellectual potential of a nation as a state of society and a basis for building a human and tolerant civilization.<sup>1</sup>

Libraries have long admitted that their role must go beyond the cement blocks of their buildings. The libraries anticipated any mobile connection through the traveling libraries. Therefore, reading constitutes a means of aid which is obviously intellectual. A good selection of reading is of importance for any glorious future. Thus, a multilateral connection creates a favorable atmosphere for an intellectual society.

This idea of multilateralism is initiated by several factors including the bookmobile.

---

<sup>1</sup> Ivanka Stricevic and Ahmed Ksibi, *Intergenerational Solidarity in Libraries / La Solidarite Intergenerationnelle dans les Bibliothèques*, Berlin, De Gruyter Saur, 2012, IFLA Publications, p. 112.

<sup>2</sup> <https://en.wikipedia.org/wiki/Bookmobile>

The bookmobile or traveling book (bookmobile later) is a 19th century invention, in England, precisely in 1857, the traveling library began in Cumbria, serving eight villages. George Moore had created this project in the end to spread the good literature among the rural population. <sup>2</sup>This project, likewise, was able to mobilize a lot of animation around the world of the book and encouraged the reading in distant regions.

Moreover, the development of printing technology facilitates intergenerational linkages and the closer interaction between culture, education and science.<sup>3</sup>

The culture of reading is always considered as a socio-cultural phenomenon, which defines the intellectual and cultural development of society. It follows the path of change under the influence of electronic technology. In a specific sense, the culture of reading can be defined as the ability to perceive, understand and analyze verbal communication in written, printed and electronic form. The culture of reading society and the individual is closely linked, since the reading culture of the individual is shaped largely by the influence of the surrounding people and their attitude towards books and reading. The level of reading culture in a society consists of the reading interest of each individual.<sup>4</sup>

The role of the library was primarily the organization of knowledge for a better investment of the content of its resources. We should not blame the new technology for having negatively affected this role, since it has helped libraries to more easily fulfill their role. The term "reading" currently does not mean a specific medium, whether it is a book, a magazine, etc., but rather, the term refers to the unit of knowledge which is undoubtedly information. The electronic format is the instant product of information, and what happens on blogs and Facebook pages, Twitter, etc ... it is only the raw information that needs to be maintained, pursued. The new information profile is very dynamic and sometimes vain. Dynamic because one does not want to stop to delve deep into the truth read, and vain because it is not sure that one arrives at a clear and legible end.

Could we talk, here, about the surrealism of information?!

The information is transformed into an interactive subject, its resources are multiple and arrive in various senses, if the electronic resources are revealed therefore the Web 2.0, Web 3.0, form real factors mobilizing the future of the information and consequently reading. It remains at this stage to define the reading activity. Since information is the unit of reading resources, then can we consider all information as reading?

This question provides an update on the role of the libraries and redefines the definition of reading in the 21st century.

Electronic space is defined as an environment of objective reality; this interactive information environment contributes to the creation of a new cultural reality that involves many important changes for reading.<sup>5</sup>

---

<sup>3</sup> Ivanka Stricevic and Ahmed Ksibi, *op. cit.*, p. 113-114.

<sup>4</sup> *Ibid.*, p. 116.

<sup>5</sup> *Ibid.*, p. 114-115.

Undoubtedly, the Internet has transformed the whole ecosystem of information. For some this intervention inflicts the logical order of the information and consequently its use. This complicated aspect of information implies a fine sense of analysis and interpretation; it is no longer a flat reading which has prompted certain organizations to take advantage of these assets as useful tools for reading, education or training.

E-reading is thus influenced by the linguistics of the interactive environment. The language used in the new information ecosystem, unlike classical reading, remains an environment that is impregnated by the impressions of the communicators; each speaker leaves his / her traces. This calls to replace the term reader by a new one "communicator". To a large extent, the new ecosystem of information reveals interactive reading.

The active exchange of information and the widening of the limits of the information space lead to the entry of foreign words and concepts into the written and spoken language. With the enrichment of the linguistic zone<sup>6</sup>, there is a big need to update our search strategies that must lie on the semantic web.

The electronic space is transformed into a virtual culture area. The introduction of digital libraries is at this stage an essential element for the preservation of a good level of culture despite its difference. Cyberspace communicators need to find a good guide in their virtual journey for the benefit of any receiver and transmitter. This causes an in-depth problem checking for reliability of virtual content. The role of libraries is clear in this respect. It is obvious that virtual reading has been able to manipulate the destiny of the world of information. Classical reading is based on language skills while virtual reading at certain levels is based on technological skills.

As a "temple of scholarship", the library has assumed an almost sacred role<sup>7</sup> in this regard. Contemporary university libraries can have a history that goes up to more than 200 years. They gathered all the researchers needed from printed collections, manuscripts, bibliographies; and their access was a great privilege<sup>8</sup>.

Despite this privilege of old university libraries, this mystical aspect has helped to create a gap between the general public and libraries in general. People have continued to view libraries as sacred places of worship. So technology is emerging as an immediate need to reinvent the role of the library. Technology is the savior catalyst for libraries, which will help them avoid becoming obsolete institutions.

---

<sup>6</sup> *Ibid.*, p. 115-116.

<sup>7</sup> Council on Library and Information Resources, *Library as Place: Rethinking Roles, Rethinking Space*, Washington, D.C., February 2005, p. 1.

<sup>8</sup> *Ibid.*

## II. CHALLENGES

In this respect, it is essential to insist on the word "reinvent" with all its nuances. One of the essential needs is to free the libraries from their physical presence and to give them a virtual presence of refined quality. Some consider that the prestigious presence of large buildings enhances the role of the library. While the building, in the era of technology, is just another amenity. The Google or, in this context, the rival of libraries according to information professionals, is no longer known by its building. On the contrary, very few people know where this institution that manages this information monopoly of the twenty-first century is located. It should be noted that the company has approximately 50,000 employees. Most of them work at the world headquarters: the Googleplex, in Mountain View, California, has at least 40 seats around the world. Google is one of the largest companies in the Internet market and, together with Apple, Facebook and Amazon.com, is part of the Big Four (the "Big Four", also known as GAFA).<sup>9</sup>

It is clear that the physical presence is not the big challenge; while the real challenge is to maintain the importance of libraries. This will take place by the integration of information technologies<sup>10</sup>, in all library services. Obviously, libraries will introduce innovative services in response to the era of cloud computing. This active course will combat the obsolescence of the roles of libraries. Those who are charged with guiding the future of these institutions must deviate from any idea that consider libraries as repositories of the printed and digital resources, and to go further in order to meet the new needs of young people and the general public. These innovative services will group the needs of all categories in a single click.

The vigilance of decision-makers must be deep enough to know that the goal of modern technology is to offer the most services via the web, that is, everything is done without real travel. This is where the great challenge of the innovative role of libraries lies, not always thinking about bringing people, on the contrary, we must think about going to them.

Some libraries have had successful attempts to combat obsolescence by working with architects and planners to anticipate the impact of integrating new information technologies into their facilities. Thanks to this approach, the number of visits to these institutions doubled and even tripled<sup>11</sup>. Despite these successes, some consider this step to be a big trap, because if these institutions have succeeded in involving users on their premises now, they will not be able to do so in the near future.

The library, which is still a combination of the past (printed collections) and the present (new information technologies), has to be considered with a new perspective and understanding in order to fulfill its potential. The integration of new information technologies has become the catalyst that transforms the library into a more vital intellectual center<sup>12</sup>. The effectiveness of the virtual presence must replace any fear of threat to the traditional concept of the library.

Electronic space is defined as an environment of objective reality, in which human intervention is carried out for the creation of a new cultural reality. As a result of the era of globalization, this interactive information environment contributes to the creation of a new cultural reality that involves many important changes for reading.<sup>13</sup>

Information is today the fundamental value of the era of globalization. Thanks to the new technology, the information finds various forms. It is transmitted orally, written, animated audio, video. It is represented by a wide range of creative solutions.<sup>14</sup>

---

<sup>9</sup> <https://fr.wikipedia.org/wiki>

<sup>10</sup> Council on Library and Information Resources, *op.cit.*, p. 2.

<sup>11</sup> *Ibid.*

<sup>12</sup> *Ibid.*

<sup>13</sup> Ivanka Stricevic and Ahmed Ksibi, *op.cit.*, p. 114-115

<sup>14</sup> *Ibid.*, p. 115-116

The active exchange of information and the widening of the limits of the information space lead to the entry of foreign words and concepts into the written and spoken language. With the enrichment of the linguistic zone, there is a simplification and a depletion of the voice communication. This causes an in-depth problem checking for reliability of virtual content. The role of libraries is clear in this respect. It is obvious that virtual reading has been able to manipulate the destiny of the world of information.

Libraries have a traditional role in the development of the reading culture. They perform an important task in responding to the intellectual and cognitive needs of individuals. Despite this considerable role of libraries, some see an inverse relationship between the status of libraries and technology. Libraries find themselves in a declining position because they do not fit into the riders of technology. In other words, libraries must anticipate the technology that serves the culture of reading and not remain as receivers. They must have a creative role and manipulate the novelties of technology to serve its purposes.

This makes it essential to integrate new technology with school libraries, from an early age. This approach will allow children to integrate the creative mind easily into their lifestyle, which will ensure a better assimilation of innovative ideas.

This innovative role of libraries requires new implementations to ensure proper functioning. A genuine national and international action plan must be put in place as soon as possible. Rapid and simultaneous action is essential this time so as not to be overtaken by new technological forms, without real integrations useful to the world of information dissemination via libraries.

A real metamorphosis must be manifested in the world of libraries. The model that will accept the fastest change is university libraries. The fate of the great libraries has been inseparable from that of the well-known universities from the beginning of humanity. These libraries were both learning centers and important gathering places for academics. They were frequented by the elite of the intellectual society.

In the prospective of engaging users in the new services of the library, information professionals find it logic to provide training courses to the public. These courses and lectures will have the essential aim of creating a bond of trust between the users and the library. These courses will develop the strengths of a library for research purposes. Information literacy is a key element for these courses and conferences, and it forms the basis for a successful research.

### **III. THE EDUCATIONAL AND TRAINING PROGRAMS AT THE BIBLIOTHECA ALEXANDRINA**

Providing training courses in libraries is not a reduced phenomenon for university libraries but the incorporation of new technology in pushing public libraries to offer courses to the public with a view to helping library visitors take advantage of all library resources; this is the case of the new library of Alexandria or the BA. Being a library of the 21st century, the BA offers recent resources on the content and technology used for the provision of information. To this end, the BA has devoted a group of information professionals responsible to train library visitors.

Such a service normally takes place in a university library, but in the case of the BA, the situation was different. The BA has a lot of unusual information resources for a public library in general, and more specifically in Egypt. Starting from this idea, the BA has implemented a laboratory equipped with 20 computers to serve the courses addressed to the public. This step introduces the public library of the 21st century as an information and research center responsible for the acquisition and preservation of important collections, but also a creative center based on research production, taking advantage of the BA valuable collections. This laboratory or more definitely, this learning center, over fifteen years, has maintained the dynamism of research within the BA. It is used for the technological updating and research of the public of the BA, in the end to produce more rigorous research. It should also be

pointed out that a public library does not have a defined role in the field of training, but it remains a point that depends on the community served. In fact the public hosted by the BA includes multiple categories, which raises many questions about the nature of the services offered by the learning center. This can be defined as the interpretation of the learning center within the public library and research.

Undoubtedly, it was a great challenge to implement this learning center without having seen similar experiences. In order to train adults, the people in charge of this service began to develop questionnaires in order to achieve the desired goal without any derivation. These questionnaires, based on the expectations of adults at the BA, for their development, were analyzed carefully in order to keep the concept of creating an environment addressed to the user. The new space must offer a combination of all needs, it must meet the expectations of general and specialized researches. The identification of this new type of installation in a public library will be the subject of an intense dialogue which will present the library as a central information gateway. The learning center space of a public library will become a lifelong learning space, building on a partnership between information literacy curators and the public. In fact, all the courses offered were based on pre- and post-course questionnaires for better intellectual input to all participants.

This regular process effectively contributes to maintaining the right up-date to technological change. Similarly, it represents a new implementation technique as an infrastructure adaptable to flexible reconfiguration of services. The learning center is a space designed for lifelong learning that applies in spaces like different libraries. Public, school and university libraries are subtle entities for accomplishing these distinct missions, each library has a special addition in this regard, which is complementary at the same time.

Thus, the BA has collaborated in formulating new missions for public libraries in the 21st century. A single building communicates physically and virtually with the public in terms of training throughout life.

Teaching and learning spaces are at the heart of many academic libraries. Public libraries share this commitment to teaching and learning by offering space for tutoring, literacy activities, training in Internet usage and resources, and homework help.<sup>15</sup>

The library's mission is creating an Environment for Lifelong Learning, promoting lifelong learning from youth to old age empowers citizens and students to achieve a better quality of life, offering enjoyment, and bridging the digital age. Integration of learning activities in spaces that house collections, workstations, and group assemblage is essential to the libraries' shared mission.

Since 2003, the Educational Services in Bibliotheca Alexandrina (BA) promotes the development of critical thinking and research skills for professionals & non-professionals to tackle the nature of information and its uses through learning. Over the past 15 years the education and training services were offered by means of face-to-face courses, trainings, workshops, lectures and sessions.

In January 2017, the BA celebrated the New Year by announcing the launch of its e-learning platform: BA Moodle (<https://moodle.bibalex.org>). This platform is the first e-learning platform in a public and research library, that offers its free courses in three languages: Arabic, English and French.

The E-learning services are encouraging Internet users to gain greater responsibility for self-learning and enabling them to reach their full potentials through the development of a desire for ultimate learning. This service is providing sustainable educational development that aligns with the 2030 Agenda for Sustainable Development Goal 4 which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”.<sup>16</sup>

---

<sup>15</sup> Council on Library and Information Resources, *op. cit.*, p. 60.

<sup>16</sup> <http://en.unesco.org/education2030-sdg4>

UNESCO defined Seven Outcome Targets for the 4th goal, and three means of implementation that are:

- Effective learning environments
- Scholarships
- Teachers and educators

Actually, the BA educational services since its beginning tried to implement these means by creating effective learning environments in the BA labs equipped for the education and training purposes. An “Information for All Program” took place in the BA premises since 2003. This BA initiative was based on the UNESCO Information For All Programme (IFAP), announced in the 2001. And it was followed by the Beacons of the Information Society: The Alexandria Proclamation on Information Literacy and Lifelong Learning. The proclamation was celebrated by the High Level Colloquium on Information Literacy and Lifelong Learning held at the Bibliotheca Alexandrina on 6-9 November 2005 and proclaimed that information literacy and lifelong learning are the beacons of the Information Society, illuminating the courses to development, prosperity and freedom.[...] This assists societies and their institutions to meet technological, economic and social challenges, to redress disadvantage and to advance the well-being of all.<sup>17</sup>

Also, a special program for teachers was offered since 2014, in order to give them the opportunity to take advantage of the new technology and implement what they learnt in class.

An online presence for these activities was incontestable.

Currently, the BA e-learning platform offers information literacy courses that help general public and students to accomplish their research needs successfully. Furthermore, new course that approaches the Suez Canal history will be in use shortly.

These courses go with the main themes of UNESCO:

- Protecting Our Heritage and Fostering Creativity<sup>18</sup>
- Building Knowledge Societies<sup>19</sup>
- Certainly, these approaches represent a main need for the Arab and African region.

#### **IV. LIBRARIES: CREATING DIGITAL CITIZENS**

Libraries are also, increasingly, applying their long experience of promoting literacy to the digital environment. Digital literacy is about more than technical skills, and looks rather at the broad range of knowledge, skills and behaviours that allow people to make the most of the potential of the Internet safely.

IFLA took a lead role in a workshop focusing on how to define digital literacy and ensure that it is incorporated into efforts to bring more people online. The role of libraries – as venues for training, as educators, and as experts in how to navigate information – would be essential. Libraries have been at the heart of the information society since the very early days of the information and communication technology revolution, continuously adapting to new means of communication to fulfill their mandate of providing universal access to information and knowledge.

---

<sup>17</sup> <https://www.ifla.org/publications/beacons-of-the-information-society-the-alexandria-proclamation-on-information-literacy>

<sup>18</sup> <http://en.unesco.org/themes/protecting-our-heritage-and-fostering-creativity>

<sup>19</sup> <http://en.unesco.org/themes/building-knowledge-societies>

Since 2002, International Federation for Library Association (IFLA) has contributed to define the information society policy at the international level through its participation in the World Summit Information Society (WSIS). Consequently, the WSIS Tunis Agenda recognized the important public-service role of libraries in providing open, equitable and affordable access to information and of improving ICT literacy and community connectivity, particularly in underserved communities.

The BA implemented the information literacy program and the professional training through a variety of courses and programs (see graphs below):

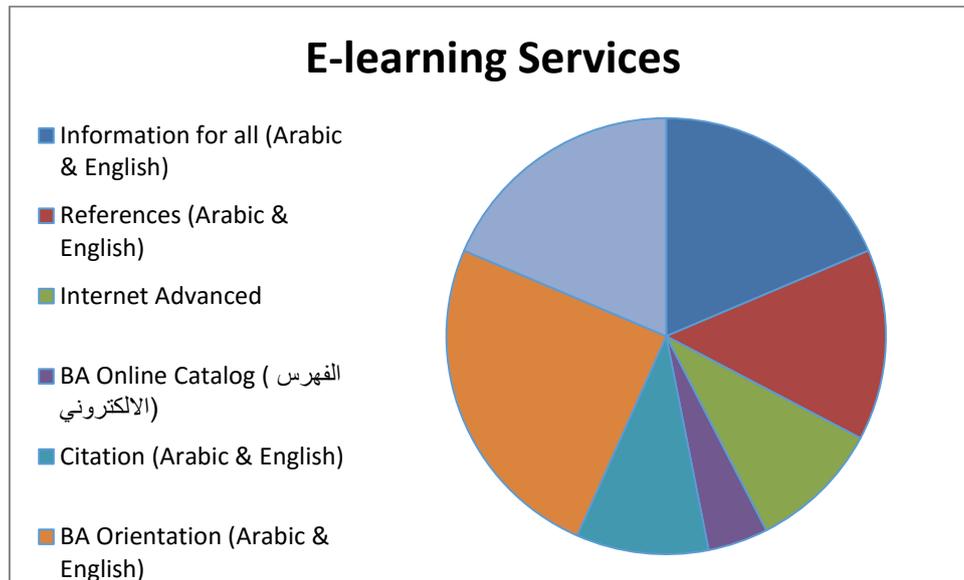
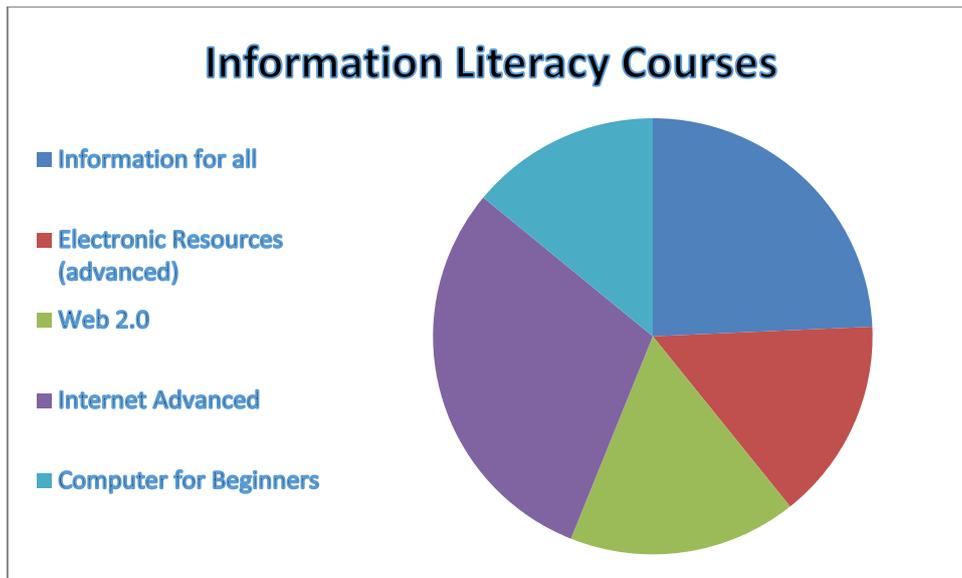


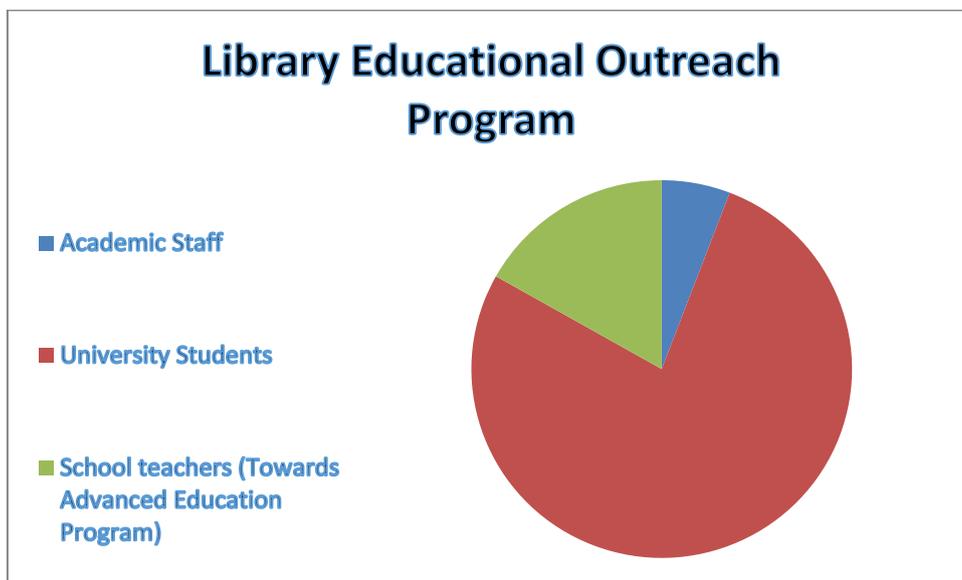
Fig. 1. E-learning Services



Fig. 2. International Librarianship Training Program



**Fig. 3.** Information Literacy Courses



**Fig. 4.** Library Educational Outreach Program

## REFERENCES

- [1] Stricevic, Ivanka; Ksibi, Ahmed. Intergenerational Solidarity in Libraries / La Solidarite Intergenerationnelle dans les Bibliotheques, Berlin, De Gruyter Saur, IFLA Publications, 2012.
- [2] Council on Library and Information Resources, Library as Place: Rethinking Roles, Rethinking Space, Washington, D.C., February 2005.
- [3] <http://en.unesco.org/education2030-sdg4>
- [4] <https://www.ifla.org/publications/beacons-of-the-information-society-the-alexandria-proclamation-on-information-literacy>
- [5] <http://en.unesco.org/themes/protecting-our-heritage-and-fostering-creativity>
- [6] <http://en.unesco.org/themes/building-knowledge-societies>
- [7] (Basic Book/Monograph Online Sources) J. K. Author. (year, month, day). Title (edition) [Type of medium]. Volume(issue). Available: [http://www.\(URL\)](http://www.(URL))

## AUTHOR(S) BIO



**Suzanne Samir**, master degree in library and information science (MLIS) from the ENSSIB (Ecole Nationale Supérieure des Sciences de l'Information et des Bibliothèques), Lyon, France, 2003. Suzanne joined the Library of Alexandria in 1999, before its inauguration. She participated in the preparation for the soft opening of the Library. Currently, she is the head of the Educational Section in the Library of Alexandria.



---

## Contacts

Arab States Research and Education Network  
info@ASRENOrg.net  
Phone: +962 6 5100250