STEMI Olympiads and Competitions Community of Practice

# 2018 Conference Highlights Report

# Contents

# 1.  Executive Summary

The STEMI Olympiads and Competitions Community of Practice (CoP) Conference is an annual conference that is dedicated to the advancement of the Science, Technology, Engineering, Mathematics, and Innovation (STEMI) Olympiads and Competitions in South Africa by creating a community of practice where best practices are identified and benchmarked. This is achieved by bringing stakeholders together to present academic and non-academic research, talks, and to facilitate a platform for engagement between parties.

The focused audience for the conference is STEMI Olympiads and Competitions organisers and stakeholders that have a direct or indirect impact on this niche, such as educators, academics, science centres, government departments, science agencies, and professional bodies.

*Theme: "Building a culture of volunteerism and community service in Science, Technology, Engineering, Mathematics, and Innovation (STEMI)"*

The 3rd STEMI Olympiads and Competitions CoP Conference was held from 19 to 22 February 2018 at Burgerspark Hotel in Pretoria. A total of 174 delegates from 82 different organisations, including 21 Olympiad and Competitions organisers attended. In addition, representatives from the United States of America, as well as Australia were in attendance. This year, a total of 17 academic and non-academic talks were presented under the following sub-themes:

- Volunteerism and service at school level, tertiary level, and beyond in *science education*, *awareness*, and *communication*.
- How far scientists, engineers, and researchers can be expected to participate in nurturing talent through science engagement.
- Community service done by STEM university students.
- Best practices by professional organisations that identify and nurture talented young people.
- The involvement of STEMI professionals in Olympiads and Competitions.

In addition to the presentations, workshops for skills development, consisting of science communication, academic writing and mathematics, were offered to interested delegates. Emanating from the 2017 conference, a framework on mentoring and coaching in Olympiads and Competitions was developed and presented by the Department of Science and Technology as part of its commitment to the community of practice; which was subsequently adopted.

Conclusively, a total of 81% of attendees surveyed felt that the overall conference was above average or excellent and 84% agreed or strongly agreed that the conference engaged them fully. A total of 90% of the delegates felt that the programme was well organised, with 57% responding positively to the quality of the presentations and 81% agreeing that the presentations were relevant to the sub-theme topics.

## 2.    Objectives of the Conference

The following outlines the generic objectives for the conference based on its expected long-term outcomes.

| Generic Conference Objectives |
|---|
| To positively contribute towards a STEMI-driven culture |
| To create a platform for collaborative problem-solving |
| To act as a catalyst between people and organisations |
| To facilitate the development of tools to improve the connection between science and society |
| To assist in transforming innovative ideas and actions into benchmarked practices |

Prior to the conference, objectives related to the theme were identified. Due to its nature, these will be reviewed at the 2019 conference to measure the actual performance. The objectives were identified as follows:

| 2018 Conference Objectives |
|---|
| Inculcate the culture of volunteerism and community service for the advancement of youth participation in STEMI |
| Establish best practices of volunteer- and community service by driving mentoring and coaching |
| Achieve in principle, consensus or agreement on the basics of the proposed "National Mentoring and Coaching Framework" |
| Strengthen and/or establish community interaction enabling approaches between conferences |

*"At the heart of volunteerism are the ideals of service and solidarity and the belief that together we can make the world better."*

*– Kofi Annan (Former Secretary-General, United Nations)*

# 3.    Key Learnings from the Conference

The following outlines the key learnings from the conference plenary sessions, presentations, and break-away sessions.

## 3.1 Volunteerism and Community Engagement

The keynote address by Mr Jim Adams, former Deputy Chief Technologist from the *National Aeronautics and Space Administration (NASA)*, expressed the importance of sharing scientific knowledge. It further highlighted that there are inequalities of

*"It is not science until it is shared" – Jim Adams*
*(Formerly from NASA)*

gender participation in STEMI and this can be viewed as an opportunity cost for STEMI. Hence, volunteerism is a viable solution to mitigate the inequalities, drive science awareness, and science engagements. Mr Adams expounded on how citizen science and life-long learning is fundamental for global peace and sustainability especially in STEMI. *"So having this network of 35000 volunteer observations helped us calibrate the measurements that we were making from space. It is not simply about teaching kids maths and science and innovation, it is about life skills, about capitalizing on a child's wonder and inquisitiveness, about engaging a retiree like myself in lifelong learning".* NASA was used as an example to highlight how volunteerism plays an essential part of space exploration and how former President Barack Obama initiated volunteer initiatives across the United States in an attempt to raise mathematics results and awareness within the United States. Mr Adams advocated for science engagement of "genius" collective crowd by promoting Mathematics and Science practices from Primary Schools, Secondary and Tertiary levels. In conclusion, the keynote address outlined the importance of having outreach programmes, as well as volunteerism in STEMI. Jim's title of his book provides a good description of his keynote address; *'STEM innovation impacts everything'*

Delegates from the *South African Association for Marine Biological Research (SAAMBR)* and international delegates shared valuable insight on how the community of practice can benefit from involving volunteers. Ms Sizwekazi Yapi from SAAMBR shared some of the best practices that are being used by SAAMBR when appointing volunteers. One example is scrutinising the volunteer applicant's willingness, interest, personal growth, ability to impart knowledge, and continuous learning; this assessment enables SAAMBR to appoint suitable volunteers in the field. Ms Lorriane Collins from Australian Volunteers International gave a detailed perspective on what constitutes a volunteer, and

*The interest in gaining knowledge is one of the leading motivators that retain volunteers*

which organisational support systems are essential to aid and retain volunteers. According to the case study on *Shaw Sea World*, the volunteers have to achieve a minimum score of 70% on the assessment given as an entry requirement and have to spend a maximum of four hours a day volunteering. From the study, one of the incentives that keeps the volunteers engaged is the urge to know more.

The case study conducted for the *University of Cape Town (UCT)* Mathematics Olympiads, indicate that 250 teachers and 50 UCT students volunteer in diverse ways within the region. It was stressed that there are teachers that want to stay involved outside of their formal setting but that engagement is required to drive volunteerism.

From the presentations made it was established that volunteers can be sourced from the following organisations for a variety of tasks.

| Sources for Volunteers | | Tasks Volunteers Engage In | |
|---|---|---|---|
| Universities | Schools | Coaching | Mentoring |
| Science Centres | Science Councils | Judging (Events) | Motivational Talks |
| Professional Organisations | Industry | Career Guidance | Role Modelling |
| Alumni of Olympiads | General Public | Project Assistants | |

Interestingly, a panel session with the presenters resulted in a floor discussion on the characteristics of volunteerism and authorities in labour relations raised concerns. The delegates had dissimilar interpretations; some associated volunteerism with internship or with volunteers who are contracted as part of the *DST National Youth Service Programme (NYSP)* where volunteers are paid stipends. Although general consensus was that a volunteer exchanges skill without monetary compensation and in the context of social responsibility, the concept of stipend as opposed to salary had to be explained; a stipend enables a volunteer to engage by providing funds for transport, meals, and clothing depending on the volunteer engagement. Conclusively, volunteerism was defined as individuals that assist in variable capacity without the expectation of structured remuneration or the expectation of permanent or regular employment as per the relevant legislative requirements.

## 3.2 STEM Professionals

Several papers either directly or indirectly scrutinised the roles of STEM professionals and specifically the role of teachers as a recurring theme. Mr David Malati and Dr Phathisiwe Sithole, both from the *Department of Basic Education*, profiled how the collaborative efforts of volunteer teachers from three districts in KwaZulu-Natal, promoted the steady growth in Science Olympiad participation.

Mr Soocklachar Naidoo, from *South African Science Olympiads*, highlighted that although teachers play a vital role, there are many challenges that teachers are facing; *"teachers have limited time, not necessarily highly qualified and have limited resources to work with gifted and talented".* Many educators are subjected to the lack of resources, thus many teachers are unable to conduct experiments. Mr Ajay Bissessur, from the *University of KwaZulu-Natal*, said, *"…as most schools have no laboratory facilities, practicals are mere demonstrations, and many educators, due to a lack of*

*Teachers face challenges that hinder  support for their gifted learners*

*exposure to proper laboratory facilities, are extremely nervous and lack confidence to carry out more complex practical demonstrations."* Comments in response to this was that Higher Education Institutions (HEIs) are generally better equipped to facilitate interactive experiments, both in resources, as well as expertise. Therefore, involving academics from HEIs should be a priority to drive change in the landscape of STEMI.

*Involvement of STEMI Professionals should be a collaborative effort between Government, Universities, Schools and Sponsors*

Mr Sure Mupezeni's research from *Eskom Expo for Young Scientists*, among other topics, hinted at the importance on developing teachers in scientific research methodology to adequately support and empower their learners whom are participating in Olympiads and Competitions. This will also result in skills transfer, where learners are better equipped at tertiary level with research skills that was instilled at a younger age. This also strengthened the argument that HEIs play a critical role in improving educators' understanding of science-orientated theories, as well as shifting perceptions towards Science Olympiads and Competitions as a tool to identify and nurture talent.

## 3.3 Learner Performance in Olympiads and Competitions

An academic study conducted by Dr Vasythavan Govender suggested that there could be reasons why senior phase learners perform poorer than the senior secondary school learners. The study suggested that issues such as maturity, exposure of learners to higher-order questions, and the ability to grasp scientific concepts have a direct impact on performance. Whereas, the poor learner performance in the different categories of Olympiads and Competitions was attributed to other things such as the depth of knowledge, which may be linked to poor teaching practices.

*"Learner success is dependent on an efficient and supported community of practice"*
*- Dr Vino Paideya*
*(University of KwaZulu-Natal)*

A case study by Mr Mlungisi Nyamane suggested that curiosity is an essential element that drives learners to perform better. It was noted that learners should be stimulated and inspired, preferably from the lower grades, which may subsequently have an effect on their performance in senior phase Olympiads.

## 3.4 Preparing Learners for Olympiads and Competitions for participation

Speaking from the angle of international competitions, Mr Bissessur's study addressed the fundamental component of preparing learners for Olympiads and Competitions. The study highlighted the need for learners, who participate in Chemistry Olympiads, to be exposed to experiment-based learning, as well as exposing them to concepts that are beyond the scope of the curriculum. Therefore, the involvement of STEMI professionals and HEIs were perceived as an essential component to prepare learners for Olympiads and Competitions.

*Voluntary activities increase enjoyment in Olympiads and Competitions and contribute to the development of mature students*

Ongoing developmental coaching and mentoring was expounded upon by Ms Patricia Gouws from UNISA I-SET. She highlighted the influence and "role mentors" and coaches in competitions. The success of these types of competitions is mainly hinged on the integrated approach of *"actors, artifacts, and activities to create opportunities in STEMI".* A mentor and coach are there to impart the proper techniques and procedure to increase learners' performance. The *University of Pretoria's* Dr Harry Wiggins, suggested new models of preparing learners for Olympiads and Competitions; by introducing the concept of 'Olympiad homework' and 'Olympiad classes', which are purely based on learners' keen interest in participating and performing well in Olympiads and Competitions. He said; *"… [it is] a voluntary activity but students will increase their enjoyment and [into] grow as mature students and scientist"*

## 3.6 Identifying and Nurturing Talent in STEMI Olympiads and Competitions

Professor Poobhalan Pillay, who is the national academic coordinator of *Siyanqoba Olympiad and Training*, presented a case study on the *South African Mathematics Foundation's* Siyanqoba project. The case study highlighted the importance of focussing on nurturing to improve the performance learners in Olympiads; where nurturing is described as a qualitative intervention that has a positive influence on both participation and performance. Professor Pillay indicated that the involvement of HEIs are vital to *"unearth"* and nurture talent.

Mr Naidoo's presentation echoed the findings of Professor Pillay, stating that there is a need to strengthen the link between HEIs and Olympiads. The recommendations from Mr Naidoo's talk outlined the importance of HEIs to participate in Olympiads especially for increasing participation of South African teams in international competitions, as well as to prepare learners for said international competitions. Due to the higher standards that international competitions tend to exhibit, it was indicated that HEIs involvement is critical in ensuring the *"readiness"* of learners to participate on an international platform.

## 3.7 Digitalisation of Olympiads and Competitions

What emanated from the presentation by the *South African Institute of Physics*, as presented by Mr Case Rijsdijk, is that there is a lack of internet access in some parts of South Africa. This was indicated as the main barrier when compared to the lack of computers; learners mostly have access to smart mobile phones, as opposed to computers. This should be addressed because the digitalisation of Olympiads and Competitions can become a catalyst to effectively track and monitor learners.

## 3.8 Landscape

According to the study conducted by the *Human Science Research Council (HSRC)*, the urban school learners are more willing to compete; can afford to compete; and want to compete, while in rural schools, the cost factor is a challenge. No-fee paying schools usually score lower points than those from urban areas and when these rural schools underperform, they are less likely to enter again.

Other challenges that were identified by the study were:

- The learners' lack of practical work experimentations;
- The performance of the participating learners is not tracked over the years;
- The teachers do not go beyond the syllabus;
- The learners need to be taught about how to think and reason; and
- The teachers need to realise the value of talent search and be prepared to identify it.

The report, 'Mapping the landscape of STEMI Olympiads and Competitions in South Africa' (February 2018), can be obtained from Ms Ncamisili Zulu (NZulu@hsrc.ac.za) of the HSRC.

# 4.    Conference Feedback

This section reflects on the evaluation that was conducted after the conference by means of a survey and the following highlights the outcome of the evaluation study, which had a 36% response rate. It is noted that based on the outcome of the survey, the conference planning committee can confidently confirm that the conference was a success.

## 4.1 Demographics

The following figures outline the demographics of the delegates in attendance.
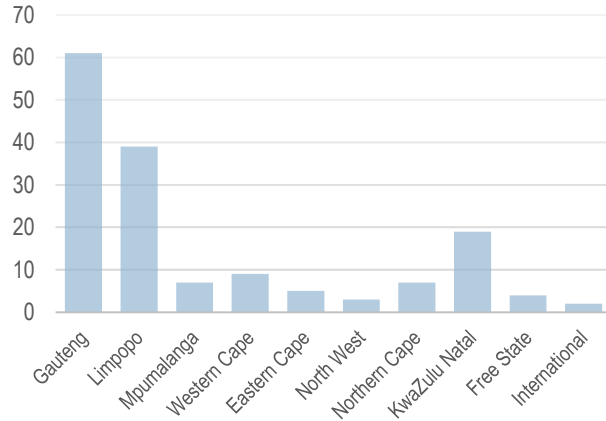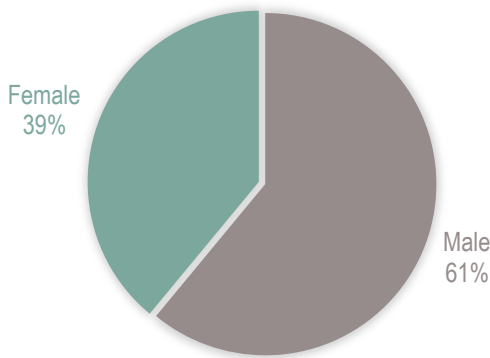
The delegates in attendance were predominantly male with the highest number of delegates from Gauteng, followed by Limpopo and Kwa-Zulu Natal. Two of the delegates were representative of the the United States of America and Australia.

## 4.2 Service Quality

The following figure outlines the delegate response to the event planning and logistics.
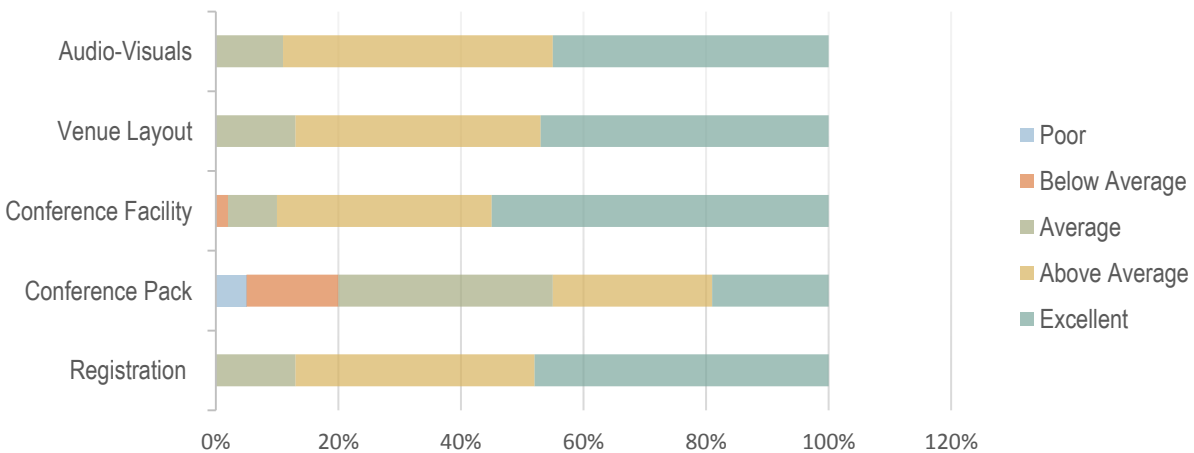


The findings show that majority of the delegates experienced the planning and logistics of the conference as above average or excellent. Although a very small percentage of the delegates found the conference pack as poor, it is noted that this is the one area that causes a measure of dissatisfaction every year.

## 4.3 Conference Implementation

The following figure outlines the progression of the conference.
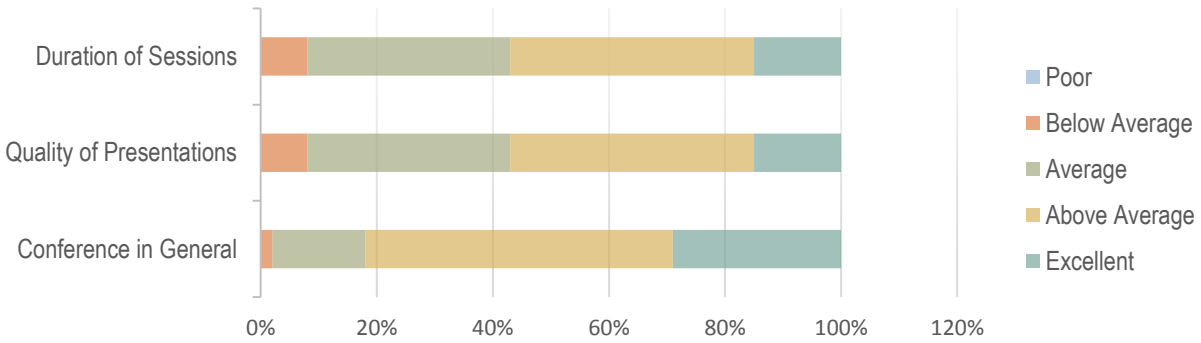
Majority of the respondents found the conference implementation above average or excellent. In addition, 90% of the delegates felt that the programme was well organised and 79% indicated that their expectations were met.

## 4.3 Conference Content

The following figure outlines the content of the conference sessions and/or talks.
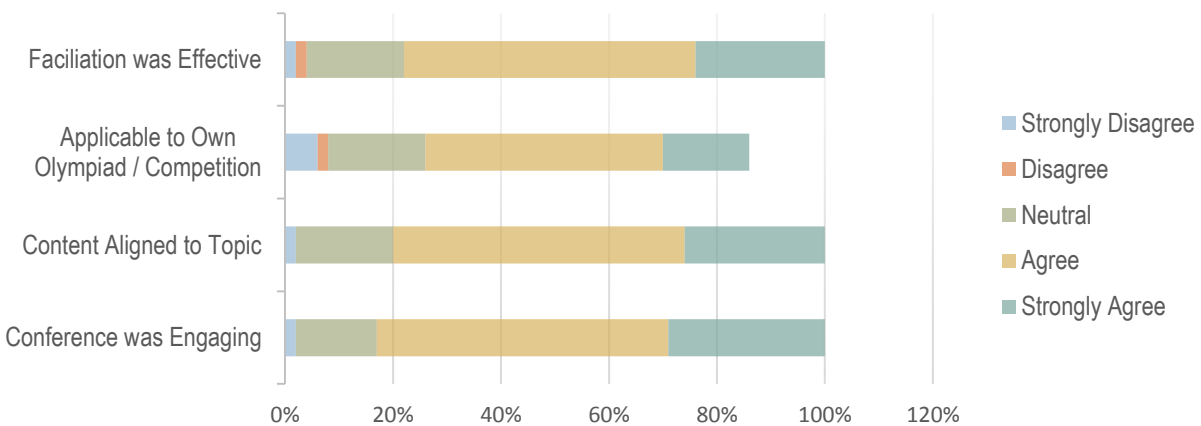


Majority of the respondents responded positively to the conference content which included the plenary sessions, break-away sessions, and workshops. It was noted that the delegates voted "STEM Readiness", a presentation by Ms Lorraine Collins (International Representative: Australia), as the best overall presentation, followed by "Robotics" presented by Mrs Patricia Gouws (UNISA I-SET), an emerging field in STEMI.

## 4.4 Building a Community of Practice

Majority (72%) of the respondents indicated that the conference was a suitable platform to establish relationships and to build networks to share knowledge, expertise and best practices, as well as plan collectively. A total of 95% of the respondents perceived other delegates as either partners and/or potential partners and 85% indicated that they were provided with enough opportunity and time to build their networks.

## 4.5 Recommendations from the Evaluation

Although majority of the delegates indicated that their expectations were met, several areas were highlighted that should receive attention. These are highlighted as follows:

- More time should be allotted to share best practices between Olympiad and Competition Organisers.
- More information on schools and access to schools should be provided.
- Language barriers and how to address it.
- How to monitor and evaluate the impact of the different Olympiads and Competitions.
- How to source support funding from the private sector.
- How the Department of Science and Technology, the South African Agency for Science and Technology Advancement and the Association for STEMI Olympiads and Competitions will synergise Olympiads and Competitions.

# 5.    Programme of Action

## 5.1 Volunteerism and Alumni

- A system must be developed to aid the tracking of alumni.
- The Association for STEMI Olympiads and Competitions (ASTEMI) should compile and manage a database of alumni for all Olympiads and Competitions.
- A platform should be created where alumni can interact and possibly form an organisation / group where they can be tracked.

## 5.2 Virtual mentoring and coaching

- Identification of mentors and coaches must be done and a database of professionals that are willing to mentor must be created. This should be made available to nearby science centres.
- Qualitative training must be provided for mentors and coaches.
- Support systems must be created and with stakeholders' support, for example, the support and buy-in from Department of Basic Education, must be secured.

## 5.3 Virtual and Online Competitions

- Due to infrastructure challenges, such as connectivity, competitions should employ allow both online and manual participation.

- Online competitions should, in future, have a wider reach.
- Commitment from schools and district officials remain a challenge and should be secured to assist Olympiad and Competitions organisers.
- Available skills and expertise is another challenge, however, through an online community of practice ideas and support can be provided.
- There should be different solutions for different provinces. An example would be that paper-based competitions could be used in certain provinces where rural communities are prevalent.
- The involvement of HEI's was deemed necessary; by tapping into the expertise of the institutions, support for online competitions can be possible.
- Teacher and learner development is critical for Olympiads and Competitions.
- It is important to take advantage of accessible resources such as cellular phones. Therefore, hosting competitions online on cellular phones can be an effective method for participation, although not all have access.

## 5.4 Volunteerism and Professionals

- Enlisting professionals as volunteers require the objectives of their involvement to be clearly defined and the expectations clarified. Professionals can best be enlisted through reaching agreements with professional associations and bodies. Direct recruitment can also be done at gatherings of professionals.
- Support is to be provided to the volunteers to enable them to execute their tasks undertaken in contributing to society.
- Effective and consistent communication channels need to be established and maintained to assist the volunteers
- A structured approach to retaining the volunteers need to be developed which will be in the form of incentives.  These will be hinge on earning continuous professional development points, as outlined in the professional body's statutes.

## 6.  Way Forward

| Short-term Key Deliverables | |
| --- | --- |
| The Framework for STEMI Coaching and Mentoring to be completed within 2019/20 for approval by the internal authorities. | 12 – 24 Months |
| A new support Framework for STEMI Olympiads and Competitions be developed, taking into account the Coaching and Mentoring Framework. | 12 – 24 Months |

| | |
|---|---|
| A state of readiness study for online and digital Olympiads and competitions in South Africa to be conducted | 12 – 24 Months |
| The state of readiness study discussed during the conference, including a feasibility model for online / virtual competitions and Olympiads. | 12 - 24 Months |
| Sharing the Human Science Research Council's 2017 research study report on the STEMI Olympiads and Competitions, once adopted internally. | June 2018 |
| Continuous improvement of the annual conference. | Ongoing |
| Online platform interaction between the conferences need to be realised. | Ongoing |

# 7.   Appendices

To access the appendices, kindly click on the links below

Link: Attendance register

Link: Abstracts

Link: Programme

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